Engineering Change: A Blueprint for Strengthening Women's STEM Entrepreneurship

National Women's Business Council

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Glossary

High-growth industries	STEM-adjacent industries.
High-yield industries	STEM industries.
NAICS	North American Industry Classification System.
Patentee	Someone who owns a patent.
Sector	Industry associated with a particular NAICS code.
STEM industries	Defined as science, technology, engineering and mathematics industries, and others such as data processing, medicine, and pharmaceuticals that yield high profits for entrepreneurs.
STEM-adjacent	Industries such as architecture, engineering and construction (AEC), and industries that have come into focus recently such as, infrastructure, supply chain, sustainability, etc. These industries are growing rapidly but do not yield profits comparable to classic STEM industries.
Undervalued industries	Care providing industries such as, home healthcare, nursing care, childcare, elder care, adult care, and others such as arts and education related industries.
Women in STEM	Women entrepreneurs in the high-yield and high-growth industries.

1. Executive Summary

We performed this research to further understand female entrepreneurship in high-yield and high-growth industries. Phase I of this research resulted in a report (NWBC 2023) that examined the current status of "Women in STEM" and provided policy solutions for their success. However, the Phase I research relied only on 2019 Census data for female-owned STEM businesses. In this Phase (Phase II) we collected and examined data on these businesses for the years 2012 through 2020, studied the impact of variables that influence these entrepreneurs, and developed policy recommendations based on the relationships between these variables and women STEM entrepreneurs.

1-1 National Level Analysis and Results

For the national level analysis, we collected three-digit NAICS data on the number of female STEM entrepreneurs at the national level for the years 2012-2020 from various Census sources.

For employer firms we used sources such as:

- Survey of Business Owners (SBO)
- Statistics of U.S. Businesses (SUSB)
- Annual Survey of Entrepreneurs (ASE)
- Annual Business Survey (ABS)

For nonemployer firms, we used the following sources:

- Non-employer Statistics by Demographic series (NES-D)
- Nonemployer Statistics (NES) Tables for nonemployer firms

We examined and ordered this data and put the data in a form suitable for econometric analyses. For the years where this data was not available by sex or available at the two-digit level, we developed estimates based on data from appropriate years.

We gathered data on factors that could influence the number of female STEM entrepreneurs such as

- National level female patentee data from U.S. Patent and Trademark Office (USPTO) PatentsView Annualized Data Tables
- National venture funding for female-founded and co-founded firms from PitchBook's Female Founders Dashboard
- Interest rate data from the Federal Reserve
- National level employment data from the Current Population Survey (CPS)
- National women STEM graduates' data from the National Center for Education Statistics (NCES) Digest of Education Statistics
- National per-capita income data from the Bureau of Economic Analysis (BEA)

Next, we used a national level log-log model to study the relationships between these factors (independent or explanatory variables), including a dummy variable for COVID-19, and the number of female STEM entrepreneurs (dependent variable). The log-log model is a standard statistical form used frequently in econometric research, (Cobb and Douglas 1928, Biddle 2012[i], Baum-Snow et al. 2024[ii]) and gives easy methods to calculate elasticities. The model captured a high percent of variation in the dependent variable, the model fit the data well, and the model explained the effects of changes in independent variables such as women patentees, venture capital funding on the dependent variable reasonably well.

The independent variables used to examine the women STEM entrepreneurs' data are natural ones to use. Changes in any of these independent variables can't be guaranteed to cause entrepreneurship. But the features covered by these variables map very well to endowments, which a World Bank study finds highly related to women entrepreneurial success (Carranza et al. 2018)[iii]. However, it is important to note that these relationships identified by our research are correlations, not definitive proofs of causality.

1-1-1 National Level Model Findings

Female STEM entrepreneurs are concentrated in the Professional, Scientific, and Technical Services (NAICS Code 541) and Ambulatory Health Care (NAICS Code 621) sectors at the national level. This is true for both employer and nonemployer firms, over the years 2012 through 2020. We found the following from running the national level log-log model:

- A 1% increase in the number of women patentees produces about a 0.56% increase in the number of women STEM entrepreneurs. So, higher numbers of female patentees lead to increases in female STEM entrepreneurship.
- A 1% increase in female venture capital funding (funding to female-founded and co-founded firms) leads to a .29% increase in the number of female STEM entrepreneurs. This could be because more of this funding is directed towards STEM, including the sectors where female STEM businesses are concentrated. This could alleviate the intense competition for limited resources that these firms face, allowing them to flourish.
- An increase in the national labor force of 1% results in a 37% increase in the number of these entrepreneurs. Saksena et al. (2022) in a USPTO study mention the better childcare options and increased networking opportunities for women entrepreneurs due to a large labor force. This could result in an increase in their numbers.
- An increase in female STEM graduates leads to a decrease in the number of female STEM entrepreneurs, who are in sectors as diverse as Fabricated Metal Product Manufacturing (NAICS Code 332) to Data Processing, Hosting, and Related Services (NAICS Code 518). The academic credentials needed for these sectors could be very different. A 1% increase leads to a 9.9% fall in the number of

entrepreneurs in business. This could happen if these graduates gravitate towards sectors that female STEM entrepreneurs are concentrated in, leading to increased competition and firm failures.

- If interest rates rise by one percentage point, it will cause a cause a 0.08% decrease in the number of women STEM entrepreneurs. Rising interest rates imply increasing financing difficulties for these entrepreneurs. The magnitude of this decline is small, possibly because most of these businesses are nonemployer firms, which because of their low capital requirements are less susceptible to interest rate changes.
- Higher per-capita incomes lead to a decline in female STEM entrepreneurship. A 1% increase in per-capita real income causes a close to 3% decrease in the number of women STEM entrepreneurs. Higher per capita incomes could act as a supply variable instead of a demand variable that stimulates the demand for female STEM firms' services. With the flexibility that higher incomes provide, women could prioritize raising families over starting businesses. Also, the gender disparity in incomes and the glass ceiling that women face in the STEM workforce leads some of them to start businesses. With higher incomes this may no longer be the case. In other words, when good jobs are available, women seize the option.
- There is a positive relationship between the COVID-19 pandemic and female STEM entrepreneurship[1]. Among the many reasons for this contrary result are:
    - Early-stage female entrepreneurs reported finding new opportunities during the pandemic (Elam et al. 2021/2022).
    - In 2020, women reached their highest monthly rate of new entrepreneurs in 24 years (Fairlie and Desai 2021).
    - Women STEM entrepreneurs are concentrated in the healthcare sector which grew during COVID-19.
    - The second round of pandemic funding through community organizations could have benefited these entrepreneurs.
    - Direct cash payments to families could have helped women start new businesses.
    - Economic necessity could have driven rising entrepreneurship.

[1] The magnitude of the COVID-19 results and their interpretation is included in Appendix A for the national results and Appendix B for the state results.

1-1-2 National Level Policy Implications

The above findings that show positive relationships suggest that federal policy should aim to increase the magnitude of those independent variables to increase women STEM entrepreneurship. This leads to the following policy implications:

- Congress and the Department of Education could work with state and local jurisdictions to condition public funding of higher education institutions on female students' commercialization exposure. This could lead more female students to patent their research. The increase in patentees would bring about an increase in the number of female STEM entrepreneurs.
- Congress could authorize state and local governments to use grant funding in programs including Community Development Block Grants (CDBGs) to establish commercialization authorities that work with institutions to help commercialize the research of underserved populations in STEM, leading to more patentees in these fields and more female STEM entrepreneurs.
- Congress could legislate additional public funding for Small Business Investment Companies (SBICs)[iv] and the State Small Business Credit Initiative (SSBCI)[v] to strategically invest in sectors in which women STEM entrepreneurs are concentrated, and to target women in sectors in which they're underrepresented. These partners could target both crowded and less crowded female STEM sectors. Increased funding in crowded sectors could take the pressure of businesses competing for limited dollar amounts and help them succeed. Other STEM sectors in which female firms are less represented could benefit from additional funding, allowing new female entrepreneurs to access funding to start businesses.
- The SBA could train investors and lenders on targeted female STEM investment. The SBA could train female venture capitalists and angel investors to invest in female businesses in specific STEM sectors. The SBA could also partner with banks and other institutional lenders to help them lend to female businesses in these sectors.
- The federal government could provide grants similar to the child care stabilization grants to increase the childcare labor force and increase childcare options for women entrepreneurs.
- State government access to federal grants and other resources could be conditioned on their support of child care worker wages and benefits, again increasing care options for women businesses.
- The federal government could tie K-12 funding to female STEM learning. This would create a pipeline for a skilled STEM workforce which would allow for more networking options and employee options for female STEM businesses.
- The SBA could provide application assistance to female businesses during emergencies, helping them access government funding during these times.
- The federal government could use community organizations to provide emergency assistance, leading to more assistance for female businesses.

- The federal government could provide direct cash payments to families during shocks. This would give more women the flexibility to start new businesses.

1-1-3 National Level Race, Ethnicity, and Veteran Status Data and Model Findings

We ran the national level model for different races, ethnicities and veteran status by using Census data on the number of female STEM entrepreneurs by race, ethnicity and veteran status for the years 2012 through 2020. We gathered Census data for female STEM firms at the two-digit NAICS level because data at the three-digit level by race, ethnicity was not available for the years of our study. For employer businesses in these sectors, we used the SBO (2012), ASE (2014, 2015, 2016), and ABS (2017, 2018, 2019, 2020) as sources to gather female STEM entrepreneur numbers by ethnicity, race and veteran status. For the year 2013 we used SUSB as a source that did not differentiate the data by sex, race, or ethnicity. We applied the appropriate year ratios from the ABS to obtain the 2013 female STEM employer numbers by race, ethnicity and veteran status.

For the nonemployer data, we used NES as a source for the years 2012 through 2016. However, this data was not differentiated by sex, ethnicity, race, or veteran status. We applied appropriate year demographic percentages from the NES-D to the total nonemployer numbers from these years to obtain the nonemployer female STEM entrepreneur data by the different race, ethnic and veteran status categories. For the years 2018, 2019, and 2020, we used nonemployer women STEM entrepreneur data differentiated by sex, race, and ethnicity from the NES-D.

For the explanatory variables such as women patentee numbers, female venture funding, women STEM graduates, etc. we used national level data not broken down by race, ethnicity, or veteran status, to understand how the number of female STEM entrepreneurs by race, ethnicity, and veteran status changes with overall national level female patentees, female funding, female STEM graduates etc.

1-1-3-A Black or African American Results

Over the time period of this study, we found that female Black or African American employer and nonemployer STEM firms are concentrated in the Health Care and Social Assistance sectors (NAICS Code 62). There is also a relatively large number of Black nonemployer STEM firms in the Professional, Scientific, and Technical Services (NAICS Code 54) sectors. Below are the findings from running the national level log-log model for this group:

- Increase in female patentees leads to an increase in female STEM entrepreneurship for this group. A 1% increase in female patentees leads to a 1.6% increase in Black female entrepreneur numbers. A larger pool of female patentees could imply more Black female patentees leading to increases in STEM entrepreneurs.

- An increase in female venture funding leads to an increase in the number of Black female STEM entrepreneurs. A 1% increase in funding leads to a .9% rise in their numbers. So, the entrepreneurship of these entrepreneurs is very sensitive to venture funding. This could reflect the fact that very small amounts of funding go to these entrepreneurs to begin with, and the additional funding is directed to the highly concentrated sectors alleviating a resource crunch for existing entrepreneurs. In addition, increased funding could also go to STEM sectors that these firms are not concentrated in, allowing for the formation of new firms.
- A larger labor force leads to a larger number of Black female entrepreneurs in STEM. For a 1% increase in the labor force, their numbers go up by 114%. Increases in the work force could bring about more child care options and networking options for these businesses. It is possible that Black women are particularly likely to take up entrepreneurship related earning activities when labor participation rates rise.
- Increasing the number of female STEM graduates leads to a decline in the number of Black female STEM firms. A 1% increase in graduates corresponds to a 31% decline in in these firms' numbers. It is possible that the larger number of female STEM graduates are in fields in which there is already a lot of competition, leading to firm failures and exits. It is also possible that female STEM graduates tend to remain in academia instead of becoming entrepreneurs.
- Interest rate increases don't impact these entrepreneurs greatly. A one percentage point increase in interest rates, leads to a .3% decline in Black female STEM entrepreneurship. This could be because these businesses don't rely on traditional financing, and the large number of nonemployer firms for this group implies lesser capital requirements and less sensitivity to interest rate changes.
- Higher incomes lead to fewer Black women starting STEM businesses. Increases in per-capita incomes by 1% leads to a 10.5% decline in their numbers. Higher incomes might lead Black women to leave and raise families, or not start new businesses due to income parity in the workplace.
- COVID-19 led to more Black women starting STEM businesses. This could have happened because of employment disruptions or because they are concentrated in the health care sector which grew during COVID-19. In addition, stimulus payments could have led to more personal resources to start businesses.

1-1-3-B American Indian or Alaska Native Results

American Indian and Alaska Native (AIAN) employer and nonemployer female STEM firms are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance sectors.

There are some data limitations with this group. However, the numbers of female STEM firms in this group, especially in later years are not small, and looking at the data across different STEM sectors yields numbers that add up to tens of thousands of firms. So, the results are worth considering, and also because the statistical tests point to some model validity. Below are the findings from running this model:

- Increasing women patentees has a strong and significant positive impact on the number of firms in this group. A 1% increase in female patentees leads to a 17.7% increase in the numbers of these firms.
- Female venture capital funding increases translate into greater numbers of female AIAN STEM entrepreneurs. A 1% increase in funding is related to a 6.6% increase in entrepreneurship.
- Higher labor force numbers lead to higher entrepreneurship numbers for this racial category. A 1% increase in the labor force is associated with an 864% increase in these firms' numbers. Given the small numbers for the number of female STEM entrepreneurs in the initial years, the large numbers in later years could reflect changes in recording, classification and reliability of data. This could have produced the large percentage change associated with the change in the labor force.
- Greater number of female STEM graduates bring about declines in the number of STEM firms in this group. A 1% increase in graduates brings about a 240% decline in these entrepreneurs. This could happen if these graduates are in the already concentrated STEM fields.
- A rise in interest rates impacts these firms negatively. An increase of 1% in interest rates leads to a 2.8% decrease in firm numbers, probably due to financing difficulties. There exist loan programs specifically tailored for AIAN tribes. The Bureau of Indian Affairs in the Department of Interior, through its Indian Loan Guarantee Program provides repayment guarantees to outside lenders for Indian-owned businesses[vi]. The Oweesta Corporation provides financial services including business loans exclusively to Native communities[vii]. To the extent that these programs are exclusively available to Native communities, they are also only available to AIAN women-owned businesses, and not to other women-owned businesses. Since these loan programs target Native communities specifically, it is possible that businesses in these communities are getting better loan terms including interest rates than outside of these loans. This could lessen the impact to some extent of interest rate increases for these businesses.
- Higher incomes lead to fewer female AIAN STEM firms. There is a 70% decline with a 1% increase in per capita incomes. This could happen because women leave to raise families or start fewer firms due to less income disparity in the workplace.
- COVID-19 led to an increase in the number of female American Indian or Alaska Native STEM businesses because of their health care concentration. The NDN Collective does business lending through its NDN Fund[viii]. The Relief and Resilience program in this fund provides small business loans of up to $500,000 to Indigenous businesses and entrepreneurs, to overcome the financial impacts of the pandemic. Since these loans are only available to Indigenous entrepreneurs, they are financing options available for American Indian women but not available

for other women. This fund could have also helped Native American women businesses survive beyond the pandemic.

1-1-3-C White Racial Group Results

White female-owned employer and nonemployer businesses are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance sectors, from the years 2012 through 2020.

Following are the results for this racial group:

- An increase in female patentees produces an increase in the number of White female STEM entrepreneurs. A 1% increase in female patentees is associated with a .7% increase in female White firm numbers. More female patentees overall could mean more White female patentees, who go on to form STEM businesses.
- Increased female venture funding leads to an increase in White women STEM entrepreneurs. A 1% increase in funding leads to a .5% increase in entrepreneurship. This could be due to funding going to overcrowded sectors allowing greater access to resources for firms in those sectors, or funding being directed to the less concentrated sectors leading to new business formation.
- A larger labor force impacts the numbers of these entrepreneurs positively. A 1% increase in the labor force results in a close to 57% increase in the number of White female STEM firms. There could be more child care and networking options available to these entrepreneurs.
- A greater number of women STEM graduates leads to a decrease in White female STEM entrepreneurs. A 1% increase in these graduates leads to a 15% decline in these firms' numbers. Women STEM graduates could be going to crowded fields leading to firm failures. It is also possible that STEM education is a pipeline to academia and not to STEM entrepreneurship.
- Higher interest rates do not have a huge impact this group. For a one percentage point increase in interest rates, these firms see only a .14% drop in their numbers. The large number of nonemployer female White firms with lower capital requirements are probably not sensitive to interest rate changes.
- Higher per-capita incomes lead to less entrepreneurship in this group. If incomes go up by 1%, these firms see a 5.4% decline in their numbers. Higher incomes could cause these entrepreneurs to leave and raise families.
- The pandemic led to more female White firms, possibly due to their concentration in the health care sector and new business opportunities.

1-1-3-D Asian Racial Category Results

Asian female STEM employer firms are concentrated in the Professional, Scientific, and Technical Services and Health Care and Social Assistance sectors. Nonemployer female Asian STEM firms are also concentrated in these sectors, and their nonemployer numbers between the two sectors are approximately equal for all the years in the study, thought the professional sector starts overtaking the health care sector in the later years.

The national level results for this group are as follows:

- An increase in female patentees leads to an increase in the number of these firms. A 1% increase in patentees lead to a 2.4% rise in the number of these firms. More women patentees could imply more Asian women patentees who go on to start more STEM businesses.
- An increase in female venture capital funding leads to an increase in the number of female Asian STEM firms. If funding goes up by 1%, the numbers of these firms go up by 1.4%. The increase in funding could allow for less resource competition in concentrated sectors and more business formation in nonconcentrated sectors.
- A larger labor force leads to an increase in the number of these firms. A 1% increase in labor force causes a 168% increase in numbers. The presence of more skilled workers, and child care options could help these firms. It is also possible that Asian women are more inclined to take up entrepreneurship related earning activities when labor participation rates rise.
- More female STEM graduates lead to a decline in the number of Asian female STEM firms. A 1% increase in STEM graduates brings about a 45% drop in firm numbers. The increase in the number of female STEM graduates could cause increased competition in crowded sectors leading to the demise of firms. It is possible that female STEM graduates because of their academic success stay in academia or take up other employment rather than become entrepreneurs.
- Higher interest rates lead to a decline in these firms, due to financing difficulties. A one percentage point increase in interest rates leads to a .5% decline in Asian female STEM entrepreneurship.
- Higher incomes lead to a fall in firm numbers. A 1% increase in per-capita incomes is related to a 15.5% decrease in Asian female STEM numbers.
- COVID-19 increased the numbers of these firms possibly because of new opportunities for these firms.

1-1-3-E Native Hawaiian and Other Pacific Islander Results

The number of Native Hawaiian and Other Pacific Islander female STEM firms is quite small, compared to other racial groups. There are only a few hundred employer firms and a few thousand nonemployer firms in this category, for all the years of the study. Both employer and nonemployer firms are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance categories, though there are more nonemployer firms in the health care sector than in the professional services sector from 2012 to 2020.

We are aware of the data limitation issues with this group, however the results are worth considering, because the statistical tests point to some validity of the model and the number of observations across sectors lends them to some statistical validity. The results for this category from the national level model are as follows:

- More female patentees lead to a greater number of these businesses. An increase in women patentees could imply an increase in Native Hawaiian and Other Pacific Islander women patentees, and they could form more STEM firms. A 1% increase in female patentees leads to an 8.8% rise in the numbers of these firms.
- An increase in female venture capital funding increases the number of these firms. Venture funding for Native Hawaiian and Other Pacific Islander female STEM businesses could be small to begin with, and additional female funding may help sectors where they are concentrated, leading to less competition. It could also lead to growth in sectors where they are small. A 1% increase in funding results in a 3.3% rise in firm numbers.
- A larger labor force leads to a dramatic increase in the numbers of these firms. Greater child care and networking options could help these firms. A 1% increase in the labor force is associated with a 437% increase in entrepreneurship. Given the small numbers for the number of female STEM entrepreneurs in the initial years, the large numbers in later years could reflect changes in recording, classification and reliability of data. This could have produced the large percentage change associated with the change in the labor force.
- A greater number of female STEM graduates leads to a decline in female Native Hawaiian and Other Pacific Islander STEM firms. More graduates in the popular sectors could cause greater competition and failure of firms. A 1% increase in graduates is related to a 121% decrease in these firms.
- Higher interest rates lead to fewer firms in this group, due to financing difficulties. A one percentage point rise in interest rates leads to a 1.4% decline in firm numbers.
- Higher incomes lead to a decline in these firms' numbers, possibly due to Native Hawaiian and Other Pacific Islander women taking time to raise families. If incomes go up by 1%, there is a 36.6% decline in firm numbers.
- The pandemic had a positive impact on these firms, possibly because Native Hawaiian and Other pacific Islander firms found new business opportunities.

1-1-3-F Hispanic Ethnic Group Results

For the time period of this study, Hispanic woman-owned female STEM employer and nonemployer firms are concentrated in the Professional, Scientific, and Technical services, and Health Care and Social Assistance sectors with a greater number of employer and nonemployer firms in the health care versus the professional services sector.

- There is a positive relationship between female patentees and the number of these firms. Increases in the number of women patentees could mean positive changes in the numbers of female Hispanic patentees and the formation of businesses by them. A 1% rise in patentees leads a 1.5% increase in firms.

- Similarly, increases in female venture capital funding result in increases in female Hispanic STEM entrepreneurship. Again, this could be because of the increased funding happening in concentrated sectors, and in noncrowded STEM sectors. A 1% increase in funding results in a close to 1% rise in female Hispanic STEM firm numbers.
- A larger labor force leads to more female Hispanic STEM firm numbers. This could happen because of the increased availability of child care, skilled labor force and networking options. An increase of 1% in the labor force leads to a 122% rise in firm numbers. It is also possible that Hispanic women are highly likely to take up entrepreneurship related earning activities when labor participation rates rise.
- Increases in interest rates lead to a small decrease in the number of Hispanic female STEM entrepreneurs. A one percentage point increase in interest rates causes a .3% decrease in the numbers of these firms. The fact that these businesses are not dependent on traditional financing could mean that they are not impacted by higher interest rates.
- Higher per-capita incomes lead to a decrease in the number of these businesses. There is a 11% decline in the number of Hispanic female STEM firms with a 1% increase in incomes. Rising incomes could allow Hispanic women to take time to raise families.
- An increase in the number of female STEM graduates leads to a decline in the number of Hispanic women-owned entrepreneurs. A 1% increase in graduates leads to a 32.6% decline in the numbers of these firms. More female STEM graduates concentrated in a few fields could lead to increased competition and business failures. In addition, women STEM graduates may be deciding to stay in academia.
- The pandemic had a positive impact on STEM businesses owned by Hispanic women. The growth in the health care sector during COVID-19 could have led to this effect.

1-1-3-G Non-Hispanic Ethnic Group Results

We found that during the years of our study, non-Hispanic female STEM employer and nonemployer businesses are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance sectors. There are more employer firms in the health care sector compared to the professional sector for this group, for most years of the study. As regards nonemployer firms, there are more firms in health care in the first two years, and a greater number in professional services in the latter years of the study.

The national level model results for this group are below.

- An increase in women patentees leads to a small increase in entrepreneurship for this group. A 1% increase in female patentees leads to a .6% increase in the number of female non-Hispanic STEM firms.

- Increased venture capital funding leads to a rise in STEM entrepreneurship in this group. This could reflect the concentration of this group in certain STEM sectors that receive more funding, allowing for less competition for resources. Higher funding could also go to STEM sectors with fewer non-Hispanic firms, leading to new business formation. A 1% increase in funding leads to .43% rise in firm numbers.
- A larger labor force leads to an increase in the number of these firms. Increased options for child care, a skilled labor force, and networking could cause this to happen. A 1% rise in the labor force results in a close to 52% rise in the number of these firms.
- More female STEM graduates have a negative impact on these firms. An overall increase in graduates could increase the number of non-Hispanic graduates in concentrated sectors, leading to business failures. A 1% rise in graduates causes a close to 14% decline in female non-Hispanic firm numbers.
- Higher interest rates lead to a small decrease in these firms. This could be because these are primarily nonemployer firms and therefore less sensitive to interest rate changes. A 1% interest rate rise results in a .13% fall in the firm numbers.
- Higher incomes possibly cause non-Hispanic women to focus on raising families leading to a decline in their numbers. A 1% rise in per-capita incomes leads to a 4.7% decline in non-Hispanic female STEM numbers.
- The pandemic had a positive impact on these firms. The concentration of these firms in the health care sector could have led to this increase. These entrepreneurs could also have found new opportunities during the pandemic.

1-1-3-H Veteran Group Results

Businesses in this group are concentrated in the Professional, Scientific, and Technical Services and Health Care and Social Assistance sectors, though there are many more nonemployer than employer firms. Amongst both employer and nonemployer firms, the number of firms is higher in health care than in professional services.

Following are the model results for this group:

- An increase in female patentees produces an increase in the number of Veteran female STEM entrepreneurs. A 1% rise in female patentees leads to a .62% rise in female Veteran STEM firms. More female patentees overall could mean more Veteran female patentees, who go on to form STEM businesses.
- Increased female venture funding leads to an increase in Veteran women STEM entrepreneurs. A 1% rise in funding cause a .37% increase in firm numbers. This could be due to funding going to overcrowded sectors allowing greater access to resources for firms in those sectors, or funding being directed to the less concentrated sectors leading to new business formation.
- A larger labor force impacts the numbers of these entrepreneurs positively. A 1% increase in the labor force leads to a 40% rise in the numbers of female Veteran

STEM firms. There could be more child care and networking options available to these entrepreneurs.

- A greater number of women STEM graduates leads to a decrease in Veteran female STEM entrepreneurs. A 1% rise in STEM graduates leads to an 11% decline in firm numbers. Women STEM graduates could be going to crowded fields leading to firm failures, or staying in academia.
- Higher interest rates have a small negative impact on this group. A one percentage point rise in interest rates leads to a .15% decline in female Veteran STEM firms. The large number of nonemployer female Veteran firms with lower capital requirements are probably not sensitive to interest rate changes.
- Higher per-capita incomes lead to less entrepreneurship in this group. An increase of 1% in per-capita incomes brings about a 3.8% decline in the numbers of these firms. Higher incomes could cause these entrepreneurs to leave and raise families.
- The pandemic had a positive impact on these firms. This could be because of new business opportunities for female veterans.

1-1-3-I Non-veteran Group Results

Non-veteran employer and nonemployer firms are concentrated in the Professional, Scientific, and Technical Services, and Healthcare and Social Assistance sectors. There are many more nonemployer than employer firms in these sectors.

The national model results for this group are as follows:

- An increase in female patentees produces an increase in the number of non-veteran female STEM entrepreneurs. More female patentees overall could mean more non-veteran female patentees, who go on to form STEM businesses. A 1% rise in female patentees corresponds to a .7% increase in firm numbers.
- Increased female venture funding leads to an increase in non-veteran women STEM entrepreneurs. A 1% increase in funding causes a .5% rise in non-veteran female STEM firms. This could be due to funding going to overcrowded sectors allowing greater access to resources for firms in those sectors, or funding being directed to the less concentrated sectors leading to new business formation.
- A larger labor force impacts the numbers of these entrepreneurs positively. An increase of 1% in the labor force leads to a 60% increase in firm numbers. There could be more child care and networking options available to these entrepreneurs.
- A greater number of women STEM graduates leads to a decrease in non-veteran female STEM entrepreneurs. A 1% increase in these graduates' results in a 16% decline in firm numbers. Women STEM graduates could be going to crowded fields leading to firm failures.
- Higher interest rates have a small negative impact on this group. A one percentage point increase in the interest rate leads to a .16% decline in the numbers of these firms. The large number of nonemployer female non-veteran

firms with lower capital requirements are probably not sensitive to interest rate changes.

- Higher per-capita incomes lead to less entrepreneurship in this group. If incomes go up by 1%, there is a drop of 5.5% in female non-veteran firm numbers. Higher incomes could cause these entrepreneurs to leave and raise families.
- The pandemic led to a positive impact on these firms. This could be because of new business opportunities for female non-veterans.

1-1-4 Trends across Race, Ethnic, Veteran Status groups and Policy Implications

There are similarities in the results for the Black or African American, American Indian or Alaska Native, White, Asian, Hispanic, non-Hispanic, Veteran and non-veteran categories. The results show that:

- Female STEM firms in these categories are concentrated in the professional and health care sectors.
- There is a positive relationship between the numbers of female STEM entrepreneurs in these groups and female patentee numbers, female venture funding levels, and employment numbers.
- Increases in the labor force bring about large positive changes in the numbers of these firms.
- There is a negative relationship between female STEM entrepreneur numbers in these groups and women STEM graduate numbers and per-capita incomes.
- Higher interest rates lead to a decline in female STEM firm numbers for these groups but not by a large percentage.
- COVID-19 led to an increase in the numbers of female STEM entrepreneurs in these groups.

Within these groups, there is a range in sensitivities of female STEM numbers to different variables as follows:

- Female STEM firm numbers in the Black, Hispanic and Asian groups react more positively to increases in female patentee numbers and venture capital funding than female STEM firm numbers in the White, non-Hispanic, Veteran and non-veteran categories.
- Female STEM firms in the Black, Hispanic and Asian groups react more negatively to increases in women STEM graduate numbers and per-capita incomes than female STEM firms in the White, non-Hispanic, Veteran and non-veteran categories.
- Female STEM firm numbers for AIAN, and Native Hawaiian and Other Pacific Islander groups change by large percentages in response to changes in the labor force and female STEM graduate numbers. The base numbers of these firms are small, and even small changes in numbers lead to large changes in percentages.

For example, for the Native Hawaiian and Other Pacific Islander groups, the change in the numbers of nonemployer female STEM entrepreneurs in the Professional, Scientific, and Technical Services sector between 2012 and 2019 was 174%. The large differences could reflect changes in classification, or recording of data which impacts data reliability. However, the results are worth noting because of the model statistical results.

Based on the findings and observations above, the policy implications for these groups are as follows:

- Federal agencies could incentivize state governments to support women-owned businesses' commercialization in less concentrated sectors. State governments could do this by collaborating with institutions and industry partners. This will increase the number of women patentees and impact female STEM numbers positively.
- SBA could cultivate more women as investors and lenders by making them aware of investment opportunities in female STEM firms. SBA could work with existing financiers to educate them about alternative financing mechanisms such as, impact investing and gender bonds, to level the playing field for female STEM businesses.
- Government-backed equity investments, for example, through the SBIC program could be concentrated in certain STEM sectors. These could be STEM sectors where women-owned businesses are concentrated to alleviate competition in these sectors, or it could be in STEM sectors where women-owned businesses are underrepresented to help female entrepreneurs start new businesses.
- Federal agencies could provide targeted mentoring, networking to female businesses in certain STEM sectors to increase the number of firms in these sectors.
- The federal government could tie K-12 funding to educating female students in STEM, leading to the development of a skilled workforce for female STEM firm creation and growth.
- The federal government could provide child care grants to states and states could support the wages and benefits of child care workers. This will create a child care workforce with increased care options for female STEM firms.
- Congress and the Department of Education could work with state and local jurisdictions to condition public funding of higher education institutions on increased female STEM enrollment in varied STEM sectors and commercialization exposure, leading to more female researchers, patentees and STEM firms.
- Congress could legislate emergency funding assistance through local organizations, for increased access to financial assistance for underserved populations.
- SBA's resource networks could train female entrepreneurs on emergency funding applications.

- The federal government could provide direct cash payments to families during emergencies, creating a financial cushion and helping women start STEM businesses.
- The federal government could provide financial and child care assistance to mothers during emergencies, especially to mothers with few child care options.

A few specific policy implications for the AIAN, and Native Hawaiian and Other Pacific Islander categories are as follows:

- Federal funding to schools in indigenous communities could be tied to female STEM enrollment and exposure.
- The federal government could work with states to tie funding for tribal institutions to innovation exposure for female students and faculty.
- Congress could authorize states with large indigenous populations to use grant funding to establish an authority to encourage innovation by Native American female faculty.
- Federal government and non-profits could provide venture capital access training and mentorship to Native American female entrepreneurs.
- Federal funding for Asian American and Native American Pacific Islander-Serving Institutions (AANAPISI) could be tied to increased training and commercialization exposure for female Asian American or Native American Pacific Islander students and faculty.
- Federal funding for Pacific Islands institutions could be tied to increased commercialization exposure for Native Hawaiian and Other Pacific Islander female STEM students. This could increase the numbers of these students and faculty who go on to patent their inventions.
- Federal funding for K-12 could be tied to increased enrollment and training for Native Hawaiian and Other Pacific Islander female students, to create a skilled workforce.

1-2 State Level Analysis and Results

For the state level analysis, we collected three-digit NAICS data on the number of female STEM entrepreneurs for each state for the years 2012-2020 from the same Census sources, mentioned above for the national level analysis. We ordered this data to put it in a form for econometric analyses and for the years where this data was not available by sex or available at the two-digit level, we developed estimates based on data from appropriate years.

For the factors that could influence the number of female STEM entrepreneurs in each state, we gathered data from the following sources:

- State level female patentee data from our constructed dataset using data downloads from USPTO's PatentsView and merging files

- State venture funding for female-founded firms from PitchBook's Female Founders Dashboard
- State level employment data from the Bureau of Labor Statistics (BLS)
- State per-capita income data from the Bureau of Economic Analysis (BEA)

For the interest rate and women STEM graduate data, we used the national values, since interest rates are national and women STEM graduates are able to move easily form state to state. We also included a COVID-19 dummy variable. We used a state level log-log model to understand how these factors influence the number of female STEM entrepreneurs in each state.

1-2-1 State Level Analysis and Results

Female STEM entrepreneurs are concentrated in the Professional, Scientific, and Technical services and Ambulatory Health Care sectors at the state levels also. This is true for both employer and nonemployer firms, over the years 2012 through 2020. We ran the state level log-log model for each state to understand the relationships between the explanatory factors and the number of female STEM entrepreneurs in each state.

Our results from this modeling are captured in Table 1-1 below. This table shows the positive or negative relationship between state female patentees, state female venture funding, state employment, national women STEM graduates, interest rates, and COVID-19, and the number of female STEM entrepreneurs in a state. The up and down arrows represent the positive and negative relationships respectively between each of the explanatory factors and state female STEM numbers.

Table 1-1: State Level Log-Log Model Findings

State	State female patentees'	State female venture funds Increase	State labor force Increase	Women STEM graduates' increase	Interest rate increase	State per-capita income increase	COVID-19
AL	↑	↓	↑	↑	↓	↑	
AK	↓	↓	↓				
AZ	↓	↑	↑	↓	↓	↑	↑
AK	↑	↓	↑	↑	↑	↓	↑
CA	↓	↑	↓	↑	↑	↑	↓
CO	↑	↑	↑	↓	↓	↑	↓
CT	↑	↓	↑	↑	↑	↑	↑
DC	↑	↑	↑	↓	↓	↓	↓
DE	↑	↑	↓	↑	↓	↑	↓
FL	↓	↓	↓	↑	↑	↓	↓
GA	↑	↓	↓	↑	↑	↑	↓
HI	↓	↑	↓	↑	↑	↑	↓
ID	↑	↓	↑	↓	↓	↓	↑
IL	↓	↓	↓	↑	↑	↓	↓
IN	↓	↓	↓	↑	↑	↑	↓
IA	↓	↓	↓	↑	↑	↑	↓
KS	↑	↑	↑	↑	↓	↓	↑
KY	↑	↑	↑	↑	↓	↓	↑
LA	↓	↑	↓	↑	↑	↓	↑
ME	↑	↓	↑	↓	↑	↑	
MD	↓	↓	↓	↑	↑	↑	↓
MA	↑	↓	↓	↑	↑	↑	↓
MI	↓	↓	↓	↑	↑	↓	↓
MN	↓	↓	↑	↓	↑	↑	↑
MS	↓	↑	↓	↑	↑		
MO	↑	↓	↑	↓	↓	↓	↑
MT	↑	↓	↓	↑	↑	↑	↓
NE	↓	↓	↑	↓	↓	↓	↑
NV	↑	↓	↓	↑	↓	↓	
NH	↓	↓	↓	↑	↑	↓	↑
NJ	↓	↑	↑	↓	↑	↑	↓
NM	↓	↑	↓	↑	↑	↓	↓
NY	↓	↑	↓	↑	↑	↑	↓
NC	↓	↓	↑	↓	↑	↓	↑
ND	↓						
OH	↓	↓	↓	↑	↑	↓	↓
OK	↓	↑	↓	↑	↓	↑	↓
OR	↓	↓	↓	↑	↑	↑	↓
PA	↓	↓	↑	↑	↑	↓	↑
RI	↑	↓	↓	↓	↓	↑	↓
SC	↑	↑	↓	↑	↓	↑	↓
SD	↓	↓	↓	↑	↑	↑	
TN	↓	↑	↓	↑	↓	↓	↓
TX	↑	↑	↓	↑	↑	↓	↓
UT	↑	↓	↑	↓	↑	↑	↑
VT	↓	↑	↓	↑	↓	↑	↓
VA	↑	↓	↑	↓	↑	↑	↑
WA	↓	↑	↑	↑	↓	↓	↑
WV	↑	↓					
WI	↑	↑	↓	↑	↑	↑	↓
WY	↓	↓	↓	↑	↓	↓	

Note: Where the cells have missing arrows, there was not enough data for the model to compute the result.

1-2-2 State Level Policy Implications

Instead of discussing the policy implications state by state, we summarize the policies appropriate for positive relationships versus those that apply to negative relationships between each factor and state female STEM numbers. The detailed discussion state by state is included in Chapter 5. These policies are grouped below:

1-2-2-A Positive relationships between variables

1. A positive relationship between women patentees and the number of women STEM entrepreneurs in a state, implies the need to increase the number of female patentees in a state. Regionally, the Southeast has more states with this positive relationship. Georgia is as an outlier, where the coefficient representing this positive relationship is higher than the national coefficient. Universities in Georgia support innovation. Other states with large positive coefficients include Maine in the Northeast that is higher than the national coefficient and Colorado and Idaho in the West that have relatively larger positive coefficients, but not higher than the national coefficient. The Maine results could be skewed because of missing values in the female STEM entrepreneur numbers across some sectors.
    a. Congress and the Department of Education could work with state and local jurisdictions to condition public funding of higher education institutions on increased female STEM enrollment and commercialization exposure.
    b. This would incentivize universities and research institutions in the state to conduct targeted outreach to female students and academics, providing support for their academic success and commercialization efforts.
    c. Congress could authorize state and local governments to use grant funding in programs including CDBGs to establish commercialization authorities to support STEM research, innovation, and entrepreneurship, with a focus on promoting female participation by licensing offices.
    d. Federal policymakers could examine the specific factors contributing to female STEM entrepreneurs' success in states' with relatively large positive relationships. They could identify and share best practices from these states to inform policies and programs in other parts of the country. For example, universities in Georgia have innovation initiatives (Section 5-12-1 Georgia Model Interpretations) that complement the support provided by other groups to women STEM entrepreneurs, leading to an entrepreneurial ecosystem in which these entrepreneurs thrive. Federal policymakers could work with states to incentivize institutions in other states to do the same.
2. A positive relationship between female venture capital funding that is funding provided to female founded and co-founded firms and the number of female STEM entrepreneurs within a state, suggests the need to increase this funding. One way to increase this funding is to increase female representation in venture capital funding. Increasing women representation in venture capital funding may result in increasing funding for women STEM entrepreneurs. The overall

trend in the Southwest region shows that female venture capital funding is generally having a positive impact on female STEM entrepreneurship, with Texas leading the way and being close to the national level result.

   a. Congress could legislate additional public funding for SBICs and SSBCI to strategically invest in sectors in which women STEM entrepreneurs are concentrated, and to target women in sectors in which they're underrepresented.
   b. SBA could train new female venture capital/angel investors to increase their numbers in venture funding and guide them on investing in female STEM businesses in varied STEM sectors.
   c. SBA could educate local lenders on female STEM investment in all STEM sectors.
   d. Federal policymakers could learn from states in the Southwest region such as Texas and develop strategies to replicate this success in other states. Texas institutions have institutes and centers (Section 5-45-1 Texas Model Interpretations) that support innovation and entrepreneurship, which could lead to increased venture funding creating a relatively large positive impact. Federal policymakers could work with states to encourage the establishment of similar institutes, centers and initiatives in institutions in other states.

3. If there is a positive relationship between the labor force and the number of female STEM entrepreneurs in a state, the following initiatives are relevant. There are some states such as Idaho, Minnesota, North Carolina, and Pennsylvania that have large positive relationships, though none of them are as large as the national result.
   a. Congress could legislate programs like the American Rescue Plan's childcare stabilization grants, helping state governments provide funding to support competitive wages for childcare providers, thereby expanding the childcare labor force.
   b. This could encourage practices like providing monthly stipends, location assistance, and health insurance benefits to childcare workers and attract more individuals to the childcare workforce.
   c. The federal government could tie K-12 funding to female STEM learning. These efforts could contribute to a larger pool of the female STEM workforce, leading to more networking opportunities and support for female STEM entrepreneurs.
4. A positive relationship between female STEM graduates and female STEM entrepreneurship indicates the importance of education and training, attraction and retention of female STEM graduates in a state. Huntington-Klein (2021)[ix] finds that one explanation for labor market returns to education is signaling, because it allows high-ability students to distinguish themselves to employers. To the extent that women STEM graduates in a state choose entrepreneurship over employment, this relationship is not indicative of signaling. Most states in the Northeast have positive coefficients. The West region also has mostly positive

coefficients, suggesting a generally favorable environment for women STEM graduates pursuing entrepreneurship. The Southeast includes many states that have positive coefficients. These states likely have unique conditions or support systems that strongly encourage women STEM graduates to pursue entrepreneurship.

   a. The federal government could tie K-12 funding to a focus on engaging and retaining female students in STEM subjects.
   b. Congress could work with state governments to condition funding to universities and colleges on expansion of their STEM programs, outreach to female students, and increased entrepreneurship exposure for these students.
   c. This could incentivize universities and colleges in the state to develop entrepreneurship education programs and incubators specifically designed for women STEM students and graduates.
   d. It could also encourage partnerships between educational institutions and industry to provide internships, mentorship, and networking opportunities for women STEM students and graduates interested in entrepreneurship.
   e. Congress could authorize states to use program grant funding for the establishment of an authority to support research, innovation, entrepreneurship, funding, growth and commercialization of underrepresented populations in the STEM fields.

5. A positive relationship between per-capita real income and women STEM entrepreneurs in a state highlights the importance of fostering economic growth and creating a supportive environment for entrepreneurship. There could be a bi-directional causality here in that an increase in female STEM entrepreneurship in a state could lead to higher per-capita incomes. But we don't study that here, instead focusing only on whether high per-capita incomes in a state lead to more women STEM businesses. Georgia in the Southeast and Maine in the Northeast have large positive coefficients, whereas Rhode Island in the Northeast, South Carolina in the Southeast, Indiana in the Midwest and Oklahoma in the Southwest have moderate positive coefficients. The Maine results have data limitations mentioned above.
   a. The federal government can invest in infrastructure projects in a state to stimulate demand and economic growth.
   b. The federal government can provide funding for K-12 education and healthcare in a state to increase human capital and support industries, especially STEM industries.
   c. Congress could legislate programs like the American Rescue Plan's childcare stabilization grants to help state workers remain in jobs and earn incomes.
   d. The federal government could provide tax incentives and other support measures to encourage the growth of STEM-related industries and startups, particularly those owned by women in a state.

    e. The federal government could work with states to foster collaboration between industry, academia, and government to create a vibrant and supportive entrepreneurial ecosystem that encourages innovation and risk-taking.
    f. Federal policymakers could study states like Georgia to understand why increasing incomes lead to greater female STEM entrepreneurship in the state and how those factors could be replicated in other states. As mentioned above, the entrepreneurial climate for women entrepreneurs in Georgia created by institutions and other groups supports these businesses, and policymakers could encourage institutions to replicate this in other states.
6. A positive relationship between the national interest rate and women STEM entrepreneurs in a state implies a need to investigate the specific factors influencing this relationship and develop targeted policies to support women entrepreneurs. In the Northeast region, most states have small positive coefficients. The Midwest region also exhibits mostly small positive coefficients, with Minnesota having a relatively larger coefficient. In the Southeast, Georgia and Louisiana have relatively larger positive coefficients.
    a. The federal government could investigate policies to support more nonemployer STEM businesses in a state, that are not heavily impacted by increased cost of financing.
    b. The SBA could encourage alternative financing options such as angel investment for female STEM entrepreneurs that are not dependent on traditional financing.
    c. The SBA could learn from states like Georgia that have alternate sources of funding for female entrepreneurs, and train lenders on female STEM investment.
7. A positive impact of the COVID-19 pandemic on women STEM entrepreneurship in a state highlights the resilience and adaptability of women entrepreneurs in the face of adversity and suggests a need to support and foster these qualities moving forward. In the Northeast region, Connecticut shows an increase. The Southeast region has some states like North Carolina, Virginia, Arkansas, Kentucky, and Louisiana that follow the national trend and show an increase. In the Midwest region, states like Kansas, Minnesota, Missouri, and Nebraska show increases in female STEM entrepreneurship. Arizona and Utah in the Southwest, and Idaho and Washington in the West also follow the national trend.
    a. The federal government could support the state government in conducting a study to identify the specific strategies and approaches that women STEM entrepreneurs in the state employed to adapt and succeed during the pandemic, such as pivoting to online business models, leveraging digital technologies, or tapping into new markets and opportunities. For example, in Virginia (Section 5-48-1 Virginia Model Interpretations) many businesses shifted their operations online. Moreover, a pre-existing requirement that a minimum percentage of disadvantaged businesses

including women-owned businesses be utilized in state contracting, probably helped these businesses work on projects funded by the American Rescue Plan Act (ARPA).

   b. Based on the findings, the federal government could provide funding to the state to develop programs and initiatives to support and encourage the continued innovation and adaptability of women STEM entrepreneurs, such as providing access to digital skills training, e-commerce platforms, and online networking opportunities, to withstand future economy-wide shocks.
   c. The federal government could work with states to ensure that projects funded by future emergency recovery funds utilize small businesses including women-owned businesses.

1-2-2-B Negative relationships between variables

1. A negative relationship between women patentees and women STEM entrepreneurs in a state suggests a need to address barriers to commercialization and support the transition from patent holder to entrepreneur. The Northeast and Midwest regions have more states with negative relationships, although the changes are generally small in magnitude. Pennsylvania in the Northeast and Ohio, South Dakota and North Dakota in the Midwest have relatively larger negative coefficients, as does North Carolina in the Southeast.
   a. Congress could legislate that federal agencies participating in the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs develop initiatives similar to NSF's Accelerating Women And underRepresented Entrepreneurs (AWARE) program to promote female participation in commercialization and entrepreneurship. The AWARE program provides grant writing assistance, commercialization and entrepreneurship summits, and sharing of success stories to underrepresented populations. These agencies could help the state government provide resources and support to help women patentees in the state navigate the commercialization and entrepreneurship process, such as access to funding, mentorship, and networks.
   b. Congress could legislate that federal agencies participating in the STTR program provide funding to university licensing offices at partnering research institutions, to train and support female academic STEM entrepreneurs on grant applications, especially for nonconcentrated STEM sectors.
   c. Congress could authorize states to use program grant funding for the establishment of a dedicated agency or initiative to foster collaboration between women patentees, entrepreneurs, and industry partners, facilitating the commercialization of patents and the growth of women STEM businesses.

2. A negative relationship between female venture capital funding and the number of female STEM entrepreneurs within a state, suggests the need to increase this funding in targeted sectors. In the Northeast region, most states have small negative coefficients or no change in the relationship between female venture capital funding and the number of female STEM entrepreneurs. It is possible that in these states funding is going to overcrowded STEM sectors, leading to no impact or negative impact on STEM entrepreneurship due to competition. There is a relatively large negative relationship in Florida, Minnesota, and Alabama.
    a. SBA could train female venture capital/angel investors on female STEM investment in nonconcentrated STEM sectors.
    b. SBA could educate local lenders on female STEM investment in underrepresented STEM sectors.
3. A negative relationship between the labor force and the number of female STEM entrepreneurs in a state indicates the lack of workers skilled in different STEM disciplines. Assuming skilled workers can move freely, they could move to states with higher wages and benefits. Florida has a large negative relationship. Georgia, Indiana, Maryland and Massachusetts are other states with relatively large negative relationships, though smaller than Florida's coefficient.
    a. The federal government could provide funding to the state government to invest in STEM education and training programs, particularly those targeting women and underrepresented groups, to build a strong pipeline of skilled talent for a state's STEM industries.
    b. The funding could be conditioned on the state partnering with industry and educational institutions to develop internship, apprenticeship, and mentorship programs in diverse STEM sectors that provide women with hands-on experience and exposure to STEM careers and entrepreneurship.
    c. The federal funding could also be linked to state policies and initiatives that promote diversity in the workplace, such as pay equity with other states, flexible work arrangements, and family-friendly benefits, to attract skilled and talented workers to the state.
4. A negative relationship between national women STEM graduates and women STEM entrepreneurs in a state suggests a need to better understand and address the specific challenges faced by women transitioning from education to entrepreneurship in the state. States with negative coefficients generally have smaller coefficients compared to the national trend. North Carolina, Idaho, and Minnesota have the largest negative coefficients though smaller than the national result, suggesting the presence of significant barriers or challenges for women STEM graduates pursuing entrepreneurship in these states. Other states with negative coefficients have smaller coefficients than these states.
    a. The federal government could support the state government in commissioning a study to examine the barriers and opportunities for women STEM graduates.

    b. Based on the findings, the federal government could encourage the state to develop targeted initiatives to support women STEM graduates in launching and growing their businesses, such as incubator and accelerator programs tailored to their needs.
    c. These initiatives could also include collaborations between educational institutions and industry to provide women STEM students with exposure to entrepreneurship and hands-on experience through internships.
    d. Federal grant funding for state institutions could be tied to the inclusion of diverse faculty in grant applications to encourage institutions to find creative ways to promote female faculty and make it easier for them to commercialize their inventions, given their seniority.
5. A negative relationship between per-capita real income and women STEM entrepreneurship in a state, indicates a need to address the opportunity cost of entrepreneurship and provide support for women entrepreneurs in the state. Pennsylvania in the Northeast and Idaho in the West have larger negative coefficients than the national negative coefficient. Louisiana and Washington have moderate negative coefficients that are smaller than the national one.
    a. The federal government could help the state government conduct a study to identify the specific economic, social, and cultural factors that may influence women's decisions to pursue STEM entrepreneurship in the state, such as industry composition, childcare and other care, and financial considerations.
    b. The federal government could provide grants to the state government to develop targeted policies and programs to support women STEM entrepreneurs, such as providing access to affordable childcare, and mentorship and networking opportunities, and financial assistance.
6. A negative relationship between interest rates and women STEM entrepreneurs in a state, suggests that access to affordable financing could be important for supporting women-owned STEM businesses. Alabama and South Carolina in the Southeast, and Oklahoma in the Southwest have a negative coefficient equal to the national level coefficient, whereas Tennessee in the Southeast, Delaware in the Northeast, Colorado and Idaho in the West, and the District of Columbia have negative coefficients larger than the national level coefficient.
    a. The SBA could work with financial institutions to develop targeted loan programs for women STEM entrepreneurs in the state, providing access to affordable financing to help them launch and grow their businesses.
    b. Federal agencies could provide loan guarantees or other forms of support to help women STEM entrepreneurs secure affordable financing, particularly in the early stages of their businesses.
    c. The SBA could provide financial education and counseling services to help women STEM entrepreneurs in the state navigate the financing process and make informed decisions about their businesses.
7. A negative impact of COVID-19 in a state means that it is crucial to provide ongoing support and resources to help women-owned businesses navigate

economic uncertainties. In the Northeast most states except for Connecticut saw a decrease in female STEM entrepreneurship during the pandemic. In the Southeast states like Florida, Georgia, South Carolina, and Tennessee oppose the national trend and saw declines. In the Midwest states like Illinois, Indiana, Iowa, Michigan, Ohio, and Wisconsin have decreases. Texas, Oklahoma, and New Mexico in the Southwest saw declines. Most states in the West, including California, Colorado, Hawaii, Montana, and Oregon saw declines.

a. The federal government could help the state government establish a dedicated fund to provide emergency financial assistance and technical support to women STEM entrepreneurs affected by the pandemic or other economic shocks.
b. The SBA could collaborate with local organizations, chambers of commerce, and its' own resource networks to develop targeted resources and guidance for women STEM entrepreneurs on business continuity planning, digital transformation, and accessing federal and state aid and assistance programs.
c. The SBA could provide digital infrastructure and skills development programs to help women STEM entrepreneurs in the state adapt to the changing business landscape and build resilience in the face of future economic challenges.

2. Introduction

The *Bipartisan Infrastructure Law* (BIL), the *CHIPS and Science Act and Inflation Reduction Act (IRA) of 2022* include large investments in manufacturing, clean energy and infrastructure projects. These Acts also aim to invest in disadvantaged communities. The National Women's Business Council (NWBC, Council) wants female entrepreneurs in high-yield and high-growth industries to take advantage of these historic opportunities. However, women-owned businesses face challenges in finding and growing their businesses in these sectors. The Women in STEM research aims to understand the current representation of women in these industries and identify policies to support these businesses. We describe the two phases of this research below.

In Phase I, we performed a literature survey of previous research on female STEM entrepreneurship, an analysis of the most recent (2019) data on women business owners in these industries, and a policy review of existing policies impacting these businesses. The literature survey and data analysis helped us make policy inferences to support these businesses. The policy review helped us further refine these inferences and develop policy solutions to enhance Women in STEM success. However, these policy recommendations were preliminary, because they were based on data at a point-in-time that presented a snapshot of Women in STEM status in 2019.

We conducted a Phase II of this research to understand the historical trends of female STEM businesses, and to make more definitive policy recommendations based on these trends. We gathered national- and state-level Census data on employer and nonemployer female STEM businesses from 2012 through 2020, and data on factors such as female patentees, funding and financing, STEM graduates, labor force, and per-capita incomes that could influence these numbers. In order to study the impact of these factors, we performed an econometric analysis based on log-log models at the national and state levels and by race and ethnicity. We examined the results of these analyses to understand the influence of these variables on female STEM entrepreneurs and developed national policy implications as well as those specific to race and ethnicity and the 50 U.S. states and District of Columbia.

The remainder of this report is organized as follows:

- Chapter 3, describes the Data and Methodology
- Chapter 4, provides National Results and Policy Implications
- Chapter 5, specifies State Results and Policy Implications
- Chapter 6, is the Conclusion
- Chapter 7, is a list of References
- Appendices with model results and statistical references are included at the end of the report

3. Data and Methodology

This chapter describes the data sets we accessed and the research methodology we used to further investigate Women in STEM entrepreneurship. We identify the sources we used to gather the data, steps we undertook to prepare the data and close data gaps for data analysis, the econometric and statistical methods we used to analyze the data and the software we employed to run the econometric models.

3-1 Data Sets

We developed data sets for this research by gathering data on the number and location of female STEM entrepreneurs, patent information, funding and financing data, employment data, female STEM graduates' data, and per capita income data. We used the same NAICS codes for STEM sectors that were identified and used in Phase I of the research.

3-1-1 Number and Location of Women STEM Entrepreneurs

We chose to gather the number and location of female STEM entrepreneurs at the more detailed three-digit NAICS level, as opposed to the two-digit level. The NAICS at the three-digit level covers both STEM and STEM-adjacent industries. For example, NAICS 541 covers STEM industries such as "Scientific research and development services", but also STEM-adjacent industries such as "Architectural, engineering, and related services". For the years where the data was available only at the two-digit level, we used three-digit by two-digit ratios from appropriate years to convert the data to three-digit levels. Some of the sources we used report data by 2017 NAICS, whereas some use 2012 NAICS. We looked at the correspondence between 2012 and 2017 NAICS codes for the STEM sectors and found that they matched.

We obtained the number of female employer STEM entrepreneurs, and their location by state from the Census SBO, for the year 2012[x]. This data is by the 2012 NAICS and is available at the two-digit NAICS level[xi]. To obtain this data at the three-digit level, we applied the 2017 female employer three-digit by two-digit ratios for each sector to the 2012 two-digit number of female employer firms per sector.

We used the 2013 SUSB Annual Data Tables by Establishment Industry as a source for the number of employer firms in 2013 by 2012 NAICS, but the data are not divided by sex[xii]. We calculated the 2017 three-digit number of female STEM employer firms as a percent of 2017 three-digit total number of STEM employer firms. We applied this percentage to the 2013 three-digit STEM total number of firms from SUSB to obtain the estimated number of three-digit female-owned STEM employer firms in 2013.

For the years 2014, 2015, and 2016, we obtained female STEM employer data from the ASE. The ASE provides "economic and demographic characteristics of employer businesses and their owners by sector, sex, ethnicity, race, and veteran status for the nation, states, and the fifty most populous metropolitan statistical areas (MSAs)"[xiii].

This data was available by sex at the two-digit level. We applied the 2017 female employer three-digit by two-digit ratios for each sector to the two-digit number of female employer firms per sector for each of these years to obtain the data at the three-digit level.

We obtained the number of female employer STEM entrepreneurs, and their location by state from the ABS, for the years 2017 to 2020[xiv] from the 2018, 2019, 2020 and 2021 ABS. Each ABS provides data for the previous year. For example, the 2018 ABS covers reference year 2017.

The 2018, 2020 and 2021 ABS provide employer information for three-digit NAICS, whereas, the 2019 ABS provides employer data only for two-digit NAICS (the above endnote has links to the methodology of these surveys). So, the employer data for 2017, 2019 and 2020 is more detailed at the three-digit NAICS level, as compared to the data for 2018, which is at the two-digit level. We calculated the data for 2018 by taking an average of the 2017 and 2019 female employer three-digit by two-digit ratios for each sector, and applying this average to the 2018 two-digit number of female employer firms by STEM sector.

The Census NES Tables[xv] provide data on U.S. nonemployer businesses by sector at the three-digit level. However, this data is not differentiated by sex. So, we calculated the 2018 three-digit number of female STEM nonemployer firms as a percent of 2018 three-digit total number of STEM nonemployer firms. We applied this percentage to the 2012 through 2016 three-digit STEM total number of nonemployer firms from NES to obtain the estimated number of three-digit female-owned STEM nonemployer firms for these years.

For 2017, the estimated number of female nonemployer firms is available from Table 1 of the 2017 NES-D[xvi]. However, these are just estimates. So, we used the NES Tables for 2017 that have data that are not estimates, and applied the fraction of female to total number of nonemployer establishments from 2017 to obtain the number of 2017 nonemployer female firms. For the years 2018 and 2019, NES-D data is available at the three-digit NAICS level and we used this data for the number of nonemployer firms in these years. For 2020, NES-D data was not available when we started the analysis, though it has become available recently[xvii]. So, in the beginning, for 2020 we used NES data on total nonemployer establishments and applied an average of 2018 and 2019 female nonemployer fractions to it, to obtain the 2020 female STEM nonemployer firms' number. However, we updated the regression analysis with actual 2020 female STEM nonemployer firm numbers as the data became available. The results after the update were very close to the initial results.

3-1-2 Patent Information

We gathered national level patent data from PatentsView Annualized Data Tables[xviii] that provide information on the inventors, companies and gender of inventors for the patents granted in a particular year. We downloaded patent data by year from these data tables, then distilled patent data where at least one of the inventors was female, and summed the number of female patentees by year to obtain the national number of women patentees by year.

For the state level patent data, we constructed our own dataset. We used the data downloads found at PatentsView[xix]. Next, we merged the following files together: g_patent with g_inventor by patent_id to get the patent grant date, and merged the above dataset to g_location_disambiguated by location_id to get the locations of the inventors by year. We then extracted the female inventors from these files to get the number of female inventor patentees by state by year.

3-1-3 Funding and Financing Data

We accessed venture capital funding data for women entrepreneur startups at the state and national levels from PitchBook's Female Founders Dashboard[xx]. We gathered investment data for female-only founded and co-founded firms by year, and summed this data to get the total investment in female-founded firms by year, both nationally and by state.

To understand the impact of changing interest rates on the financing obtained by female entrepreneurs, we collected national interest rate data (30-year fixed rate mortgage average in the U.S.) from sources such as the Federal Reserve Bank of St. Louis Federal Reserve Economic Data, (FRED), series[xxi].

3-1-4 Labor Force/Employment Data

We obtained national level employment data from the CPS[xxii]. We collected data on the Total employed, 16 years and over in thousands, for the years 2012 through 2020.

For state-level employment data we used the Bureau of Labor Statistics (BLS) [xxiii] as a source. We chose a state, and then selected Total Nonfarm, Not Seasonally Adjusted, include Annual Average (All Employees, In Thousands)[xxiv] data. Seasonal adjustment is only used for quarterly and more frequent data and annual average data are never seasonally adjusted.

3-1-5 Women STEM Graduates Data

To obtain this data we accessed NCES Digest of Education Statistics and found information on the number of STEM degrees by sex of student[xxv]. We collected data on the total number of STEM degrees/certificates obtained by female U.S. citizens, permanent residents, and nonresidents by year for the years 2012-13 through 2020-21.

3-1-6 Per capita Income Data

We accessed this data from the Bureau of Economic Analysis (BEA) “Regional Data and Personal Income” [xxvi]. We used “Per capita personal income (dollars)” as the chosen statistic, and “United States” as the chosen area for the national data. For the state-level data, we picked each state instead of selecting the United States. We adjusted these data to take account of the effects of inflation, to get “real” per capita income for all years.

3-2 National Level Methodology

We used the Continuous Variables Approach (CVR) to evaluate how explanatory variables such as female patentee numbers, venture capital funding, interest rates, etc. impact the number of female STEM entrepreneurs at the national level. The variables at the national level are as follows:

NWSTEM = the number of women STEM entrepreneurs nationally

W_{PAT} = the number of women patentees nationally

VCF = national level venture funding for women STEM entrepreneurs

LF = national labor force

WSG = women STEM graduates in the U.S.

R = Interest rate (30-year fixed rate mortgage average in the U.S.[xxvii])

PCI = Real per-capita income in the U.S.

D = Dummy with a value of 0 for non-pandemic years (2012 thru 2019) and 1 for the pandemic year 2020

ε = random error

log = the natural logarithm

Then a continuous variables equation for women STEM entrepreneurs at the national level is below. This equation is based on a log-log model.

The log-log model is a standard statistical form used frequently in econometric research. Perhaps the most famous use is the Cobb-Douglas production function, which is the basic form used for decades in (industry) production or cost studies (Cobb and Douglas 1928, Biddle 2012)[xxviii]. A recent study uses the model in much more complex form to study industrial behavior (Baum-Snow et al. 2024)[xxix].

This model has the convenient and widely used feature that elasticities (percent changes in the dependent variable due to a percent change in an independent variable) are easy to calculate. We found that the model captured a high percent of variation in the dependent variable, the model fit the data well, and the model explained the effects of changes in independent variables such as women patentees, venture capital funding on the dependent variable reasonably well.

We tested other models, such a logistic regression to model the data by sector (for states with missing values in the female STEM employer and nonemployer numbers), and the standard errors in the results were very high, showing the low accuracy of the statistics. So, we did not use this approach.

We did not use a fixed effects model with states. A fixed effects estimator sets a variety of constant adjustments for different individual series. For 50 states, plus the District of

Columbia, there would be 51 possible numbers that would get added to the constant, to change the constant to be appropriate for each individual series. However, the state-level models did not converge with all the variables in several cases. There were serious differences in the variable coefficients well beyond the differences in the constants. For example, there were different coefficients for the venture-capital variable by state, and the real per-capita income variable by state. The fixed effects model would have blurred all these differences into the fixed effects. With the log-log model we have much more information individual state by individual state. It is not clear that that there is one national market, and there are only differences in constants, and everything would be captured by the fixed-effect terms. Knowing what the individual state coefficients are is a useful starting point because for example, it cannot be said that Nebraska is competing with California for women STEM entrepreneurs, and all the independent variable effects are really the same for both of them except for constants modified by fixed effect intercepts.

The national level equation based on the log-log model is:

$$\mathit{log}\ (\mathrm{NWSTEM}) = \beta_0 + \beta_1 * \mathit{log}\ (\mathrm{WPAT}) + \beta_2 * \mathit{log}\ (\mathrm{VCF}) + \beta_3 * \mathit{log}\ (\mathrm{LF}) + \beta_4 * \mathit{log}\ (\mathrm{WSG}) + \beta_5 * \mathrm{R} + \beta_6 * \mathit{log}\ (\mathrm{RI}) + \beta_7 * \mathrm{COVID19\_D} + \varepsilon$$

The model is in (natural) logarithms, and attempts to describe the (logarithm of the) number of women STEM entrepreneurs in the U.S. in the years 2012 – 2020. The variable names are as follows:

LNWSTEM = Log of number of Women STEM Entrepreneurs in a year

LWPAT = Log of the number of Women Patentees for a given year

LVCF = Log of venture capital funding (Inflation-Adjusted) in firms with at least one female founder in millions of dollars

LLF = Log of the (Employed) U.S. Labor Force, 16 and older for the given year in thousands

LWSG = Log of the number of Women STEM graduates in the given year

R = Average 30-year Mortgage Rate in the given year

LRI = Log of Real (Inflation-Adjusted) Per-Capita Income in the given year in dollars

COVID19_D = A dummy variable to account for COVID-19 (1 only in 2020)

(Intercept) = The Constant Intercept in the regression

The independent variables used to examine the women STEM entrepreneurs are natural ones to use. Patentees, venture funding, financing based on interest rates, employment, and female STEM graduates impact the supply of female STEM entrepreneurs whereas per-capita incomes impact their demand.

Changes in any of these independent variables cannot be guaranteed to cause entrepreneurship. The motivations to enter entrepreneurship have been studied by The World Bank, and are due to factors such as economic necessity, entrepreneurship as a complement to family orientation (Carranza et al. 2018). But the features covered by these variables map very well to endowments, which The World Bank study finds highly related to women entrepreneurial success[xxx].

The economic variables discussed in this study are corroborated in The World Bank Study. The study states: "Access to finance is an important constraint of women entrepreneurs". Venture capital financing, especially from women-founded venture capital funds, can help relieve this constraint. Interest rates, which are included as a variable here, are an important feature in measuring the relative ease of obtaining not just venture capital funding, but all funding, especially loan-based. The study also states: "Education and experience can be improved by business training. Network endowments can be strengthened by networking and mentoring opportunities.". These are directly connected to the number of women STEM graduates, and labor force variables included in our study. In comparing women STEM entrepreneurs to men STEM entrepreneurs, the study states: "In particular, the size and sector of the firm often explain a large portion of the differences in performance." Real income is a useful explanatory variable in explaining the relative openness and market demand in the STEM sectors.

We used R to run the above regression model to explain female entrepreneurship in STEM in the U.S., for the years 2012 – 2020. The regression describes how different factors affect the number of women STEM entrepreneurs in the U.S.

We also ran this equation at the national level by demographic characteristics, such as race and ethnicity. The equations that we used for this modeling are:

$$\log(\text{NWSTEMR}) = \beta_0 + \beta_1 * \log(\text{WPAT}) + \beta_2 * \log(\text{VCF}) + \beta_3 * \log(\text{LF}) + \beta_4 * \log(\text{WSG}) + \beta_5 * \text{R} + \beta_6 * \log(\text{RI}) + \beta_7 * \text{COVID19\_D} + \varepsilon$$

$$\log(\text{NWSTEME}) = \beta_0 + \beta_1 * \log(\text{WPAT}) + \beta_2 * \log(\text{VCF}) + \beta_3 * \log(\text{LF}) + \beta_4 * \log(\text{WSG}) + \beta_5 * \text{R} + \beta_6 * \log(\text{RI}) + \beta_7 * \text{COVID19\_D} + \varepsilon$$

$$\log(\text{NWSTEMV}) = \beta_0 + \beta_1 * \log(\text{WPAT}) + \beta_2 * \log(\text{VCF}) + \beta_3 * \log(\text{LF}) + \beta_4 * \log(\text{WSG}) + \beta_5 * \text{R} + \beta_6 * \log(\text{RI}) + \beta_7 * \text{COVID19\_D} + \varepsilon$$

The three new variable names are as follows:

LNWSTEMR = Log of the number of Women STEM Entrepreneurs in a race in a year nationally for each of the five races identified in the ABS and NES-D - White, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander

LNWSTEME = Log of the number of Women STEM Entrepreneurs by ethnicity in a year nationally for each of the two ethnicities identified in the ABS and NES-D – Hispanic, and non-Hispanic

LNWSTEMV = Log of the number of Women STEM entrepreneurs by veteran status in a year nationally for each of the two veteran statuses identified in the ABS and NES-D – Veteran, and Non-veteran.

We gathered Census data for these three variables at the two-digit NAICS level (31-33 Manufacturing, 51 Information, 54 Professional, scientific, and technical services, 55 Management of companies and enterprises, and 62 Health care and social assistance). This is because data at the three-digit level for these variables was not available for the years of our study. For employer businesses in these sectors, we used the SBO (2012), ASE (2014, 2015, 2016), and ABS (2017, 2018, 2019, 2020) as sources to gather data on the two ethnicities, five races, and two veteran statuses. For the year 2013 we used SUSB as a source. This data was not differentiated by sex, race, ethnicity, or veteran status. We applied the appropriate 2017 ratios (for example, 2017 female STEM Hispanic employer numbers by 2017 total STEM employer numbers) to obtain the 2013 employer numbers.

For the nonemployer data for these variables, we used NES as a source for the years 2012 through 2016. However, this data was not differentiated by sex, ethnicity, race, or veteran status. The 2017 NES-D estimates provide nonemployer data differentiated by these categories. We applied 2017 demographic percentages (for example, 2017 female STEM Hispanic nonemployer numbers by 2017 total STEM nonemployer numbers) to the total nonemployer numbers from these years to obtain the data by the different race, ethnic and veteran status categories. For the years 2018, 2019, and 2020, we were able to obtain data differentiated by sex, race, and veteran status from the NES-D.

3-3 State Level Methodology

We used the CVR to evaluate how explanatory variables such as female patentee numbers, venture capital funding, interest rates, etc. impact the number of female STEM entrepreneurs at the state level. The variables at the state level are as follows:

ST = State Abbreviation, so, for Alabama it would be AL

ST_ NWSTEM = the number of women STEM entrepreneurs in a state

ST_ W_{PAT} = the number of women patentees in a state

ST_ VCF = state level venture funding for women STEM entrepreneurs

ST_ LF = State 's labor force

NAT_WSG = women STEM graduates in the U.S.

R = Interest rate (30-year fixed rate mortgage average in the U.S.[xxxi])

ST_ PCI = Real per-capita income in a state

COVID19_D = Dummy with a value of 0 for non-pandemic years (2012 thru 2019) and 1 for the pandemic year 2020

ε = random error

log = the natural logarithm

Then a continuous variables equation for women STEM entrepreneurs at the state level is as follows.

$$log\ (ST\_NWSTEM) = \beta_0 + \beta_1 * log\ (ST\_WPAT) + \beta_2 * log\ (ST\_VCF) + \beta_3 * log\ (ST\_LF) + \beta_4 * log\ (WSG) + \beta_5 * R + \beta_6 * log\ (ST\_PCI) + \beta_7 * COVID19\_D + \varepsilon$$

The model is in (natural) logarithms, and attempts to describe the (logarithm of the) number of women STEM entrepreneurs in a state in the years 2012 – 2020. The variable names are as follows:

ST_ LNWSTEM = Log of number of Women STEM Entrepreneurs in a state in a year

ST_ LWPAT = Log of the number of Women Patentees for a given year in a state

ST_ LVCF = Log of venture capital funding (Inflation-Adjusted) in firms with at least one female founder in millions of dollars in a state

ST_ LLF = Log of the (Employed) Labor Force in a state, 16 and older for the given year in thousands

NAT_LWSG = Log of the number of Women STEM graduates in the given year

R = Average 30-year Mortgage Rate in the given year

ST_ LRI = Log of Real (Inflation-Adjusted) Per-Capita Income in the given year in dollars in a state

COVID19_D = A dummy variable to account for COVID-19 (1 only in 2020)

(Intercept) = The Constant Intercept in the regression

We used R to run the above regression model to explain female entrepreneurship in STEM in a state, for the years 2012 – 2020. The regression describes how different factors affect the number of women STEM entrepreneurs in a state.

3-4 Data Limitations

Besides the limitations related to employer and nonemployer data that we discussed in Section 3-1, there were other limitations to the data we collected for this analysis. These include the following:

- We used employer and nonemployer female STEM data from the years 2012 through 2020, the years with information available on the number of female STEM businesses. There were limited statistical results and/or coefficients for some states due to missing values for employer and nonemployer female STEM numbers for certain sectors for some years. These states include Alabama, Alaska, Hawaii, Maine, Mississippi, Nevada, New Mexico, North Dakota, South Dakota, West Virginia, and Wyoming.
- There was little or no data on female STEM numbers for certain manufacturing sectors in some other states, either because there were no firms in these sectors,

or because the data was not reported. However, there was enough data across sectors for these states, so that statistical results and coefficients were successfully computed.

- More recent (2020) nonemployer data became available during the course of our analysis. We used estimations of this data for 2020 based on NES data and average of 2018 and 2019 data fractions, that were available at the start of our analysis. However, we updated our analysis with the actual 2020 nonemployer data as it became available.
- Some values in the Census data collected included letters rather than numbers, making it difficult to compile the data. Below are the letters included and their interpretation[xxxii]:
    - D- Estimate is withheld to avoid disclosing data for individual companies; data are included in higher level totals.
    - N - Estimates are not available or not comparable.
    - S- Estimate did not meet the Census reporting standards so it is unreported.
    - X- Estimates that were identified as " Not applicable" by the Census.

We did not impute values to estimates where these letters occurred in the data.

4. National Results and Policy Implications

This chapter examines the results of the national level log-log models to understand the factors that influence the number of female STEM entrepreneurs at the national level. It is important to note that these relationships identified by our research are correlations, not definitive proofs of causality. This is the case for all statistical analyses in the social sciences for which double-blind tests are simply not available. We also draw policy implications from these results to show how government programs and assistance can enhance female STEM entrepreneurs' success.

4-1 National Model Results and Policy Implications

Nationally female STEM entrepreneurs are concentrated in the Professional, Scientific, and Technical Services and Ambulatory Health Care sectors. This is true for both employer and nonemployer firms, over the years 2012 through 2020. The regression output for the national model is in Appendix A. We have interpreted the coefficients and explained the results below.

4-1-1 National Model Interpretations

Based on the National Level CVR Model Results, we draw the following interpretations.

A 1% increase in the number of women patentees produces about a 0.56% increase in the number of women entrepreneurs. A policy to address social pressures on women patentees could thus increase the number of women entrepreneurs. The sign of this coefficient conforms to expectation.

Similarly, a 1% increase in venture capital funding produces about a .29% increase in the number of women entrepreneurs. Venture capital funds devoted to promotion of women entrepreneurs thus do have the expected effect. It is surprising that a 1% increase in venture capital funding yields a 0.29% increase in the number of women entrepreneurs, since the funding to women owned firms tends to be very small to begin with. It could be that most venture capital funding even though it is a small amount goes to female STEM businesses and more specifically STEM businesses in the healthcare/medical services sector where female firms dominate, allowing for less competition towards limited resources, and leading to increases in the number of female STEM entrepreneurs.

The estimated effect of the labor force is extremely high. The estimate indicates a 1% increase in the labor force would produce a 37% increase in the number of women entrepreneurs. However, the aggregate number for the labor force is also large. The labor force currently (and in 2012 and all the years thereafter) was close to 150 million. So, a 1% increase in the labor force would be close to an increase of 1.5 million people or more, and thus, the 37% increase in projected women STEM entrepreneurs may not seem so high in context. Female STEM entrepreneurs can take advantage of increased networking opportunities and better options for childcare due to the large labor force, per the Saksena et al. (2022) USPTO study.

The increase in the interest rates has the predicted negative sign, a one percentage point rise in interest rates is projected to cause a 0.08% decrease in the number of women STEM entrepreneurs. Since such an increase would increase funding/financing difficulties for the entrepreneurs, only the magnitude of this coefficient, which is relatively small, is of any surprise. This small change could be because female STEM firms are primarily nonemployer firms, that possibly have low capital requirements and interest rate changes don't have much impact on them. Women also consistently have less access to third party capital as opposed to bootstrapping sources to raise funds, so it's possible that they're less affected than other business owners would be by interest rates.

The remaining coefficients are somewhat surprising, and some may relate to the large (relative) number of women entrepreneurs who seek to enter health or medical fields. Per the analysis of Census data in the initial phase of this study, "...a large number of STEM businesses are providing health care, professional, scientific, and technical services. In the Ambulatory Healthcare Services sector, there are more female-owned businesses overall compared to male-owned businesses. This is also true for nonemployer firms in this sector."

It would be expected that a 1% increase in women STEM graduates would lead to a positive increase in the number of women STEM entrepreneurs. The LWSG coefficient indicates that the opposite is true; that a 1% increase leads to a 9.9% fall in the number of entrepreneurs. It is quite possible that the increase in supply leads to increased competition, in which both incumbents and entrants fail, especially if the entrants specialize in concentrated fields, where the incumbents already are in place. It may be the case that there are implicit socially binding constraints to push women into the fields, and thus generate cutthroat competition. In addition, it is possible that STEM education is a pipeline to academia rather than to entrepreneurship.

Something similar may apply to the per-capita real income variable. Per-capita real income should reflect demand, in that more demand should lead to more women STEM entrepreneurs, so that the LRI sign should be positive. But in this regression, a 1% increase in per-capita real income is projected to cause close to a 3% decrease in the number of women STEM entrepreneurs, all else held constant. In addition to the possible implicit constraint, there may be abandonment of entrepreneurship by the women to raise families, so that per-capita real income is not a demand variable, but a supply variable. It is also possible that women may be opting for better-paid employment opportunities when wages are high, vs. starting their own businesses.

Finally, the COVID-19 dummy is positive. It would seem *a priori* that this sign should be negative, that the pandemic would have decreased the number of women STEM entrepreneurs, whereas the regression suggests that there was an increase in their number. The literature survey performed in the initial phase of this study could explain this relationship.

“Despite gaps in funding during the pandemic within the United States in 2021, 21.5% of early-stage women entrepreneurs reported that the pandemic provided them with new opportunities (Elam et al. 2021/2022). This coupled with the finding in the report that North American women are 78% more likely than men to start a business in the ICT fields, could imply that early-stage women entrepreneurs in these STEM-related fields found new opportunities during the pandemic…”

“Fairlie and Desai (2021) find that in 2020 the monthly rate of new entrepreneurs was .30 percent among women, and .48 percent among men. These were large increases for both men and women from the previous year. Women reached their highest monthly rate in 24 years. This monthly rate increased for all racial groups from 2019. It also increased greatly for all age groups. The increases in this rate happened as the economy experienced shutdowns, layoffs and re-openings. While this finding is not STEM-specific, the favorable entrepreneurship climate for start-ups could have helped female STEM founders as well.”

Women entrepreneurs had a hard time accessing external funds during the pandemic years, and used their own funds to start businesses. During the pandemic years, women did not receive funds during the first round of funding, but did better during the second round of funding. In addition, women might have benefited from direct cash payments to families. This could have helped them start new businesses including in the STEM fields. Also, the positive results for the number of female STEM entrepreneurs during the COVID years could be related to the focus of the women STEM entrepreneurs in the health and medical fields – the pandemic would have increased the demand for these services.

4-1-2 National Policy Implications

Based on the National Level CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-1: National Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with states to tie institutional funding to female student STEM exposure. 2. Congress could authorize states to use grant funding to establish commercialization authorities. 3. Congress could legislate additional public funding for SBICs and SSBCI to target concentrated and less crowded STEM sectors. 4. The SBA could train investors and lenders on targeted female STEM investment. 5. The federal government could provide child care stabilization grants. 6. The federal government could tie K-12 funding to female STEM learning. 7. The federal government could use community organizations for emergency assistance. 8. The federal government could provide direct cash payments to families during shocks.	1. Increase female commercialization exposure. 2. Support female academics innovation. 3. Increase funding in underrepresented STEM sectors for women. 4. Increase credit and investment availability in specific sectors. 5. Create a large pool of childcare options for female STEM businesses. 6. Create a skilled female workforce and networking opportunities. 7. Increase female entrepreneurs access to financing. 8. Help women start new STEM businesses.

We describe these policy interpretations in detail below.

1. An increase in the number of women patentees leads to an increase in the number of women STEM entrepreneurs.
    a. Congress and the Department of Education could work with state and local jurisdictions to condition public funding of higher education institutions on increased female STEM enrollment & commercialization exposure.
    b. This would encourage institutions to perform outreach to female academics and help them succeed academically.
    c. Institutions could make female faculty aware of commercialization training programs, and support their commercialization efforts.
    d. Congress could authorize state and local governments to use grant funding in programs including CDBGs to establish commercialization authorities, to support STEM research, innovation, entrepreneurship with licensing offices.

2. An increase in venture capital funding leads to an increase in the number of female STEM entrepreneurs.
    a. Congress could legislate additional public funding for SBICs and SSBCI to invest in sectors in which women STEM entrepreneurs are concentrated, and to target women in sectors in which they're underrepresented.
    b. SBA could train STEM-related female venture capital/angel investors.
    c. SBA could educate local lenders on female STEM investment, in healthcare and in the less concentrated sectors.
3. An increase in the labor force increases the number of female STEM entrepreneurs.
    a. The federal government could provide grants similar to the American Rescue Plan's child care stabilization grants[xxxiii] that provided funding to states to allocate to child care providers. This will help providers offer competitive wages to their employees, leading to an increase in the child care labor force.
    b. This could encourage states to adopt initiatives to increase the childcare labor force:
        i. Assist with child care wages similar to Minnesota's grant program.
        ii. Provide monthly stipends to child care workers similar to what is being done in Maine.
        iii. Provide additional funding to selected providers for staff recruitment and bonuses, and assist with them with payroll taxes.
        iv. Provide free health insurance to child care workers and their families similar to Washington, D.C.
    c. The federal government and states could adopt practices to increase the skilled female STEM workforce, leading to more networking opportunities for female STEM entrepreneurs:
        i. Federal funding programs for K-12, such as, Title I grants could be tied to increased exposure to STEM learning for female students by schools.
        ii. State funding per student to institutions could be tied to increased female STEM enrollment and commercialization exposure.
4. Unprecedented shocks to the economy could create new opportunities for female STEM businesses.
    a. Congress could legislate financial assistance through local/community organizations during emergencies, to help female STEM entrepreneurs.
    b. SBA could assist female STEM entrepreneurs with emergency funding applications through its resource networks.
    c. The federal government could provide direct cash payments to families during economy-wide shocks. This could benefit women and help them start new STEM businesses.

4-2 National Model by Race, Ethnicity and Veteran Status Interpretations

In this section we describe the results of the regression analyses, by year, broken down into race, ethnic, and veteran status categories. The regression outputs for the national models by race, ethnicity, and veteran status are in Appendix A. We have interpreted the coefficients and explained the results below for each racial and ethnic group, and veteran status separately.

4-2-1 Black or African American Results Interpretation

We found that over the time period of this study, female Black or African American employer and nonemployer STEM firms are concentrated in the Health Care and Social Assistance sectors. There is also a relatively large number of nonemployer STEM firms from this racial category in the Professional, Scientific, and Technical Services sectors.

The regression output for the National Level Black or African American CVR Model is in Appendix A. Based on the results of this model, we draw the following interpretations.

A 1% increase in female patentees is expected to lead to a 1.6% increase in entrepreneurship for this group. This is likely because the increase in female patentees also leads to an increase in Black women patentees, who go on to start STEM businesses.

Similarly, a 1% increase in female venture capital funding is associated with a .9% increase in the number of Black or African American women STEM entrepreneurs. The reasons for this could be many, the share of funding for these entrepreneurs is low[xxxiv] to begin with (Houston 2023). The funding could be directed to sectors where these firms are concentrated alleviating the competition for resources in these areas, or the increased funding could go to STEM sectors where there are not a relatively large number of these firms. This could help in creating new businesses in these sectors.

A 1% increase in the labor force leads to a 114% rise for female STEM entrepreneurs in this racial category. This could be because of better child care and networking options for these firms with an increase in the work force and Black female STEM entrepreneurs being more responsive to labor force changes.

An increase in the number of female STEM graduates by 1% leads to a close to 31% decrease in the number of female STEM firms in this group. This could be because increases in the number of these graduates happen in the sectors where these firms are concentrated leading to increased competition and business failures.

A 1% increase in the interest rate leads to a .31% decrease in the number of these entrepreneurs. This small decrease could be because these businesses don’t rely on traditional financing to begin with, and therefore higher interest rates don’t impact them in a significant way. There is a significantly higher number of nonemployer firms compared to employer firms in this group, across STEM sectors. These entrepreneurs operating nonemployer firms may be less sensitive to changes in interest rates due to lower capital requirements and less reliance on external financing.

Real per-capita income increases of 1% lead to a 10.5% decrease in entrepreneurship for the group. This could imply that with increasing family incomes, Black women leave to raise families. They may be less incentivized to start businesses due to declining income disparity.

COVID-19 had a positive effect for these entrepreneurs. Our literature review in Phase I of this research showed that Black women-owned businesses faced greater financial challenges than other businesses during the pandemic and were less likely to receive federal assistance and traditional financing (Wiersch and Misera 2021). Black women entered the pandemic with lower wealth status (Hernández 2021), and childcare disruptions impacted the labor force participation rates and financial status of Black mothers (Lloro 2021). However, Black STEM businesses are concentrated in the health care sector which grew during the pandemic and Black women could have found that the pandemic provided them with new opportunities in STEM. These factors probably impacted their STEM entrepreneurship positively.

4-2-1-A Black or African American Policy Implications

Based on the CVR Model Results for this group, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-2: Black or African American Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Federal agencies could develop programs to support Black female inventors. 2. Congress could work with states to support Black women-owned inventors' commercialization. 3. SBA could train lenders on Black female STEM investment and help develop alternative financing. 4. Federal agencies could provide targeted mentoring, networking to Black female businesses in certain STEM sectors. 5. The federal government could tie school funding to educating Black female students in STEM. 6. Congress could work with states to tie institutional funding to increased Black female STEM enrollment in specific sectors. 7. The federal government could provide financial and child care assistance to Black mothers during emergencies.	1. Increase Black female commercialization and patenting success. 2. Increase Black women founded firms in certain STEM sectors. 3. Support Black women-owned STEM businesses funding and financing needs. 4. Help Black women take advantage of these opportunities and start new STEM businesses. 5. Develop a skilled Black female work force. 6. Increase the number of Black female STEM graduates in certain sectors. 7. Help Black women maintain their financial status and invest in new businesses.

We describe these policy interpretations in detail below.

1. The positive relationship between women patentees and Black female STEM entrepreneurs, highlights the need for targeted support and resources to help these inventors commercialize their patents and start successful ventures.
    a. Federal agencies could develop programs to provide guidance, mentorship, and resources to Black women inventors, helping them navigate the patent process, especially in STEM sectors where they are not concentrated, and explore entrepreneurial opportunities.
    b. Congress could work with states to help them partner with universities, research institutions, and industry partners to create a supportive ecosystem for Black women inventors, offering access to facilities, expertise, and networks to facilitate the commercialization of their patents in STEM sectors where they are not concentrated.

    c. Congress could work with state governments to provide funding and incentives for Black women-owned STEM startups, particularly those based on patented technologies in less concentrated STEM sectors, to help them overcome initial barriers and scale their ventures.
2. The positive relationship between venture capital funding and Black female STEM entrepreneurs, suggests a need to address the magnitude and sectoral allocation of venture capital.
    a. The SBA could provide targeted training and support for female STEM venture capital and angel investors that invest in these firms.
    b. The SBA could educate lenders about the potential of Black female STEM investments, especially in non-healthcare and non-professional services fields.
    c. The SBA could partner with local and regional banks, credit unions, and other financial institutions to develop alternative financing programs for these entrepreneurs, such as microloans, revenue-based financing, and grants.
3. The positive relationship between the labor force and Black women STEM entrepreneurship, suggests a need to investigate and enhance their participation in the entrepreneurial ecosystem.
    a. The SBA could conduct a comprehensive study to identify the specific factors that lead to their engagement in STEM entrepreneurship, such as access to education and training in certain STEM sectors, child care options, or networking opportunities.
    b. Based on the findings, the federal government could provide child care support and tie school funding to educating female students in STEM leading to availability of a skilled workforce for these entrepreneurs.
4. The negative relationship between female STEM graduates and Black female STEM entrepreneurship leads to the following policy implications.
    a. The federal government could tie federal funding for K-12 to increased exposure to certain STEM sectors for Black female students by schools.
    b. Congress could work with states to tie institutional funding to increased enrollment of Black female students in STEM programs in less crowded sectors.
    c. This would incentivize academic institutions to place special emphasis in their entrepreneurship programs on preparing Black female students for entrepreneurship in STEM sectors where they are not concentrated.
5. The positive sign of the COVID-19 variable implies that support for Black female entrepreneurs during emergencies could lead them to create and grow STEM businesses.
    a. The federal government could provide limited resources for temporary childcare and other care in emergencies, to increase the financial stability, and entrepreneurship of Black mothers living in childcare deserts during these times.

b. The federal government could deliver financial assistance to these businesses through local/community organizations rather than mainstream financial institutions.
c. The federal government could provide paid family and medical leave, cash payments to help Black women maintain their financial status and invest in businesses during economy-wide shocks.

4-2-2 AIAN Results Interpretation

From 2012 through 2020, AIAN employer and nonemployer STEM firms are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance sectors.

We are aware of the data reliability issues with this group. There are small numbers for female STEM entrepreneurs in the initial years, but large numbers in later years. This could be the result of changes in recording, classification and reliability of data. However, the numbers of female STEM firms in this group, especially in later years are not small, and looking at the data across different STEM sectors yields numbers that add up to tens of thousands of firms. So, the results are worth considering, and also because the statistical tests point to some model validity.

The regression output for the national model for this group is in Appendix A. Below is a description of these interpretations based on the National Level AIAN CVR Model Results.

The effect of women patentees among AIAN women STEM entrepreneurs is strong and significantly positive, with a 1% increase in patentees projected to lead to a 17% increase in entrepreneurship for this group.

Venture capital also has a strongly positive effect for the group, with a 1% increase in female venture capital funding leading to a 6.5 % increase in entrepreneurship for the group.

Labor force increases promote entrepreneurship for this group, and the effect is seen as dramatic: a 1% increase in labor force leads to an 865% increase in entrepreneurship for the group. Unemployment among the group has historically been high, and increased employment overall could increase employment in these communities leading to greater access to childcare and a skilled labor force for female STEM entrepreneurs. The difference between the number of female STEM firms in the initial years versus the latter years for this group could have produced the large percentage change associated with the change in the labor force.

The impact of an increase in female STEM graduates leads to a decline in the number of STEM firms in this racial category. A 1% increase in these graduates leads to a 240% decline in these entrepreneurs' numbers. If female STEM graduates gravitate towards the already crowded sectors for this group, this could lead to increased competition and business failures.

A rise in the interest rate leads to a decrease in the number of female STEM entrepreneurs in this group – a 1% rise corresponds to an approximately 3% decline. Rising interest rates lead to financing difficulties for entrepreneurs and this could explain the decline.

Higher incomes lead to a decline in the number of these entrepreneurs. The effect of a 1% increase in real per-capita income leading to a 71% decrease in entrepreneurship for this group, could imply the supply effect of Native American women leaving to raise families or not starting businesses due to available employment opportunities.

COVID-19 had a positive impact on the number of the female STEM entrepreneurs in this racial category. This could reflect the relative separation of the group from other groups. It could also mean that given the concentration of these entrepreneurs in the health care fields, the demand for their services was greater, which led to a greater number of these businesses.

4-2-2-A AIAN Policy Implications

Based on the National Level CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-3: AIAN Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Federal funding to schools in indigenous communities could be tied to female STEM enrollment and exposure. 2. Congress could work with states to tie funding for tribal institutions to innovation exposure for female students and faculty. 3. Congress could authorize that states with large indigenous populations could use grant funding to establish an authority to encourage innovation by Native American faculty. 4. Federal government and non-profits could provide venture capital training and mentors to Native American female entrepreneurs. 5. SBA could train female venture capitalists, local lenders, and financial institutions in investing in these businesses. 6. The federal government could provide child care grants to states with large indigenous populations and states could support wages and benefits of child care workers. 7. Congress could legislate emergency funding assistance through local organizations in these communities. 8. SBA's resource networks could train Native American female entrepreneurs on emergency funding applications. 9. The federal government could provide direct cash payments to families in these communities during emergencies.	1. Develop a pipeline of skilled Native American innovators and workforce. 2. Help American Indian female students and faculty commercialize their research. 3. Foster innovation and patenting by female Native American faculty. 4. Increase venture capital funding successes of Native American female businesses. 5. Increase access to funding and financing for AIAN female businesses. 6. Enhance child care options for female American Indian and Native American businesses. 7. Provide greater funding access to these businesses in times of economy-wide shocks. 8. Help these businesses access funding during emergency situations. 9. Maintain the financial status of women in these communities and help them open new businesses.

We describe these policy interpretations in detail below.

1. An increase in the number of women patentees leads to an increase in the number of AIAN women STEM entrepreneurs.
    a. Indigenous American innovators have made major contributions to the tech industry[xxxv]. Federal funding for K-12 in AIAN communities could be tied to increased female STEM enrollment & commercialization exposure.
    b. Congress could work with states so that public funding for tribal colleges and universities could be tied to increased commercialization exposure for female STEM students.
    c. This would encourage tribal colleges and universities to make female faculty aware of commercialization training programs, and support their commercialization efforts.
    d. Congress could authorize states with large Native American populations such as, Alaska, California, New Mexico, Oklahoma, South Dakota, Arizona, and Washington to use federal grant funding to establish an authority to support STEM research, innovation, entrepreneurship of Native American faculty with university licensing offices.
2. There is a strong positive relationship between venture capital funding for women-owned businesses and the number of female AIAN STEM entrepreneurs. This would indicate equity funders are better connected to AIAN entrepreneurs, and this is a situation from which to potentially draw best practices.
    a. Not-for-profit organizations could provide training (similar to SheBoot[xxxvi]) to female entrepreneurs especially AIAN STEM women-owned businesses on how to access funding.
    b. Federal agencies could develop mentorship programs that connect AIAN female entrepreneurs to mentors who can guide them on the intricacies of accessing investment for their businesses.
    c. The SBA could provide targeted training and support for Native American female STEM venture capital and angel investors.
    d. The SBA could educate lenders about the potential of AIAN female STEM investments, especially in non-concentrated fields.
    e. The SBA could partner with local and regional banks, credit unions, and other financial institutions to develop alternative financing programs for these entrepreneurs, such as microloans, revenue-based financing, and grants.
    f. The SBA could train venture capitalists on implicit biases in funding and on targeted investments in female AIAN STEM businesses in sectors outside of concentrated sectors.
3. An increase in the labor force increases the number of female STEM entrepreneurs.
    a. The federal government could provide grants that provide funding to states with large Native American populations to allocate to child care providers. This will help providers offer competitive wages to these providers, leading to an increase in the child care labor force.

   b. The federal government could provide grants to states with large indigenous populations to adopt initiatives such as providing funding for the wages and benefits of the childcare labor force.
   c. Federal funding for K-12 int these communities could be tied to increased STEM learning for female students, helping create a skilled workforce for Native American women-owned businesses.
4. Unprecedented shocks to the economy could create new opportunities for AIAN female STEM businesses.
   a. Congress could legislate financial assistance through local/community organizations in these communities during emergencies, to help female STEM entrepreneurs.
   b. SBA offices in states with large Native American populations could assist female STEM entrepreneurs with emergency funding applications through SBA resource networks[xxxvii] in these communities.
   c. The federal government could provide direct cash payments to families in these communities during economy-wide shocks. This could benefit women and help them start new STEM businesses.

4-2-3 White Group Results Interpretation

There are relatively large numbers of White female-owned employer and nonemployer businesses in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance STEM sectors, over the years 2012 through 2020.

The regression output for the National Level White CVR Model is in Appendix A. We draw the following interpretations from the results of this model.

A 1% increase in women patentees produces about a .68% increase in the number of White women STEM entrepreneurs. This is likely a reflection of the numbers of White women patentees increasing as the national number of female patentees goes up, and these entrepreneurs starting more businesses.

As regards venture capital funding, a 1% increase in female funding leads to a .47% increase in the number of White women STEM entrepreneurs. Only a small percentage of venture capital funding goes to female entrepreneurs. It is possible that the additional funding goes to sectors in which these firms are concentrated, leading to less competition for resources, or the increased funding goes to less concentrated STEM sectors, increasing the number of new White female businesses in these sectors.

The labor force variable has a positive relationship with these firms. A 1% increase in the labor force produces a 56.86% increase in the number of White women entrepreneurs. This may have to do with the increased child care and networking options available with the increased labor force.

A 1% increase in women STEM graduates' results in a 15% decline in White female STEM entrepreneurship. This could be because increases in the number of these graduates are in sectors where these firms are concentrated, leading to increased competition and business failures.

The interest rate variable is not very impactful for this group. A 1% increase in the interest rate leads to a .14% decline in entrepreneurship for this group. There is a significantly higher number of nonemployer firms compared to employer firms in this group, across STEM sectors. These entrepreneurs operating nonemployer firms may be less sensitive to changes in interest rates due to lower capital requirements.

A 1% increase in per-capita real income is a reduction in the supply in the market of these entrepreneurs, and leads to a 5% decrease in entrepreneurship for this group. With higher incomes, more White women could leave to raise families. They could also be less motivated to start businesses because of better employment opportunities and because some of the glass ceiling and gender disparity in the workplace could be alleviated by rising incomes.

COVID-19 did not impact these businesses adversely. This could be because of their concentration in the health care sector.

4-2-3-A White Racial Category Policy Implications

Based on the CVR Model Results for this group, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-4: White Group Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with state governments to support White women inventors' commercialization in specific sectors. 2. SBA could train funders and lenders on White female STEM investment and help develop alternative financing. 3. Federal agencies could provide targeted mentoring, networking to White female businesses in certain STEM sectors. 4. The federal government could tie school funding to educating White female students in STEM. 5. Congress and the Department of Education could work with states to ensure that public funding for institutions is tied to increased White female STEM enrollment and commercialization exposure in targeted sectors.	1. Increase White female commercialization and patenting success. 2. Support White women-owned STEM businesses funding and financing needs. 3. Increase White female- founded firms in less concentrated STEM sectors. 4. Help White women-owned businesses take advantage of increases in a skilled labor force. 5. Develop a pipeline of White female STEM graduates in diverse sectors.

We describe these policy interpretations in detail below.

1. The positive relationship between women patentees and White female STEM entrepreneurs, highlights the need for targeted support and resources to help these inventors commercialize their patents and start successful ventures in sectors where they are not concentrated.
    a. Congress could incentivize state governments to partner with universities, research institutions, and industry partners, and offer expertise and networks to White female faculty to help them commercialize patents in STEM sectors where they are not heavily concentrated.
    b. This could motivate state governments to provide training for White women-owned STEM startups, particularly those based on patented technologies in less concentrated sectors, to help them overcome initial barriers and scale their ventures.
    c. Congress and the Department of Education could work with states to ensure that public funding for institutions is tied to increased commercialization exposure of White female students and faculty in targeted sectors.

2. The positive relationship between venture capital funding and the number of White female STEM entrepreneurs, suggests a need to address the magnitude and sectoral allocation of venture capital to these firms.
    a. The SBA could train White female STEM venture capital and angel investors to invest in less concentrated STEM sectors.
    b. The SBA could educate lenders about the potential of White female STEM investments, especially in non-healthcare and non-professional services sectors.
    c. The SBA could partner with local and regional banks, credit unions, and other financial institutions to develop alternative financing programs for these entrepreneurs, such as microloans, revenue-based financing, and grants.
3. The positive relationship between the labor force and White women STEM entrepreneurship, suggests a need to investigate and support the growth of these businesses through childcare and skilled workforce options.
    a. The SBA could conduct a comprehensive study to identify the specific factors that increase their engagement in STEM entrepreneurship in certain STEM sectors, such as access to child care, networking, or mentoring options.
    b. Based on the findings, the federal agencies could develop targeted initiatives and programs to support and encourage White women's entrepreneurship through the availability of childcare and skilled workforce options.
4. The negative relationship between female STEM graduates and White female STEM entrepreneurship leads to the following policy implications.
    a. The federal government could tie federal funding for K-12 to increased exposure to diverse STEM sectors for White female students by schools.
    b. State funding per student for an institution could be tied to increased enrollment of White female students in STEM programs in noncrowded sectors.
    c. Academic institutions could place special emphasis in their entrepreneurship programs on preparing White female students for entrepreneurship in STEM sectors where they are not concentrated.

4-2-4 Asian Group Results Interpretation

For the years 2012 through 2020, Asian female STEM employer firms are concentrated in the Professional, Scientific, and Technical services and Health Care and Social Assistance sectors. Nonemployer female Asian STEM firms are also concentrated in these sectors, and their numbers in these sectors are approximately equal between the two sectors for all the years in the study.

The regression outputs for the Asian group are in Appendix A. Below is an explanation of the model results.

An increase of 1% in female patentees leads to an increase of 2.4% in the number of these firms. More women patentees possibly lead to more Asian women patentees who go on to start more STEM businesses.

A 1% increase in female venture capital funding leads to a 1.4% increase in the number of female Asian STEM firms. It is possible that the increase in funding goes to sectors where these firms are already in large numbers, and helps the resource crunch faced by firms in these sectors. In addition, increased funding could be directed to the less popular sectors, leading to the formation of new firms.

A 1% increase in the labor force leads to a 168% increase in the number of these firms. The presence of more child care and skilled workers could mean greater care and networking options for these firms.

More female STEM graduates lead to a decline in the number of Asian female STEM firms. A 1% increase in these graduates leads to a 45% decrease in these firms. The increase in the number of female STEM graduates going into overcrowded fields could lead to greater competition and firm demises.

An increase in the interest rate will lead to a 0.5% decrease in the number of Asian female STEM entrepreneurs, due to higher financing terms.

Increases in per-capita incomes lead to declines in these firms' numbers. A 1% increase in incomes causes a 15% decrease in Asian female STEM numbers. The flexibility that higher incomes provide could lead more Asian women to leave and raise families. Also, the glass ceiling and income disparity issues in the workplace could be mitigated through rising incomes, leading to fewer Asian women starting businesses.

The pandemic led to increases in these firm's numbers. This seems counterintuitive, but the fact that these businesses are concentrated in the health care sector, which grew under the pandemic could explain the higher numbers.

4-2-4-A Asian Group Policy Implications

Based on the CVR Model Results for this group, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-5: Asian Group Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with states to ensure that public funding for institutions supports Asian female student commercialization exposure. 2. Congress could authorize states to use grant funding to establish authorities to help Asian female faculty commercialize their research. 3. SBA could train funders and lenders on Asian female STEM investment and help develop alternative financing. 4. The federal government could tie school funding to educating Asian female students in STEM in diverse disciplines.	1. Increase Asian female commercialization and patenting success. 2. Bring Asian female faculty research to commercial fruition. 3. Support Asian women-owned STEM businesses funding and financing needs. 4. Build a pipeline of Asian female STEM graduates in diverse sectors.

We don't detail these policy interpretations, because they are similar to those of the White racial group.

4-2-5 Native Hawaiian and Other Pacific Islander Group Results Interpretation

The number of Native Hawaiian and Other Pacific Islander female STEM firms is quite small, compared to other racial groups. There are only a few hundred STEM employer firms and a few thousand nonemployer firms in this category, for all the years of the study. Both employer and nonemployer firms are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance categories, though there are more nonemployer firms in the health care sector than in the professional services sector from 2012 to 2020.

We are aware of the data limitation issues with this group, however the results are worth considering, because the statistical tests point to some validity of the model and the number of observations across sectors lends them to some statistical validity. The regression outputs for this group are in Appendix A. Below is an explanation of the model results.

An increase of 1% in female patentees leads to an increase of 8.8% in the number of these firms. More women patentees possibly lead to more women patentees in this group who go on to start more STEM businesses.

A 1% increase in female venture capital funding leads to a 3% increase in the number of these firms. It is possible that the increase in funding goes to sectors where these firms are already in large numbers. The funding could create less competition for resources and allow these firms to thrive. In addition, funding could go to less concentrated STEM sectors, allowing for more firm creation.

A 1% increase in the labor force leads to a 437% increase in the number of these firms. The presence of more skilled and child care workers could imply more networking and child care options for these firms.

More female STEM graduates lead to a lower number of Native Hawaiian and Other Pacific Islander female STEM firms. A 1% increase in these graduates leads to a 121% decrease in these firms. The increase in the number of female STEM graduates could occur in concentrated sectors, leading to greater competition and failure of firms.

Financing difficulties due to higher interest rates impact these firms negatively. A 1% increase in the interest rate leads to a 1.4% decline in the number of these firms.

If per-capita incomes rise by 1%, the number of Native American and Pacific Islander firms goes down by close to 37%. Higher per-capita incomes allow women from these communities to devote more time to raising families, leading to less business formation.

The pandemic had a positive impact on these firms, possibly because of their concentration in the health care sector.

4-2-5-A Native Hawaiian and Other Pacific Islander Policy Implications

Based on the CVR Model Results for this group, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-6: Native Hawaiian and Other Pacific Islander Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Federal AANAPISI institution funding could support Native Hawaiian and Other Pacific Islander female student and faculty commercialization exposure. 2. Federal Pacific Islands institutional funding could support commercialization exposure for female students and faculty from this group. 3. SBA could train funders and lenders on Native Hawaiian and Other Pacific Islander female STEM investment, and help develop alternative financing. 4. The federal government could tie school funding to educating Native Hawaiian and Other Pacific Islander female students in varied STEM disciplines.	1. Increase female commercialization and patenting success for this group. 2. Increase female students and faculty from this group who patent their research. 3. Support Native Hawaiian and Other Pacific Islander women-owned STEM businesses funding and financing needs. 4. Build a pipeline of female STEM graduates in diverse sectors from this group.

We describe these policy interpretations in detail below.

1. An increase in the number of women patentees leads to an increase in the number of Native Hawaiian and Other Pacific Islander women STEM entrepreneurs.
    a. Federal funding for AANAPISI institutions could be tied to increased training and commercialization exposure for female Asian American or Native American Pacific Islander students and faculty.
    b. Federal funding for Pacific Islands institutions could be tied to increased commercialization exposure for Native Hawaiian and Other Pacific Islander female STEM students and faculty.
    c. This could incentivize institutions to perform outreach to female academics from this group and help them succeed academically.
    d. This could also lead to institutions making Native Hawaiian and Other Pacific Islander female faculty aware of commercialization training programs and support their commercialization efforts.

2. The positive relationship between venture capital funding and the number of female STEM entrepreneurs from this group, suggests a need to address the magnitude and sectoral allocation of venture capital to these firms.
    a. The SBA could train female STEM venture capital and angel investors from this group to invest in less concentrated STEM sectors.
    b. The SBA could educate lenders about the potential of Native Hawaiian and Other Pacific Islander female STEM investments, especially in non-healthcare and non-professional services sectors.
    c. The SBA could partner with local and regional banks, credit unions, and other financial institutions to develop alternative financing programs for these entrepreneurs, such as microloans, revenue-based financing, and grants.
3. The positive relationship between the labor force and women STEM entrepreneurship from this group, suggests a need to investigate and support the success of these firms.
    a. The SBA could conduct a comprehensive study to identify the specific factors that increase their engagement in STEM entrepreneurship such as child care and networking opportunities.
    b. Based on the findings, the federal agencies could develop targeted initiatives and programs to support and encourage Native Hawaiian and Other Pacific Islander women's entrepreneurship, such as increasing access to the childcare and skilled workforce.
4. The negative relationship between female STEM graduates and female STEM entrepreneurship in this group leads to the following policy implications.
    a. The federal government could tie federal funding for K-12 to increased exposure to STEM for Native Hawaiian and Other Pacific Islander female students in diverse disciplines by schools.
    b. AANAPISI and Pacific Islands institutions could place special emphasis in their entrepreneurship programs on preparing Pacific Islander female students for entrepreneurship in STEM sectors where they are not concentrated.

4-2-6 Hispanic Group Results Interpretation

Hispanic woman-owned female STEM employer and nonemployer firms are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance sectors, for the years 2012 to 2020. Nonemployer female STEM Hispanic firms in the health care sector are close to twice the number of these firms in the professional services sector.

The regression output for this group is included in Appendix A and the interpretation of the results is below.

There is a positive relationship between female patentees and number of firms for this group. A 1% increase in aggregate women patentees leads to a 1.5% increase in entrepreneurship for the group. An increase in the number of female patentees could lead to more Hispanic female patentees, who go on to form new STEM businesses.

Female venture capital funding has a positive relationship with Hispanic female STEM entrepreneurship. A 1% increase in venture funding leads to a close to 1% increase in the number of Hispanic female STEM firms. This could be because the funding goes to sectors in which these firms are concentrated leading to less competition for resources. This funding could also be going to STEM sectors where these firms are not highly represented, leading to new business formation in those sectors.

The labor force coefficient is positive. A 1% increase in aggregate labor force leads to a 122% increase in entrepreneurship. Hispanic women may be very responsive to labor force changes and increased child care and networking options could increase their propensity to start businesses.

Increases in interest rates lead to a decrease in the number of Hispanic female STEM entrepreneurs, albeit small. A one percentage point increase in interest rates leads to a .33% decrease in the number of these businesses. This could be because these businesses don't rely on traditional financing to begin with, and therefore higher interest rates don't impact them. There is a significantly higher number of nonemployer firms compared to employer firms in this group, across STEM sectors. These entrepreneurs operating nonemployer firms may be less sensitive to changes in interest rates due to lower capital requirements and less reliance on external financing. According to the U.S. Senate Committee on Small Business and Entrepreneurship report (July 2023)[xxxviii], Latino-owned businesses have the lowest rate of using bank and financial institution loans.

An increase of 1% in real per capita incomes leads to a 11% decrease in the number of these businesses. Rising incomes could provide Hispanic woman-owned businesses with the flexibility to leave and raise families.

There is a negative relationship between the number of female STEM graduates and the number of Hispanic women-owned businesses. A 1% increase in these graduates leads to a 33% decline in Hispanic women STEM entrepreneurs. This could be because increases in the number of these graduates in overcrowded sectors could lead to greater competition and business failures.

The positive sign of the COVID-19 dummy shows that the pandemic did not impact these entrepreneurs adversely. Phase I of this research shows that Hispanic women-owned woman-owned businesses faced greater financial challenges than other businesses during the pandemic, and were less likely to receive federal assistance and traditional financing (Wiersch and Misera 2021). Hispanic women entered the pandemic with lower wealth status (Hernández 2021), and childcare disruptions impacted the labor force participation rates and financial status of Hispanic mothers (Lloro 2021). These factors probably impacted their overall entrepreneurship, but the fact that these entrepreneurs are concentrated in the health care sector which grew during the pandemic might explain the positive impact on their STEM entrepreneurship.

4-2-6-A Hispanic Group Policy Implications

Based on the CVR Model Results for this group, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-7: Hispanic Group Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Federal agencies could provide support for Hispanic female inventors. 2. Congress could work with state governments to support Hispanic women-owned inventors' commercialization. 3. SBA could train lenders on Hispanic female STEM investment and help develop alternative financing. 4. The federal government could provide childcare and skilled workforce support to Hispanic female businesses. 5. The federal government could tie school funding to educating Hispanic female students in certain STEM sectors. 6. Congress could work with states to condition public funding for institutions on increased Hispanic female STEM enrollment and exposure in targeted STEM sectors. 7. The federal government could provide financial and child care assistance to Hispanic mothers during emergencies.	1. Increase Hispanic female commercialization and patenting success. 2. Increase Hispanic women founded firms in certain STEM sectors. 3. Support Hispanic women-owned STEM businesses funding and financing needs. 4. Help Hispanic women-owned businesses take advantage of increases in skilled workforce and child care labor force. 5. Develop a pipeline of Hispanic female STEM graduates in diverse STEM sectors. 6. Increase the number of Hispanic female STEM graduates in diverse sectors. 7. Help Hispanic women maintain their financial status and invest in new STEM businesses.

We don't detail these policy interpretations, because they are very similar to those of the Black or African American racial group.

4-2-7 Non-Hispanic Group Results Interpretation

Non-Hispanic female STEM employer and nonemployer businesses are concentrated in the Professional, scientific, and technical services, and Health care and social assistance sectors, for all the years of our study. The number of employer firms is roughly the same for the two sectors over the years, whereas the number of nonemployer firms in the health care sector is higher than professional services in the early years, but this changes in the latter years where nonemployer professional services numbers start becoming roughly equal and then overtaking the health care sector numbers from 2015 onwards.

Appendix A includes the regression outputs for this group. An explanation of the results from the model follows.

This group has many similar coefficients to the coefficients for White women STEM entrepreneurs, who are a large part of non-Hispanic female STEM entrepreneurs.

A 1% increase in women patentees is seen as increasing entrepreneurship for this group by 0.6%. This could mean that increasing women patentees leads to increases in non-Hispanic female patentee numbers, which leads to more businesses founded by these firms.

Increasing female venture capital funding by 1% increases the number of these entrepreneurs by .4%. It is possible that the additional funding goes to sectors in which these firms are concentrated, leading to more resources and less competition for firms in these sectors, or the increased funding goes to less concentrated sectors, increasing the number of non-Hispanic female STEM entrepreneurs through new business formation.

Increasing the labor force by 1% increases the number of these firms by 52%. Increased networking and child care options could help non-Hispanic women start more STEM businesses.

An increase in female STEM graduates has a negative impact on these firms. A 1% increase in women STEM graduates decreases the number of non-Hispanic female STEM businesses by close to 14%, compared to 15% for White female STEM firms. This could be because increases in the number of female STEM graduates occur in sectors where these firms are already concentrated, leading to increased competition and failure of firms.

A one percentage point increase in interest rates leads to a .13% decrease in the number of these firms. This is almost identical to the .14% decrease for White female STEM firms. There is a significantly higher number of non-Hispanic nonemployer firms compared to employer firms, across STEM sectors. Non-Hispanic female STEM entrepreneurs operating nonemployer firms may be less sensitive to changes in interest rates due to lower capital requirements.

The effect of real income is also similar for the non-Hispanic and White female STEM entrepreneur groups. A 1% increase in per-capita real income leads to a 4.7% decrease in non-Hispanic women STEM entrepreneurs versus the effect of 5.4% in the case of White women STEM entrepreneurs.

The pandemic had a positive impact on these businesses.

4-2-7-A Non-Hispanic Group Policy Implications

Based on the CVR Model Results for this group, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-8: Non-Hispanic Group Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with states to support non-Hispanic women-owned inventors' commercialization in non-concentrated sectors. 2. SBA could train funders and lenders on non-Hispanic female STEM investment and help develop alternative financing. 3. Federal agencies could provide targeted mentoring, networking to non-Hispanic female businesses in certain STEM sectors. 4. The federal government could tie school funding to educating non-Hispanic female students in STEM. 5. State institutional funding could be tied to increased non-Hispanic female STEM enrollment in diverse STEM fields.	1. Increase non-Hispanic female commercialization and patenting success in these sectors. 2. Support non-Hispanic women-owned STEM businesses funding and financing needs. 3. Increase non-Hispanic female-founded firms in less concentrated STEM sectors. 4. Help non-Hispanic women-owned businesses take advantage of increases in a skilled labor force. 5. Develop a pipeline of non-Hispanic female STEM graduates in diverse sectors.

We don't detail these policy interpretations, because they are very similar to those for White female STEM entrepreneurs.

4-2-8 Veteran Group Results Interpretation

Veteran female STEM entrepreneurs are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social Assistance sectors. There are more nonemployer than employer businesses for both sectors, with a few thousand more firms in the health care sector compared to the professional services sector.

The regression output for the National Level Veteran CVR Model is in Appendix A. We draw the following interpretations from the results of this model.

A 1% increase in women patentees produces about a .62% increase in the number of Veteran women STEM entrepreneurs. This is possibly due to the numbers of Veteran women patentees increasing as the national number of female patentees goes up, and these entrepreneurs starting more businesses.

As regards venture capital funding, a 1% increase in female funding leads to a .374% increase in the number of Veteran women STEM entrepreneurs. It is possible that the additional funding goes to sectors in which these firms are concentrated, leading to less competition for resources, or the increased funding goes to less concentrated STEM sectors, increasing the number of new Veteran female businesses in these sectors.

The labor force variable has a positive relationship with these firms. A 1% increase in the labor force produces a close to 41% increase in the number of Veteran women entrepreneurs. This may have to do with the increased child care and networking options available with the increased labor force.

A 1% increase in women STEM graduates' results in a 11% decline in Veteran female STEM entrepreneurship.   This could be because the number of these graduates increases in sectors where these firms are concentrated, leading to increased competition and business failures.

The interest rate variable is not very important for this group. A 1% increase in the interest rate leads to a .15% decline in entrepreneurship for this group. It is possible that these firms don't rely on traditional financing and are not impacted much by changes in interest rates.

A 1% increase in per-capita real income is a change in supply in the market of these entrepreneurs, and leads to a close to 4% decrease in entrepreneurship for this group. With higher incomes, more Veteran women have the flexibility to raise families and might decide to do so, rather than start new businesses.

COVID-19 did not impact these businesses negatively. This could be because these businesses are concentrated in the health care sector or because they found new opportunities to start other STEM businesses during the pandemic.

4-2-8-A Veteran Group Policy Implications

Based on the CVR Model Results for this group, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-9: Veteran Group Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with states to support Veteran women inventors' commercialization in specific sectors. 2. SBA could train funders and lenders on Veteran female STEM investment and help develop alternative financing. 3. Federal agencies could provide targeted mentoring, networking to Veteran female businesses in certain STEM sectors. 4. The federal government could tie school funding to educating Veteran female students in STEM. 5. State institutional funding could be tied to increased Veteran female STEM enrollment and commercialization exposure in targeted sectors.	1. Increase Veteran female commercialization and patenting success. 2. Support Veteran women-owned STEM businesses funding and financing needs. 3. Increase Veteran female- founded firms in less concentrated STEM sectors. 4. Help Veteran women-owned businesses take advantage of increases in a skilled labor force. 5. Develop a pipeline of Veteran female STEM graduates in diverse sectors.

We describe these policy interpretations in detail below.

1. The positive relationship between women patentees and Veteran female STEM entrepreneurs, highlights the need for targeted support and resources to help these inventors commercialize their patents and start successful ventures in sectors where they are not concentrated.
    a. Congress could incentivize states to provide training for Veteran women-owned STEM startups, particularly those based on patented technologies in less concentrated sectors, to help them overcome initial barriers and scale their ventures.
    b. Congress and the Department of Education could work with states to condition funding for institutions to increased commercialization exposure of Veteran female students and faculty in targeted sectors.
2. The positive relationship between venture capital funding and the number of Veteran female STEM entrepreneurs, suggests a need to address the magnitude and sectoral allocation of venture capital to these firms.
    a. The SBA could train Veteran female STEM venture capital and angel investors to invest in less concentrated STEM sectors.

   b. The SBA could educate lenders about the potential of Veteran female STEM investments, especially in non-healthcare and non-professional services sectors.
   c. The SBA could partner with local and regional banks, credit unions, and other financial institutions to develop alternative financing programs for these entrepreneurs, such as microloans, revenue-based financing, and grants.
3. The positive relationship between the labor force and Veteran women STEM entrepreneurship, suggests a need to investigate and support the growth of these businesses.
   a. The SBA could conduct a comprehensive study to identify the specific factors that increases their engagement in STEM entrepreneurship in certain STEM sectors, such as access to child care, networking, or mentoring options.
   b. Based on the findings, the federal agencies could develop targeted initiatives and programs to support and encourage Veteran women's entrepreneurship by providing childcare and skilled workforce options.
4. The negative relationship between female STEM graduates and Veteran female STEM entrepreneurship leads to the following policy implications.
   a. The federal government could tie federal funding for K-12 to increased exposure to diverse STEM sectors for Veteran female students by schools.
   b. Congress could work with states so that public funding per student for an institution could be tied to increased enrollment of Veteran female students in STEM programs in noncrowded sectors.
   c. Academic institutions could place special emphasis in their entrepreneurship programs on preparing Veteran female students for entrepreneurship in STEM sectors where they are not concentrated.

4-2-9 Non-Veteran Group Results Interpretation

Non-veteran female employer and nonemployer STEM entrepreneurs are concentrated in the Professional, Scientific, and Technical Services, and Health Care and Social assistance sectors. There are more nonemployer than employer businesses for both sectors, with slightly larger number of health care employer and nonemployer firms compared to professional services.

The regression output for the National Level Non-Veteran CVR Model is in Appendix A. We draw the following interpretations from the results of this model.

A 1% increase in women patentees produces about a .7% increase in the number of non-Veteran women STEM entrepreneurs.

As regards venture capital funding, a 1% increase in female funding leads to a .5% increase in the number of non-veteran women STEM entrepreneurs.

The labor force variable has a positive relationship with these firms. A 1% increase in the labor force produces a close to 60% increase in the number of non-veteran women entrepreneurs.

A 1% increase in women STEM graduates' results in a 16% decline in non-veteran female STEM entrepreneurship.

The interest rate variable is not very important for this group. A 1% increase in the interest rate leads to a .16% decline in entrepreneurship for this group. It is possible that these firms don't rely on traditional financing and are not impacted much by changes in interest rates.

A 1% increase in per-capita real income leads to a 5.5% decrease in entrepreneurship for this group.

COVID-19 did not impact these businesses negatively.

4-2-9-A Non-Veteran Group Policy Implications

Based on the CVR Model Results for this group, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 4-10: Non-Veteran Group Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with states to support non-veteran women inventors' commercialization in specific sectors. 2. SBA could train funders and lenders on non-veteran female STEM investment and help develop alternative financing. 3. Federal agencies could provide targeted mentoring, networking to non-veteran female businesses in certain STEM sectors. 4. The federal government could tie school funding to educating female students in STEM. 5. Congress could work with states to tie institutional funding to increased female STEM enrollment and commercialization exposure in targeted sectors.	1. Increase non-veteran female commercialization and patenting success. 2. Support non-veteran women-owned STEM businesses funding and financing needs. 3. Increase non-veteran female-founded firms in less concentrated STEM sectors. 4. Help non-veteran women-owned businesses take advantage of increases in a skilled labor force. 5. Develop a pipeline of female STEM graduates in diverse sectors.

5. State Results and Policy Implications

This chapter describes the results of the state level log-log model and the policy interpretations based on the results. We discuss the various factors impacting female STEM entrepreneur numbers in each state, and the policy initiatives to positively impact Women in STEM entrepreneurship at the state level. We identify the policy solutions specific to each state and the benefits of these policies. The relationships identified by our research are correlations, not definitive proofs of causality.

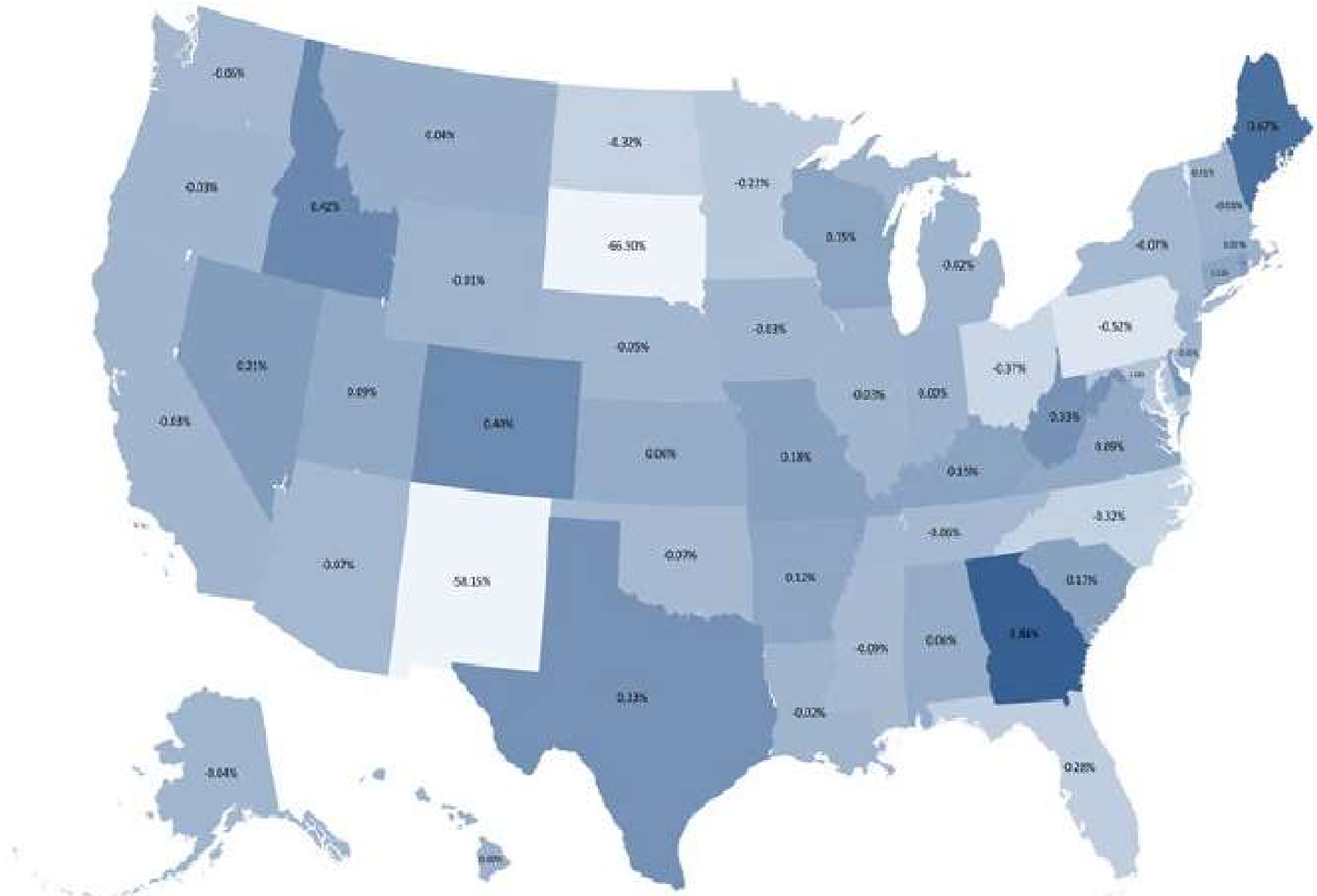
5-1 State Model Results and Policy Implications

We present the regression results per explanatory variable for each state in the maps below and make policy recommendations based on interpreting the results.

5-1-1 State Female STEM Entrepreneurship and State Female Patentees

The figure below shows the relationship between female patentees in a state and state female STEM entrepreneurship.

Figure 5-1: Percentage Change in State Female STEM Entrepreneurs with One Percent Change in State Patentees



Note: For percent changes very close to zero, such as -0.001 and .001, the map shows 0.00%, due to rounding.

The relationship between the number of female patentees and the number of female STEM entrepreneurs in the United States is complex and varies significantly across states and regions. As the national level, a one percent increase in the number of female patentees is associated with a 0.56% increase in the number of female STEM entrepreneurs. This positive relationship suggests that as more women are involved in innovation and patenting, there is a corresponding growth in female STEM entrepreneurship.

However, when examining the state-level data, a more nuanced picture emerges. The majority of states (32 out of 51) have negative coefficients, indicating that increases in female patentees at the state level are associated with declines in the number of female STEM entrepreneurs. This seemingly counterintuitive finding could be explained by the fact that in these states, female patentees may be attempting entrepreneurship in overcrowded STEM sectors, leading to increased competition and firm failures. The presence of negative coefficients in many states highlights the importance of considering local market conditions and industry saturation when assessing the impact of female patentees on STEM entrepreneurship.

Among the states with negative coefficients, New Mexico stands out as an extreme outlier with a staggering -58.15% coefficient. However, this figure should be interpreted with caution, as New Mexico had a significant amount of missing data, which could have skewed the results. Other states with relatively large decreases, ranging from -0.5% to -1%, include South Dakota, North Dakota, Pennsylvania, North Carolina, and Ohio. These states may have unique industry characteristics that are contributing to the negative relationship between female patentees and STEM entrepreneurship.

On the other hand, 19 states have positive coefficients, suggesting that increases in female patentees at the state level are associated with an increase in the number of female STEM entrepreneurs. In these states, it is possible that female patentees are operating within sectors that are not overcrowded and provide opportunities for women to enter into entrepreneurship. The states with the largest increases, between 0.5% and 1%, are Georgia and Maine. Several other states, such as Idaho, Colorado, Texas, West Virginia, Delaware, Nevada, Rhode Island, Missouri, South Carolina, Kentucky, and Wisconsin, have more modest increases between 0.1% and 0.5%. The positive coefficients in these states indicate that there may be factors supportive of female innovators commercializing their inventions, such as access to resources, mentorship, or favorable market conditions. It is also possible that in the states with the larger positive coefficients such as Georgia and Maine, the general business climate for female firms is favorable.

When comparing the state-level coefficients to the national coefficient of 0.56%, it becomes evident that there are notable regional differences in the relationship between female patentees and STEM entrepreneurship. The Northeast and Midwest regions have more states with decreases than increases, although the changes are generally small in magnitude. This suggests that in these regions, increases in female patentees may not necessarily translate into a thriving female STEM entrepreneurship ecosystem.

In contrast, the Southeast has more states with increases, implying that growth in female patentees in this region positively impacts female STEM entrepreneurship. The reasons for this could be many, including greater support for female innovators commercializing their inventions, availability of childcare options due to a larger semi-skilled labor force, licensing support at universities, or a generally more favorable entrepreneurial climate.

The West region presents a mixed picture, with some states showing modest increases while others have small decreases. This highlights the heterogeneity within the region and the need for state-specific analysis to understand the factors influencing the relationship between female patentees and STEM entrepreneurship.

Some notable regional outliers emerge from the data, such as Maine in the Northeast, Georgia in the South, and Colorado and Idaho in the West. Maine and Georgia exhibit positive coefficients that are higher than the national average, suggesting that they have unique characteristics or policies that foster a supportive environment for female innovators and entrepreneurs in STEM fields. Further research into the specific initiatives, resources, and cultural factors present in these states could provide valuable insights for policymakers and advocates seeking to promote gender equality in innovation and entrepreneurship.

In conclusion, the relationship between female patentees and female STEM entrepreneurs in the United States is multifaceted and varies significantly across states and regions. While the national-level data suggests a positive association, the state-level analysis reveals a more complex picture, with many states exhibiting negative coefficients. This underscores the importance of considering local market conditions, industry dynamics, and support systems when assessing the impact of female patentees on STEM entrepreneurship. By identifying the factors that contribute to positive outcomes in certain states and regions, policymakers and stakeholders can develop targeted strategies to foster a more inclusive and thriving innovation ecosystem for women in STEM fields.

5-1-1-A Policy Implications of State Female Patentee Results

Based on the analysis of the relationship between female patentees and female STEM entrepreneurs across different states and regions in the United States, there are several policy solutions that could address the challenges and promote greater participation of women in innovation and entrepreneurship.

In states where there is a negative relationship between women patentees and women STEM entrepreneurs, suggesting barriers to commercialization, the federal government could play a crucial role in supporting the transition from patent holder to entrepreneur. Congress could legislate that federal agencies participating in the SBIR and STTR programs develop initiatives similar to the NSF's AWARE program. The AWARE program provides grant writing assistance, commercialization summits, and sharing of success stories to underrepresented populations, which could help women patentees navigate the commercialization process and access necessary resources.

Moreover, Congress could mandate that federal agencies participating in the STTR program provide funding to university licensing offices at partnering research institutions to train and support female academic STEM entrepreneurs on grant applications, especially for nonconcentrated STEM sectors. This targeted support could help women patentees translate their inventions into successful ventures in areas where they are currently underrepresented.

To foster collaboration and support the growth of women-owned STEM businesses, Congress could authorize states to use program grant funding for the establishment of dedicated agencies or initiatives. These entities would facilitate partnerships between women patentees, entrepreneurs, and industry partners, creating a supportive ecosystem for the commercialization of patents and the development of innovative ventures.

In regions where there is a positive relationship between female patentees and female STEM entrepreneurs, such as the Southeast, policymakers could focus on further enhancing the conditions that have led to this favorable outcome. This could involve increasing the commercialization of inventions by conditioning public funding of higher education institutions on increased female STEM enrollment and commercialization exposure. Universities and research institutions would be incentivized to conduct targeted outreach to female students and academics, providing support for their academic success and commercialization efforts.

Andes (2017) [xxxix] finds that research universities in dense neighborhoods such as midtowns and downtowns generate more inventions and create more startups than other universities. So, it is possible that women patentees, especially in urban environments, could already be part of a commercial "network", and so are more likely to be successful entrepreneurs. Toole (2020) [xl] finds that as measured by the percent point change in the women inventor rate (WIR), which is the rate of U.S. inventors that are women, most companies showed improvements. So, it is possible that women in STEM fields in established firms or institutions generate business opportunities for women patentees.

Additionally, Congress could authorize state and local governments to use grant funding in programs, including CDBGs, to establish commercialization authorities that support STEM research, innovation, and entrepreneurship, with a specific focus on promoting female participation and licensing offices.

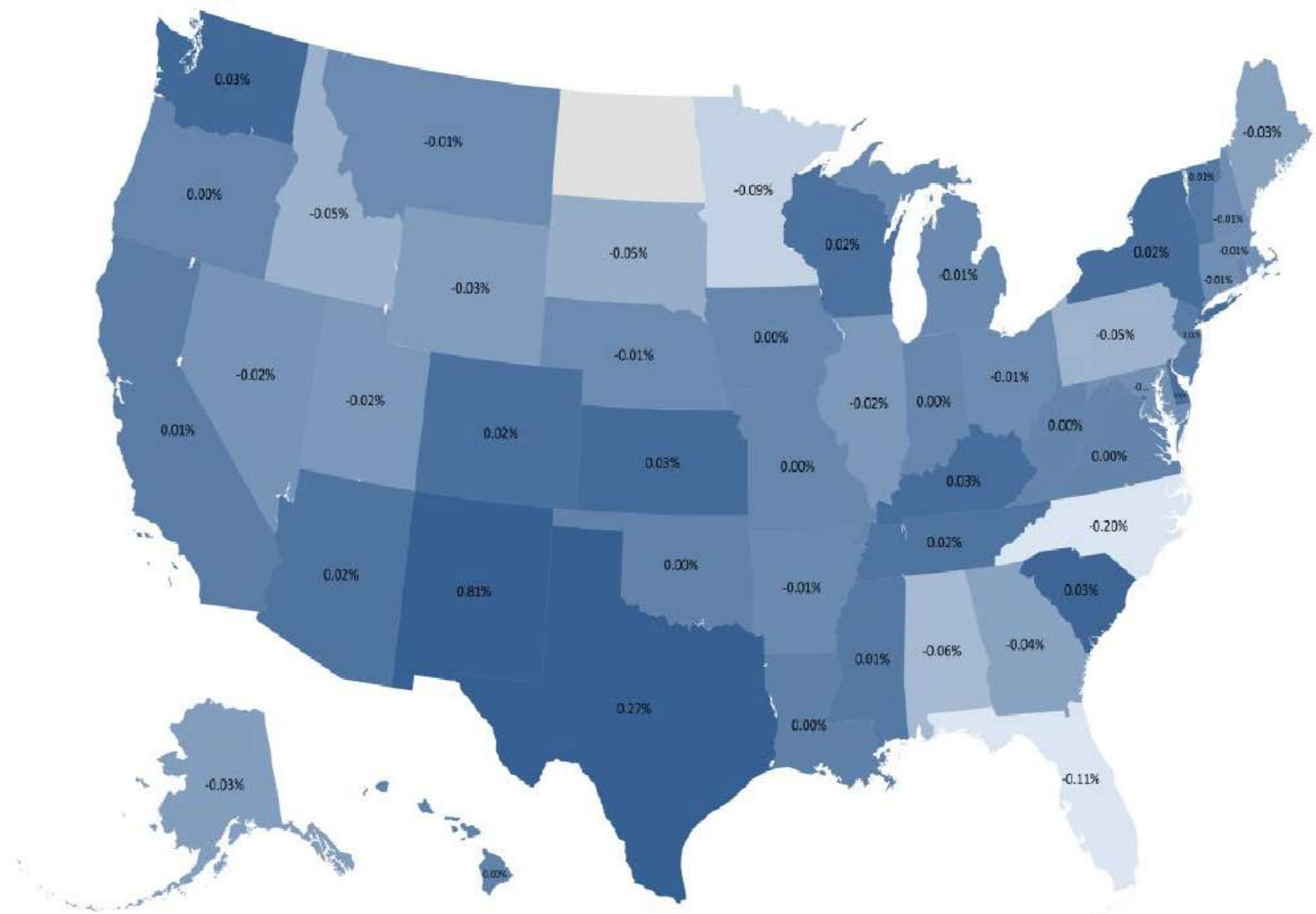
To address the negative relationship between women patentees and women STEM entrepreneurs in the Northeast and Midwest regions, where the changes are generally small, targeted interventions could be implemented. These could include providing resources and support to help women patentees navigate the commercialization process, developing programs to support women patentees in translating their inventions into successful ventures, and establishing initiatives to foster collaboration between women patentees, entrepreneurs, and industry partners.

In the regions where there are notable outliers like Maine in the Northeast, Georgia in the Southeast and Colorado and Idaho in the West, with relatively large positive coefficients, policymakers could examine the specific factors contributing to these states' success in fostering a supportive environment for female innovators and entrepreneurs in STEM fields. Identifying and sharing best practices from these states could help inform policies and programs in other parts of the region and the country.

5-1-2 State Female STEM Entrepreneurship and State Female Founders Venture Funding

Figure 5-2 below depicts the relationship between venture funding to female founders in a state and state female STEM entrepreneurs.

Figure 5-2: Percentage Change in State Female STEM Entrepreneurs with One Percent Change in State Female Founders Venture Funding



Note: The value for Maryland is -0.01% and for Rhode Island the value is 0.00%. For percent changes very close to zero, such as -0.001 and .001, the map shows 0.00%, due to rounding.

The relationship between female founders' venture capital funding and the number of female STEM entrepreneurs varies across different regions in the United States, with each region presenting a unique set of challenges and opportunities. At the national level, a one percent increase in the number of female founders' venture funding is associated with a 0.29% increase in the number of female STEM entrepreneurs. This positive relationship suggests that as more women founded firms receive venture funding, there is growth in female STEM entrepreneurship. In the Northeast region, most states have small negative coefficients or no change in the relationship between female venture capital funding and the number of female STEM entrepreneurs. States like Pennsylvania, Maine, Connecticut, Massachusetts, New Hampshire, and Maryland have negative coefficients, indicating that increases in female venture capital funding are associated with decreases in the number of female STEM entrepreneurs. Only New York, Vermont, and New Jersey have small positive coefficients, suggesting a slight positive relationship between the two variables. The overall trend in the Northeast region suggests that female venture capital funding may not be effectively translating into increased female STEM entrepreneurship, and there may be other factors at play hindering the growth of women-owned STEM businesses in the region.

The Southeast region presents a mixed picture, with some states showing positive coefficients and others showing negative coefficients. The District of Columbia, South Carolina, Tennessee, and Mississippi have positive coefficients, indicating that increases in female venture capital funding are associated with increases in the number of female STEM entrepreneurs. However, states like Florida, Georgia, North Carolina, Arkansas, Louisiana, Virginia, and Alabama have negative coefficients, suggesting that increases in female venture capital funding are not effectively supporting the growth of female STEM entrepreneurship in these states. The mixed results in the Southeast region highlight the need for a more nuanced understanding of the specific challenges and opportunities faced by female STEM entrepreneurs in each state.

The Southwest region is notable for the presence of New Mexico, which has an exceptionally high positive coefficient of 0.81%, indicating a strong positive relationship between female venture capital funding and the number of female STEM entrepreneurs. Once again, the New Mexico results need to be looked at cautiously, because this state had many missing values for female STEM numbers across sectors. Texas also has a relatively high positive coefficient of 0.27% almost similar to the national coefficient of 0.29%, suggesting that female venture capital funding is effectively supporting the growth of women-owned STEM businesses in the state. Oklahoma and Arizona have smaller positive coefficients, while Utah is the only state in the region with a negative coefficient. The overall trend in the Southwest region suggests that female venture capital funding is generally having a positive impact on female STEM entrepreneurship, with New Mexico and Texas leading the way.

The West region also presents a mixed picture, with some states showing positive coefficients and others showing negative coefficients. Washington, Colorado, California, Hawaii, and Oregon have positive coefficients, indicating that increases in female venture capital funding are associated with increases in the number of female STEM entrepreneurs. However, states like Idaho, Alaska, Wyoming, Nevada, and Montana have negative coefficients, suggesting that female venture capital funding may not be effectively supporting the growth of female STEM entrepreneurship in these states. The mixed results in the West region highlight the need for a more targeted approach to supporting female STEM entrepreneurs, accounting for the specific challenges and opportunities faced by women-owned STEM businesses in each state.

Finally, the Midwest region also presents a mixed picture, with some states showing positive coefficients and others showing negative coefficients. Kansas, Kentucky, Wisconsin, Indiana, Iowa, and Missouri have positive coefficients, indicating that increases in female venture capital funding are associated with increases in the number of female STEM entrepreneurs. However, states like Minnesota, South Dakota, Illinois, Michigan, Nebraska, and Ohio have negative coefficients, suggesting that female venture capital funding may not be effectively supporting the growth of female STEM entrepreneurship in these states. The mixed results in the Midwest region highlight the need for a more targeted approach to supporting female STEM entrepreneurs, considering the specific challenges and opportunities faced by women-owned STEM businesses in each state.

Overall, the relationship between female venture capital funding and the number of female STEM entrepreneurs varies significantly across different regions in the United States. While some regions, such as the Southwest, show generally positive trends, others, such as the Northeast and Midwest, present more mixed results. The mixed results highlight the need for a more nuanced understanding of the specific challenges and opportunities faced by female STEM entrepreneurs in each state and region, and the development of targeted strategies to support the growth of women-owned STEM businesses across the country.

5-1-2-A Policy Implications of State Female Founder Venture Funding Results

Based on the analysis of the relationship between female founders' venture capital funding and the number of female STEM entrepreneurs across different states and regions in the United States, several potential policy solutions are proposed to address the challenges and promote greater female participation in STEM entrepreneurship.

In states where there is a positive relationship between female founders' venture capital funding and the number of female STEM entrepreneurs, such as in the Southwest region, as well as in the Southeast and Midwest regions, policymakers could focus on increasing this funding to further support the growth of women STEM businesses. Dr. Angela de Manzanos has argued that "venture capital groups with women ... are twice as likely to invest in female and minority founding teams"[xli] (Burkhart 2023). Congress could legislate additional public funding for SBICs and the SSBCI to strategically invest in sectors in which women STEM entrepreneurs are concentrated and to target women in sectors in which they are underrepresented. The SBA could also train new female venture capital and angel investors on female STEM investment in varied STEM sectors and educate local lenders on female STEM investment in all STEM sectors.

On the other hand, in states where there is a negative relationship between female venture capital funding and the number of female STEM entrepreneurs, such as the relatively large negative relationship in Florida, Minnesota, and Alabama, policymakers could focus on increasing this funding in targeted sectors. The SBA could train female venture capital and angel investors on female STEM investment in nonconcentrated STEM sectors and educate local lenders on female STEM investment in underrepresented STEM sectors. This targeted approach could help address the inefficient allocation of venture funds in these states, which may be directed towards industries that are crowded with female STEM entrepreneurs, leading to increased competition and the failure of female-founded STEM businesses.

In the Northeast region, where most states have small negative coefficients or no change, with only New York and Vermont showing small positive coefficients, policymakers could focus on identifying and addressing the specific barriers to female STEM entrepreneurship in the region. This could involve conducting studies to understand the factors influencing the allocation of venture funds and the challenges faced by female STEM entrepreneurs in accessing funding and resources.

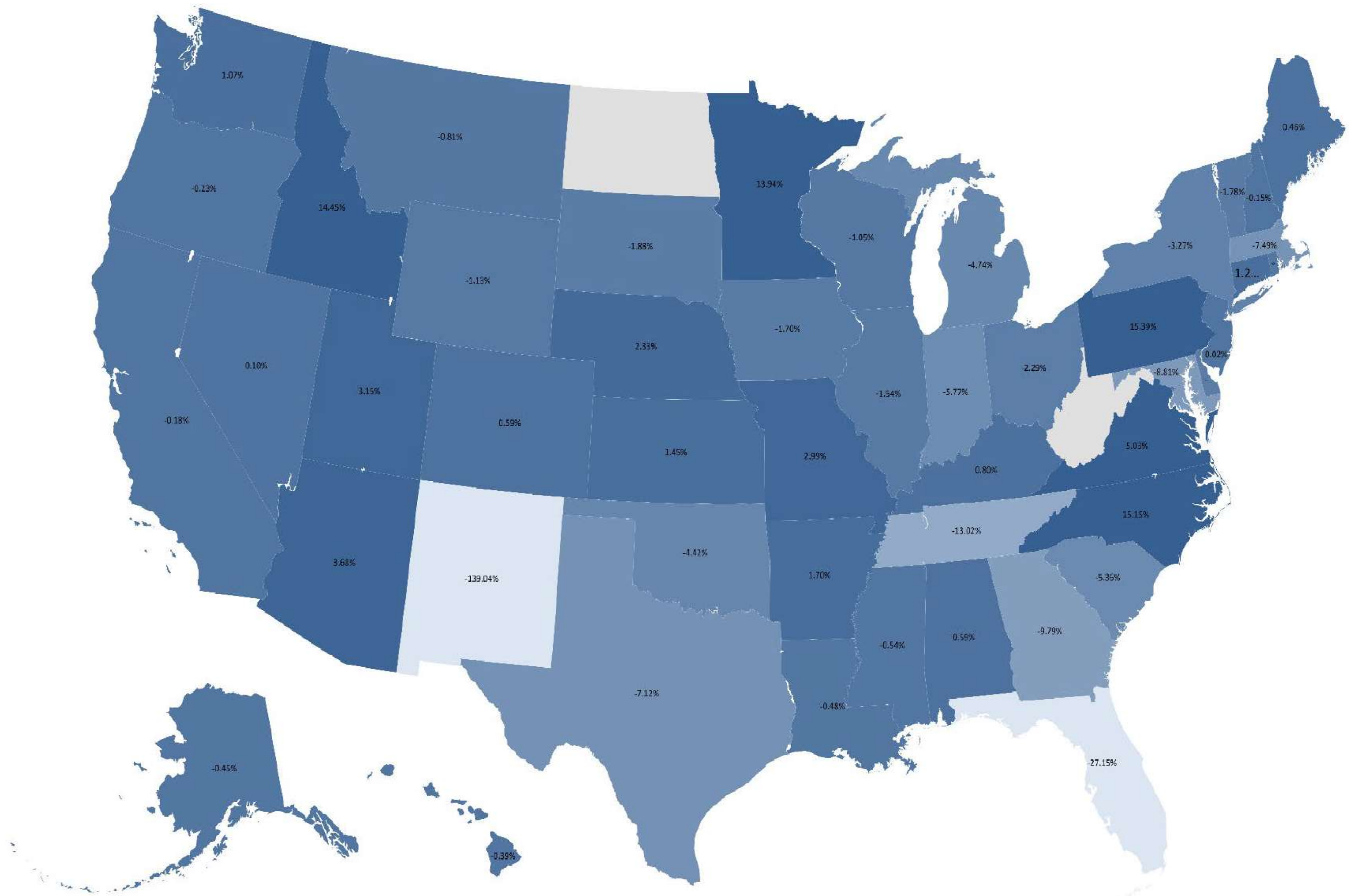
The West region presents a mixed picture, with some states like Washington, Colorado, and California showing positive coefficients, while others like Idaho, Alaska, and Wyoming have negative coefficients. Policymakers in this region could focus on learning from the states with positive outcomes and implementing targeted policies to support female STEM entrepreneurs in the states facing challenges. This could involve providing training and resources to female venture capital investors, educating local lenders, and fostering collaboration between industry, academia, and government to create a supportive entrepreneurial ecosystem.

Overall, the small magnitude of the coefficients suggests that changes in female venture funding have a limited impact on female STEM entrepreneur numbers in most states. However, the relatively large positive coefficient for Texas at 0.27% indicates that policymakers across all regions could learn from Texas and develop strategies to replicate this success in their respective states.

5-1-3 State Female STEM Entrepreneurship and State Labor Force/Employment

The figure below shows the relationship between a state's labor force and the female STEM entrepreneurs in the state.

Figure 5-3: Percentage Change in Female STEM Entrepreneurs with One Percent Change in State Labor Force/Employment



Note: For percent changes very close to zero, such as -0.001 and .001, the map shows 0.00%, due to rounding. For Nevada the map shows .10%, whereas the actual number is -.10%.

There is a positive relationship between the labor force and female STEM entrepreneur numbers at the national level. A one percent increase in national employment is associated with a 37.29% increase in the number of female STEM entrepreneurs. This positive relationship suggests that as the national employment rises, there is growth in female STEM entrepreneurship. However, the relationship between the labor force and the number of female STEM entrepreneurs varies significantly across different regions in the United States, with each region presenting a unique set of challenges and opportunities.

In the Northeast region, the impact of labor force changes on female STEM entrepreneurship is mixed. Some states, such as Pennsylvania and Connecticut have positive coefficients, indicating that an increase in the labor force is associated with an increase in the number of female STEM entrepreneurs. However, other states in the region, including New York, Rhode Island, New Hampshire, Massachusetts, Maryland, and Delaware, have negative coefficients, suggesting that a growing labor force may not necessarily translate into increased female STEM entrepreneurship in these states. The mixed results in the Northeast region highlight the need for a more nuanced understanding of the specific factors influencing the relationship between labor force growth and female STEM entrepreneurship in each state.

The Southeast region also presents a mix of positive and negative coefficients. States like North Carolina, Virginia, District of Columbia, Arkansas, Kentucky, and Alabama have positive coefficients, indicating that an increase in the labor force is associated with an increase in the number of female STEM entrepreneurs. However, other states in the region, such as Florida, Tennessee, Georgia, South Carolina, Louisiana, and Mississippi, have negative coefficients, suggesting that a growing labor force may not necessarily lead to increased female STEM entrepreneurship in these states. The mixed results in the Southeast region underscore the importance of considering state-specific factors when examining the relationship between labor force growth and female STEM entrepreneurship.

The Southwest region presents a more consistent picture, with most states having negative coefficients. New Mexico, Texas, and Oklahoma also have negative coefficients, suggesting that a growing labor force may not necessarily translate into increased female STEM entrepreneurship in these states. Arizona and Utah are the only states in the region with positive coefficients, indicating that an increase in the labor force is associated with an increase in the number of female STEM entrepreneurs. The overall trend in the Southwest region suggests that labor force growth may not be sufficient to support the growth of female STEM entrepreneurship, and other factors may be hindering the success of women-owned STEM businesses in the region.

The Midwest region presents a mix of positive and negative coefficients. States like Minnesota, Missouri, Nebraska, and Kansas have positive coefficients, indicating that an increase in the labor force is associated with an increase in the number of female STEM entrepreneurs. However, other states in the region, including Indiana, Michigan, Ohio, Iowa, Illinois, South Dakota, and Wisconsin, have negative coefficients, suggesting that a growing labor force may not necessarily lead to increased female STEM entrepreneurship in these states. The mixed results in the Midwest region highlight the need for a more targeted approach to supporting female STEM entrepreneurs, taking into account the specific challenges and opportunities faced by women-owned STEM businesses in each state.

Finally, the West region also presents a mix of positive and negative coefficients. States like Idaho, Washington, Colorado, have positive coefficients, indicating that an increase in the labor force is associated with an increase in the number of female STEM entrepreneurs. However, other states in the region, such as California, Nevada, Oregon, Montana, Wyoming, Alaska, and Hawaii, have negative coefficients, suggesting that a growing labor force may not necessarily translate into increased female STEM entrepreneurship in these states. The mixed results in the West region underscore the importance of considering state-specific factors when examining the relationship between labor force growth and female STEM entrepreneurship.

Overall, the relationship between the labor force and the number of female STEM entrepreneurs varies significantly across different regions in the United States. While some regions, such as the Southwest, show mostly negative trends, others, such as the Northeast, Southeast, Midwest, and West, present more mixed results. There are some states such as Idaho (14.45%), Minnesota (13.94%), North Carolina (15.15%), and Pennsylvania (15.39%) that have large positive relationships, though none of them are as large as the national result. Other states such as Florida (-27.15%) and New Mexico (-139.04%) have large negative relationships. New Mexico with its missing values could have skewed results. The mixed results highlight the need for a more nuanced understanding of the specific challenges and opportunities faced by female STEM entrepreneurs in each state and region, and the development of targeted strategies to support the growth of women-owned STEM businesses across the country.

5-1-3-A Policy Implications of State Employment Results

Based on the analysis of the relationship between the labor force and the number of female STEM entrepreneurs across different states and regions in the United States, several potential policy implications emerge to address the challenges and promote greater female participation in STEM entrepreneurship.

In states where there is a positive relationship between the labor force and the number of female STEM entrepreneurs, such as Pennsylvania, North Carolina, Idaho, and Minnesota, policymakers could focus on further enhancing the conditions that have led to this favorable outcome. Congress could legislate programs like the American Rescue Plan's childcare stabilization grants, helping state governments provide funding to support competitive wages for childcare providers, thereby expanding the childcare labor force. This could encourage practices like providing monthly stipends, location assistance, and health insurance benefits to childcare workers, attracting more individuals to the childcare workforce. Additionally, the federal government could tie K-

12 funding to female STEM learning, contributing to a larger pool of the female STEM workforce and leading to more networking opportunities and support for female STEM entrepreneurs.

On the other hand, in states where there is a negative relationship between the labor force and the number of female STEM entrepreneurs, such as New Mexico, Florida, Tennessee, and Georgia, policymakers could focus on addressing the lack of workers skilled in different STEM disciplines. The federal government could provide funding to state governments to invest in STEM education and training programs, particularly those targeting women and underrepresented groups, to build a strong pipeline of skilled talent for a state's STEM industries. The funding could be conditioned on the state partnering with industry and educational institutions to develop internship, apprenticeship, and mentorship programs in diverse STEM sectors that provide women with hands-on experience and exposure to STEM careers and entrepreneurship. Moreover, the federal funding could also be linked to state policies and initiatives that promote diversity in the workplace, such as pay equity, flexible work arrangements, and family-friendly benefits, to attract skilled and talented workers to the state.

In regions where there is a mix of positive and negative coefficients, such as the Northeast, Southeast, Midwest, and West, policymakers could focus on identifying and addressing the specific factors influencing the relationship between labor force growth and female STEM entrepreneurship in each state. This could involve conducting studies to understand the unique challenges and opportunities faced by female STEM entrepreneurs in different states and developing targeted strategies to support their growth and success. For example, in states with large negative coefficients, such as Massachusetts (-7.49%) and Maryland (-8.81%) in the Northeast, policymakers could investigate the specific barriers hindering the translation of labor force growth into increased female STEM entrepreneurship and develop policies to address these challenges.

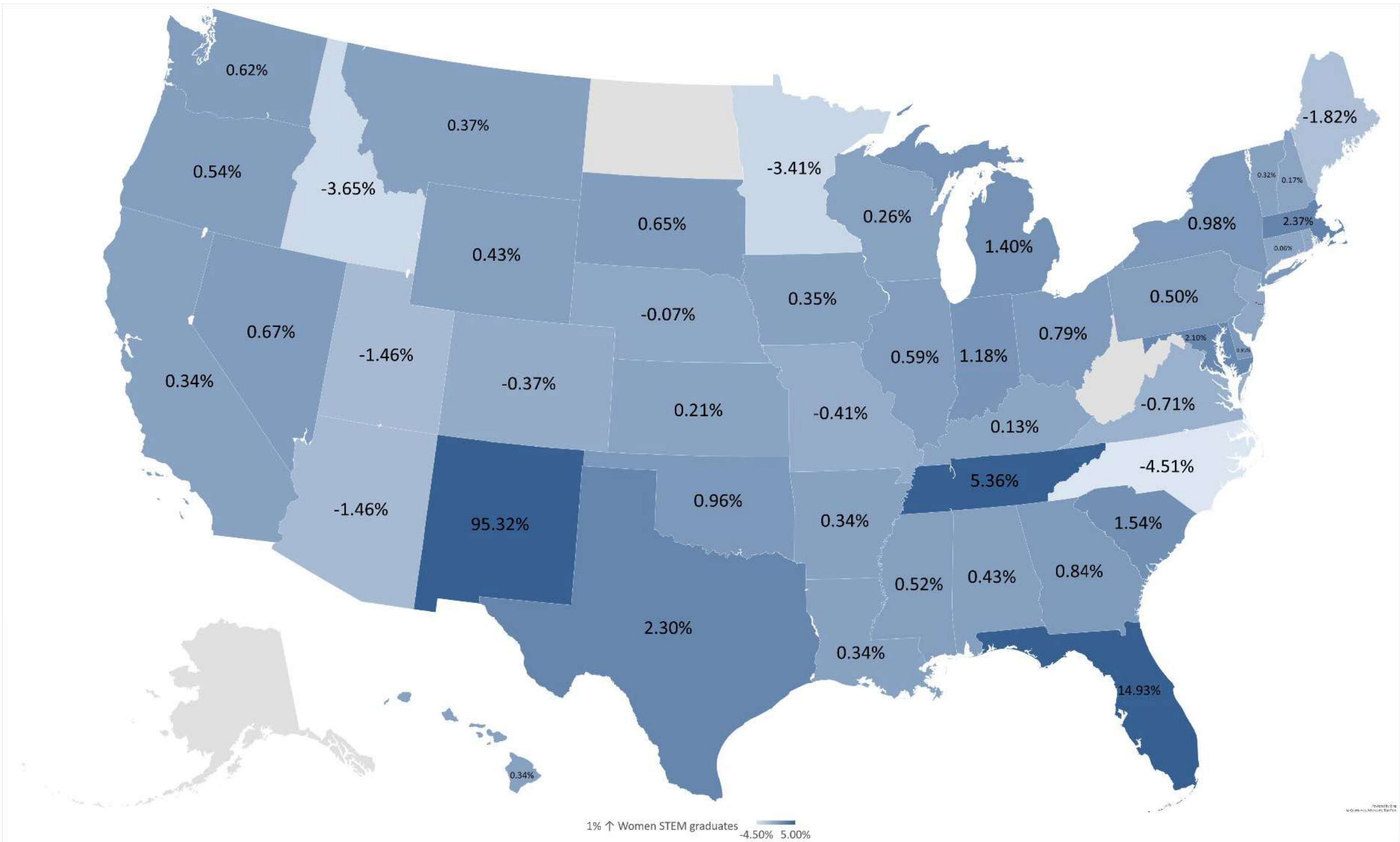
Furthermore, in regions with notable outliers, such as New Mexico (-139.04%) in the Southwest, policymakers could examine the specific factors contributing to the extremely large negative coefficient and develop targeted interventions to mitigate the adverse impact of labor force growth on female STEM entrepreneurship. This could involve addressing the mismatch between the skills of the growing labor force and the needs of STEM industries, providing resources and support for new businesses, and fostering a more supportive entrepreneurial ecosystem for women-owned STEM ventures.

Overall, the policy implications based on the labor force analysis highlight the need for a multi-faceted approach to supporting female STEM entrepreneurship across different states and regions. By investing in STEM education and training, promoting diversity in the workplace, providing targeted support for women-owned STEM businesses, and addressing state-specific challenges and opportunities, policymakers can create a more inclusive and thriving entrepreneurial ecosystem for women in STEM fields. The federal government can play a crucial role in providing child care funding, legislation, and guidance to support these efforts, while also encouraging collaboration between industry, academia, and state governments to foster innovation and entrepreneurship.

5-1-4 State female STEM Entrepreneurship and National Female STEM Graduates

Figure 5-4 depicts the relationship between a state’s female STEM entrepreneurs and national female STEM graduates.

Figure 5-4: Percentage Change in Female STEM Entrepreneurs with One Percent Change in National Female STEM Graduates



Note: For percent changes very close to zero, such as -0.001 and .001, the map shows 0.00%, due to rounding.

The relationship between women STEM graduates and female STEM entrepreneurship in the United States varies significantly across different regions, with each region presenting unique patterns for the observed coefficients. Nationally, a one percent increase in the number of female STEM graduates is associated with a 9.91 percent decrease in the number of female STEM entrepreneurs.

In the northeast region, most states have positive coefficients, indicating a favorable relationship between women STEM graduates and female STEM entrepreneurship. States like Massachusetts (2.37%), Maryland (2.10%), and New York (.98%) have coefficients notably higher than the national trend of -9.91%, suggesting that these states have strong support systems, policies, or cultural factors that encourage women STEM graduates to pursue entrepreneurship. However, a few states in the region, such as Maine (-1.82%), Rhode Island (-0.08%), and New Jersey (-0.04%), have negative coefficients, albeit smaller in magnitude compared to the national trend. This could indicate the presence of some barriers or a lack of targeted support for women STEM graduates transitioning to entrepreneurship in these states.

The Southeast also include many states that have positive coefficients, with some states showing exceptionally high values compared to the national trend. Florida (14.93%) and Tennessee (5.36%) stand out with large positive coefficients, suggesting the presence of unique conditions or support systems that strongly encourage women STEM graduates to become entrepreneurs. Other states like Texas (2.30%), South Carolina (1.54%), and Georgia (0.84%) also have positive coefficients, indicating a favorable environment for female STEM entrepreneurship. However, North Carolina (-4.51%) and Virginia (-0.71%) have negative coefficients, which, although smaller than the national trend, suggest the existence of challenges or barriers for women STEM graduates pursuing entrepreneurship in these states.

The Southwest region is characterized by a stark contrast between New Mexico and the other states. New Mexico has an extraordinarily high positive coefficient of 95.32%, indicating the presence of unique factors or support systems that strongly encourage women STEM graduates to pursue entrepreneurship, although New Mexico results could be skewed because of missing values. This could include targeted policies, strong mentorship networks, or a thriving ecosystem for female entrepreneurs. On the other hand, Arizona (-1.46%) and Utah (-1.46%) have negative coefficients, suggesting the existence of barriers or challenges for women STEM graduates transitioning to entrepreneurship in these states. However, the magnitudes of these negative coefficients are smaller than the national trend.

The Midwest region presents a mix of positive and negative coefficients, highlighting the varying relationships between women STEM graduates and female STEM entrepreneurship within the region. States like Indiana (1.18%), Michigan (1.40%), and Ohio (0.79%) have positive coefficients, indicating a supportive environment for women STEM graduates transitioning to entrepreneurship. However, Minnesota (-3.41%), Missouri (-0.41%), and Nebraska (-0.07%) have negative coefficients, suggesting the presence of obstacles or a lack of targeted support for female STEM entrepreneurs in these states. The magnitudes of the coefficients in the Midwest are generally smaller than the national trend, both for positive and negative values.

The West region has mostly positive coefficients, suggesting a generally favorable environment for women STEM graduates pursuing entrepreneurship. States like Nevada (0.67%), Washington (0.62%), Oregon (0.54%), and California (0.34%) have positive coefficients, indicating the presence of support systems, policies, or cultural factors that encourage female STEM entrepreneurship. However, Idaho (-3.65%) and Colorado (-0.37%) have negative coefficients, with Idaho's coefficient being larger. This suggests the presence of significant barriers or a lack of targeted support for women STEM graduates transitioning to entrepreneurship in Idaho.

In terms of magnitudes, some states stand out with exceptionally large positive coefficients compared to the national trend, such as New Mexico (95.32%) and Florida (14.93%). These states likely have unique conditions or support systems that strongly encourage women STEM graduates to pursue entrepreneurship. Other states with positive coefficients, like Tennessee (5.36%), Texas (2.30%), and Massachusetts (2.37%), also demonstrate a strong positive relationship between women STEM graduates and female STEM entrepreneurship, with coefficients notably higher than the national trend.

On the other hand, states with negative coefficients generally have smaller magnitudes compared to the national trend. North Carolina (-4.51%), Idaho (-3.65%), and Minnesota (-3.41%) have the largest negative coefficients, suggesting the presence of significant barriers or challenges for women STEM graduates pursuing entrepreneurship in these states. However, most other states with negative coefficients have smaller magnitudes, indicating that the negative relationship between women STEM graduates and female STEM entrepreneurship is less pronounced in states compared to the national average.

Overall, the regional differences in the relationship between women STEM graduates and female STEM entrepreneurship highlight the complex interplay of various factors, such as state-specific policies, support systems, cultural norms, and economic conditions. States with positive coefficients, particularly those with larger magnitudes compared to the national trend, likely have a combination of factors that create a supportive environment for women STEM graduates to pursue entrepreneurship. Conversely, states with negative coefficients, especially those with larger magnitudes, may have barriers or challenges that hinder the transition from education to entrepreneurship for women in STEM fields. Understanding these regional variations is crucial for developing targeted strategies and policies to support and encourage female STEM entrepreneurship across the United States.

5-1-4-A Policy Implications of National Female STEM Graduates' Results

Based on the analysis of the relationship between women STEM graduates and female STEM entrepreneurship across different states and regions in the United States, several potential policy solutions emerge to address the challenges and promote greater female participation in STEM education and entrepreneurship.

In the Northeast region, where most states have positive coefficients, policymakers could focus on further strengthening the support systems and policies that encourage women STEM graduates to pursue entrepreneurship. The federal government could tie K-12 funding to a focus on engaging and retaining female students in STEM subjects, ensuring a strong pipeline of women interested in STEM careers. Additionally, Congress could work with state governments to condition funding to universities and colleges on the expansion of their STEM programs, with a specific emphasis on outreach to female students. This could incentivize universities and colleges in the region to develop entrepreneurship education programs and incubators specifically designed for women STEM students and graduates, providing them with the skills, networks, and resources necessary to launch and grow their own businesses.

In the South region, where there are some states with exceptionally high positive coefficients, such as Florida and Tennessee, policymakers could learn from the successful practices and policies implemented in these states and work to replicate them across the region. For states with negative coefficients, such as North Carolina and Virginia, the federal government could support the state governments in commissioning studies to examine the specific barriers and challenges faced by women STEM graduates in transitioning to entrepreneurship. Based on the findings, the federal government could encourage these states to develop targeted initiatives, such as incubator and accelerator programs, to support women STEM graduates in launching and growing their businesses. These initiatives could also include collaborations between educational institutions and industry to provide women STEM students with exposure to entrepreneurship and hands-on experience through internships, co-op programs, and entrepreneurial projects. The federal government could tie grant funding for state institutions to the inclusion of diverse faculty in grant applications. This could incentivize institutions to find ways to promote female faculty, making it easier for them to commercialize their inventions, given their seniority.

According to the results of the literature survey we conducted in Phase I of this research "Colyvas et al. (2012) find that academic institutions employment and resource allocation policies do not favor women. Women faculty's likelihood of reporting inventions to university licensing offices is similar to men, but they end up reporting less due to their lack of seniority and security in faculty positions and less monetary support for research efforts. Entrepreneurial opportunities are more available for those with the status and resources to engage in scientific advancement and commercial development. Even when they report inventions to licensing offices, their lesser rank and resources compared to male faculty influence the ultimate outcome. The likelihood of their disclosures being converted to patents and licenses by these offices is lower than their male counterparts."

If federal grant funding is tied to promotion of diverse faculty including female faculty, institutions could find creative ways to promote them, such as using outside reviewers or AI and other tools to foster "gender-blind" tenure, promotion, financing and licensing decisions. It is also possible that academic institutions give tenure and promotion credit for faculty's entrepreneurship activities. The enhancement of female faculty's status and resources could help increasing their commercialization success through university licensing offices.

For the Midwest region, which presents a mix of positive and negative coefficients, policymakers could adopt a tailored approach based on the specific needs and challenges of each state. In states with positive coefficients, such as Indiana, Michigan, and Ohio, the focus could be on further enhancing the existing support systems and policies that encourage women STEM graduates to pursue entrepreneurship. This could involve expanding entrepreneurship education programs, increasing access to mentorship and networking opportunities, and providing targeted funding and resources for women-owned STEM startups. In states with negative coefficients, like Minnesota, Missouri, and Nebraska, the federal government could work with state governments to identify and address the specific barriers hindering the transition of women STEM graduates to entrepreneurship, such as lack of access to funding, mentorship, or entrepreneurial skills training.

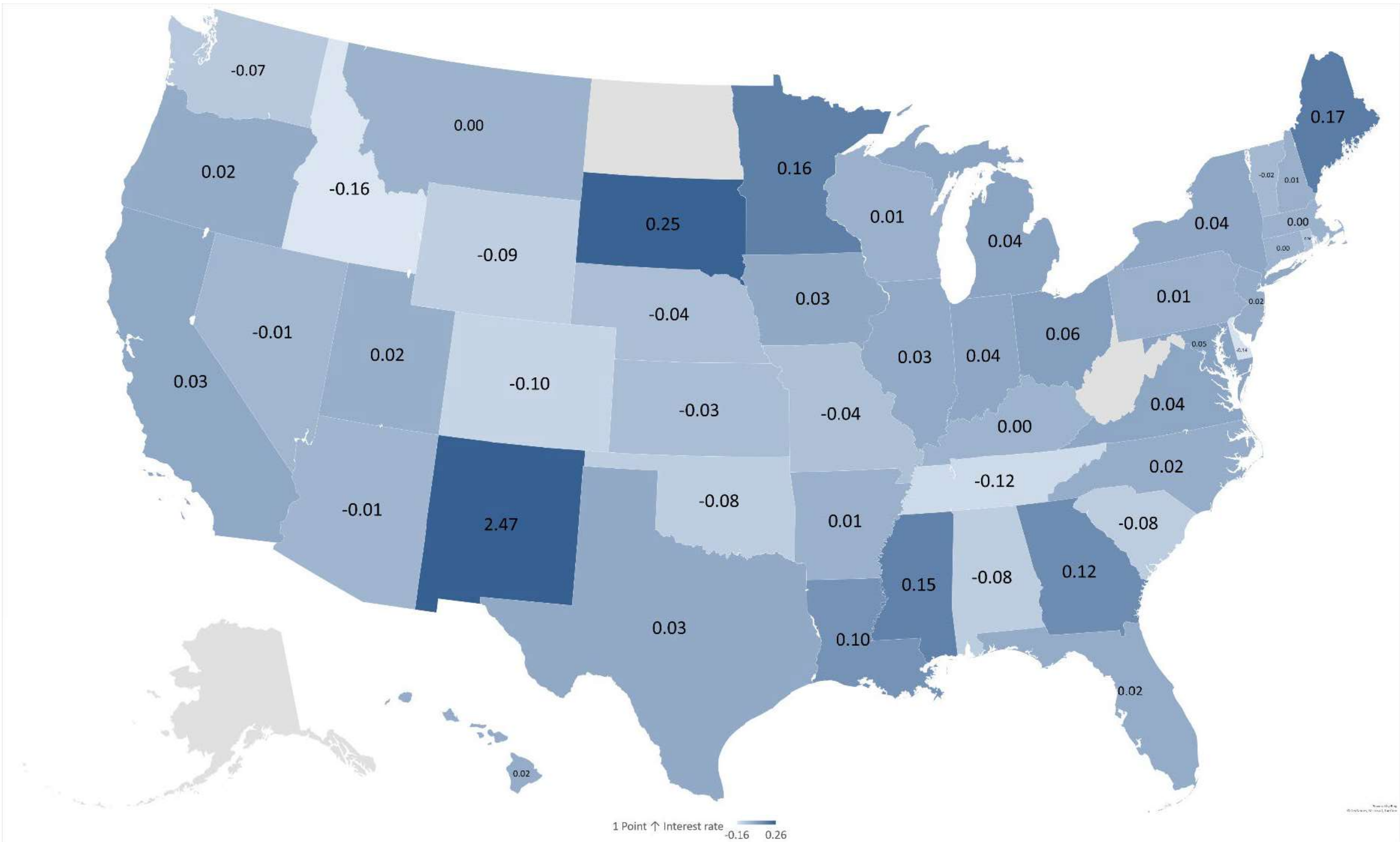
In the Southwest region, policymakers could draw insights from the success of New Mexico, which has an exceptionally high positive coefficient, to develop policies and programs that foster a supportive ecosystem for women STEM graduates pursuing entrepreneurship. This could involve replicating the targeted policies, strong mentorship networks, and thriving entrepreneurial ecosystem present in New Mexico across other states in the region. For states with negative coefficients, like Arizona and Utah, the federal government could encourage the development of targeted initiatives to address the specific challenges and barriers faced by women STEM graduates in these states, such as increasing access to funding, providing entrepreneurial skills training, and fostering collaborations between academia and industry.

Finally, in the West region, where most states have positive coefficients, policymakers could focus on strengthening and expanding the existing policies and programs that support the transition of women STEM graduates to entrepreneurship. This could involve increasing funding for entrepreneurship education programs, providing access to mentorship and networking opportunities, and offering targeted resources and support for women-owned STEM startups. For states with negative coefficients, particularly Idaho, which has a larger negative coefficient, the federal government could work with the state government to investigate the specific factors contributing to this trend and develop targeted interventions to address the barriers and challenges faced by women STEM graduates in pursuing entrepreneurship.

5-1-5 State Female STEM entrepreneurship and Interest Rates

In Figure 5-5 below, we show the relationship between interest rates as measured by the 30-year mortgage rate, and female STEM entrepreneurs in a state.

Figure 5-5: Percentage Change in State Female STEM Entrepreneurs with One Percentage Point Change in Interest Rates



Note: For percent changes very close to zero, such as -0.001 and .001, the map shows 0.00%, due to rounding.

The relationship between interest rates and the number of female STEM entrepreneurs varies across different regions in the United States, with each region exhibiting unique patterns and potential explanations for the observed coefficients.

At the national level, the coefficient for the interest rate is -0.08%, indicating that a one percentage point increase in the national interest rate is associated with a slight decrease of 0.08% in the number of female STEM entrepreneurs. This suggests that, on average, higher interest rates may pose challenges for women seeking to start or grow STEM businesses, possibly due to increased borrowing costs and reduced access to capital.

However, the regional differences reveal a more nuanced picture. In the Northeast region, most states have small positive coefficients, with Maine (0.17%) having the largest. Delaware (-.14%) has a larger negative coefficient than the national level. There are missing female STEM entrepreneur values in the Maine data, which could distort results. This suggests that female STEM entrepreneurs in the Northeast may be slightly more resilient to interest rate increases compared to the national trend. Factors such as favorable borrowing conditions, state-specific policies, or a supportive entrepreneurial ecosystem in the region could help mitigate the negative impact of higher interest rates on women-owned STEM businesses. It is also possible that female STEM entrepreneurs in the Northeast are not dependent on traditional financing to begin with, or experience wealth effects due to the higher interest rates, and therefore higher interest rates don't impact them.

The Southeast region presents a mix of positive and negative coefficients, with no clear regional trend. States like Georgia (0.12%), Louisiana (0.10%), and Virginia (0.04%) have positive coefficients, indicating that female STEM entrepreneurs in these states may benefit from higher interest rates. This could be due to state-specific economic conditions, such as increased investment in STEM industries or funding policies that support small businesses. On the other hand, South Carolina (-0.08%) has a negative coefficient the same as the national level coefficient and Tennessee (-0.12%) has a negative coefficient larger than the national level coefficient. This suggests that women-owned STEM businesses in these states may face more significant challenges when interest rates rise, possibly due to factors such as limited access to affordable capital or a less supportive entrepreneurial environment.

The Midwest region also exhibits mostly small positive coefficients, with Minnesota (0.16%) and South Dakota (0.25%) having the largest. South Dakota also has missing female STEM entrepreneur numbers across sectors which could skew results. This suggests that female STEM entrepreneurs in the Midwest may experience a mildly positive impact when interest rates increase. Factors such as a strong entrepreneurial culture, supportive state policies, or a robust STEM ecosystem in the region could contribute to this trend. It is also possible that female entrepreneurs in these states have access to alternate forms of financing, or experience wealth effects, and are not affected by interest rate changes. However, some states like Missouri (-0.04%) and

Nebraska (-0.04%) have negative coefficients, indicating that women-owned STEM businesses in these states may face challenges when interest rates rise, possibly due to state-specific economic conditions or limited access to resources.

The Southwest region is characterized by a notable outlier, New Mexico, which has an exceptionally high positive coefficient of 2.47%. This suggests that female STEM entrepreneurs in New Mexico may significantly benefit from higher interest rates. However, New Mexico results could be distorted due to missing data. Other states in the region, like Texas (0.03%) and Utah (0.02%), have smaller positive coefficients, while Oklahoma (-0.08) has a negative coefficient same as the national coefficient and Arizona (-0.01%) has a small negative coefficient. This highlights the diverse conditions and challenges faced by women-owned STEM businesses in the Southwest region.

Finally, the West region presents a mix of positive and negative coefficients. States like California (0.03%), Hawaii (0.02%), and Oregon (0.02%) have small positive coefficients, suggesting that female STEM entrepreneurs in these states may experience a slight benefit when interest rates increase. This could be due to factors such as a strong STEM ecosystem, supportive state policies, or favorable economic conditions. However, states like Idaho (-0.16%), Colorado (-0.10%), have larger negative coefficients than the national coefficient and Washington (-0.07%) has a negative coefficient slightly smaller than the national level., This indicates that women-owned STEM businesses in these states may face more significant challenges when interest rates rise, possibly due to factors such as limited access to affordable capital or a less supportive entrepreneurial environment.

5-1-5-A Policy Implications of Interest Rate Results

Based on the analysis of the relationship between interest rates and the number of female STEM entrepreneurs across different states and regions in the United States, several potential policy implications emerge to address the challenges and support female-led STEM businesses in the face of changing interest rates.

In states where there is a positive relationship between interest rates and the number of female STEM entrepreneurs, such as New Mexico, South Dakota, and Maine, policymakers could focus on investigating the specific factors influencing this relationship and developing targeted policies to support women entrepreneurs. The federal government could investigate policies to support more nonemployer STEM businesses in these states, as they may be less heavily impacted by increased costs of financing. Additionally, the SBA could encourage alternative financing options, such as angel investment, for female STEM entrepreneurs that are not dependent on traditional financing.

On the other hand, in states where there is a negative relationship between interest rates and the number of female STEM entrepreneurs, such as Delaware, District of Columbia, Idaho, and Tennessee, policymakers could focus on improving access to affordable financing and mitigating the negative impact of interest rate hikes on women-owned

STEM businesses. The SBA could work with financial institutions to develop targeted loan programs for women STEM entrepreneurs in these states, providing access to affordable financing to help them launch and grow their businesses. Federal agencies could also provide loan guarantees or other forms of support to help women STEM entrepreneurs secure financing, particularly in the early stages of their businesses. Moreover, the SBA could provide financial education and counseling services to help women STEM entrepreneurs in these states navigate the financing process and make informed decisions about their businesses.

In the Northeast and Midwest regions, where most states have small positive coefficients, policymakers could focus on maintaining and enhancing the slightly favorable environment for female STEM entrepreneurship when interest rates rise. This could involve implementing policies that mitigate the potential negative impact of increased borrowing costs, such as providing targeted financial assistance or tax incentives for women-owned STEM businesses.

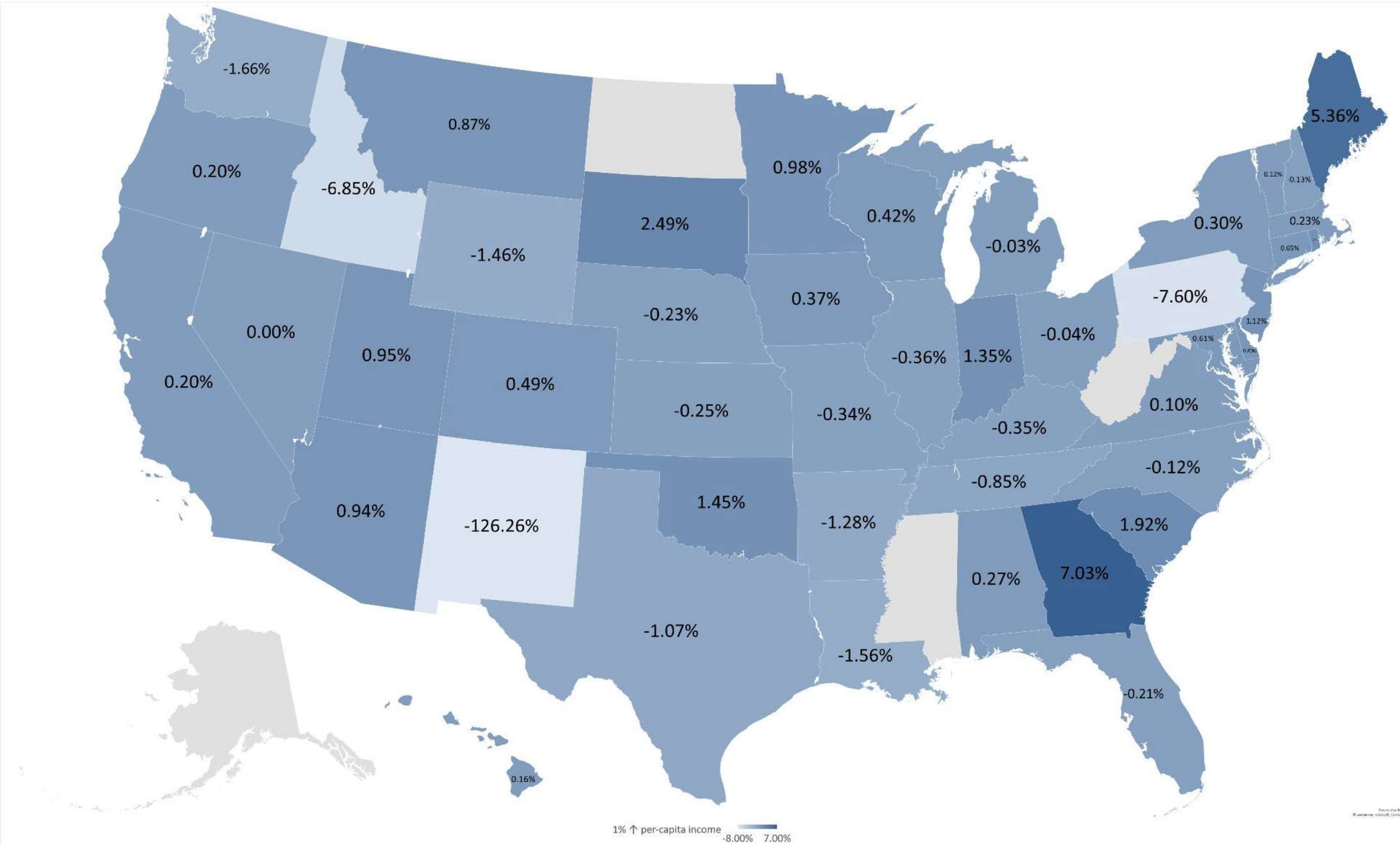
The Southeast and Southwest regions, which have a mix of positive and negative coefficients, would benefit from a more tailored approach based on the specific needs and challenges of each state. Policymakers could focus on identifying and addressing the factors that contribute to the negative impact of interest rate hikes on female STEM entrepreneurship in states like South Carolina, Tennessee, and Oklahoma, while also supporting and promoting the conditions that lead to a positive relationship in states like Georgia, and Louisiana.

Finally, in the West region, where there is a mix of positive and negative coefficients, policymakers could focus on addressing the challenges faced by women-owned STEM businesses in states with larger negative coefficients, such as Idaho, Colorado, and Washington. This could involve implementing targeted policies to improve access to affordable financing, provide financial education and support, and mitigate the negative impact of interest rate hikes on female STEM entrepreneurship in these states.

5-1-6 State female STEM entrepreneurship and State Real Per-capita Income

The figure on the next page depicts the relationship between female STEM entrepreneurs in a state and state real per-capita income.

Figure 5-6: Percentage Change in State Female STEM Entrepreneurs with One Percent Change in State Real Per-capita Income



Note: For percent changes very close to zero, such as -0.001 and .001, the map shows 0.00%, due to rounding.

The relationship between per-capita income and the number of female STEM entrepreneurs in the United States varies significantly across different regions, with each region exhibiting unique patterns and potential explanations for the observed coefficients.

At the national level, the coefficient for per-capita income is -2.96%, indicating that a one percent increase in national per-capita income is associated with a 2.96% decrease in the number of female STEM entrepreneurs. This suggests that, on average, higher per-capita income may not necessarily translate into increased female STEM entrepreneurship, and there may be other factors influencing women's decisions to pursue entrepreneurship in STEM fields.

However, the regional differences reveal a more nuanced picture. In the Northeast region, most states have positive coefficients, with Maine (5.36%) and Rhode Island (1.42%) having the largest increases. The Maine results could be skewed due to lack of data. This suggests that female STEM entrepreneurs in the Northeast may benefit from rising per-capita income, possibly due to factors such as increased investment in STEM industries, better care options, or state-specific policies that encourage entrepreneurship during times of economic growth. However, Pennsylvania (-7.60%) has a negative coefficient larger than the national one, and the District of Columbia (-1.01%) has a negative coefficient smaller than the national level. This indicates that higher per-capita income may not necessarily lead to increased female STEM entrepreneurship in these places.

The Southeast region presents a mix of positive and negative coefficients, with Georgia (7.03%) and South Carolina (1.92%) having large increases, while most other states have moderate decreases. The positive coefficients in Georgia and South Carolina suggest that female STEM entrepreneurs in these states may benefit significantly from rising per-capita income, possibly due to state-specific economic conditions, policies, or support systems that encourage entrepreneurship. However, states like Louisiana (-1.56%), Tennessee (-0.85%), and Florida (-0.21%) have negative coefficients, indicating that higher per-capita income may not necessarily translate into increased female STEM entrepreneurship in these states.

The Midwest region also has mostly positive coefficients, with South Dakota (2.49%) and Indiana (1.35%) having the largest increases. The South Dakota results could be distorted due to missing values. This suggests that female STEM entrepreneurs in the Midwest may generally benefit from rising per-capita income, possibly due to factors such as increased investment in STEM industries, more disposable income for potential entrepreneurs, or state-specific policies that support and encourage entrepreneurship. However, some states like Illinois (-0.36%) and Missouri (-0.34%) have negative coefficients, indicating that higher per-capita income may not necessarily lead to increased female STEM entrepreneurship in these states.

The Southwest region is characterized by a notable outlier, New Mexico, which has an extremely large negative coefficient of -126.26%. The New Mexico coefficient could be an outlier because of missing values. The other states in the region, like Oklahoma (1.45%), Utah (0.95%), and Arizona (0.94%), have moderate positive coefficients, indicating that female STEM entrepreneurs in these states may benefit from rising per-capita income.

Finally, the West region presents a mix of positive and negative coefficients. States like Montana (0.87%), Colorado (0.49%), and California (0.20%) have positive coefficients, suggesting that female STEM entrepreneurs in these states may benefit from rising per-capita income. However, Idaho (-6.85%) has a larger negative coefficient than the national coefficient, and Washington (-1.66%) has a negative coefficient smaller than the national one. This indicates that higher per-capita income may not necessarily translate into increased female STEM entrepreneurship in these states, and there may be other factors hindering the growth of women-owned STEM businesses.

5-1-6-A Policy Implications of State Real Per-capita Income Results

Based on the analysis of the relationship between per-capita income and the number of female STEM entrepreneurs across different states and regions in the United States, several potential policy implications emerge to address the challenges and promote greater female participation in STEM entrepreneurship.

In the Northeast and Midwest regions, where most states have positive coefficients, policymakers could focus on fostering economic growth and creating a supportive environment for entrepreneurship. The federal government can invest in infrastructure projects in states like Maine, Rhode Island, and New Jersey to stimulate demand and economic growth. Additionally, the federal government can provide funding for K-12 education and healthcare in these states to increase human capital. Congress could also legislate programs like the American Rescue Plan's childcare stabilization grants to help state workers remain in jobs and earn incomes, thereby supporting female STEM entrepreneurs.

In the South and West regions, where there is a mix of positive and negative coefficients, policymakers could adopt a tailored approach based on the specific needs and challenges of each state. For states with large positive coefficients, such as Georgia, and others with positive coefficients such as South Carolina, Montana, Colorado and California the federal government could provide funding and support to further enhance the economic conditions and entrepreneurial ecosystems that are conducive to female STEM entrepreneurship. In states with negative coefficients, like Louisiana and Arkansas, the federal government could help the state governments conduct studies to identify the specific economic, social, and cultural factors that may influence women's decisions to pursue STEM entrepreneurship. Based on the findings, the federal government could provide grants to these state governments to develop targeted policies and programs to support women STEM entrepreneurs, such as providing access to affordable childcare, mentorship, networking opportunities, and financial assistance.

In the Southwest region, policymakers could draw insights from the states with positive coefficients, such as Oklahoma, Utah, and Arizona, to develop policies and programs that support female STEM entrepreneurship. This could involve providing tax incentives, grants, and other financial support to startups, as well as investing in education and training programs to build human capital.

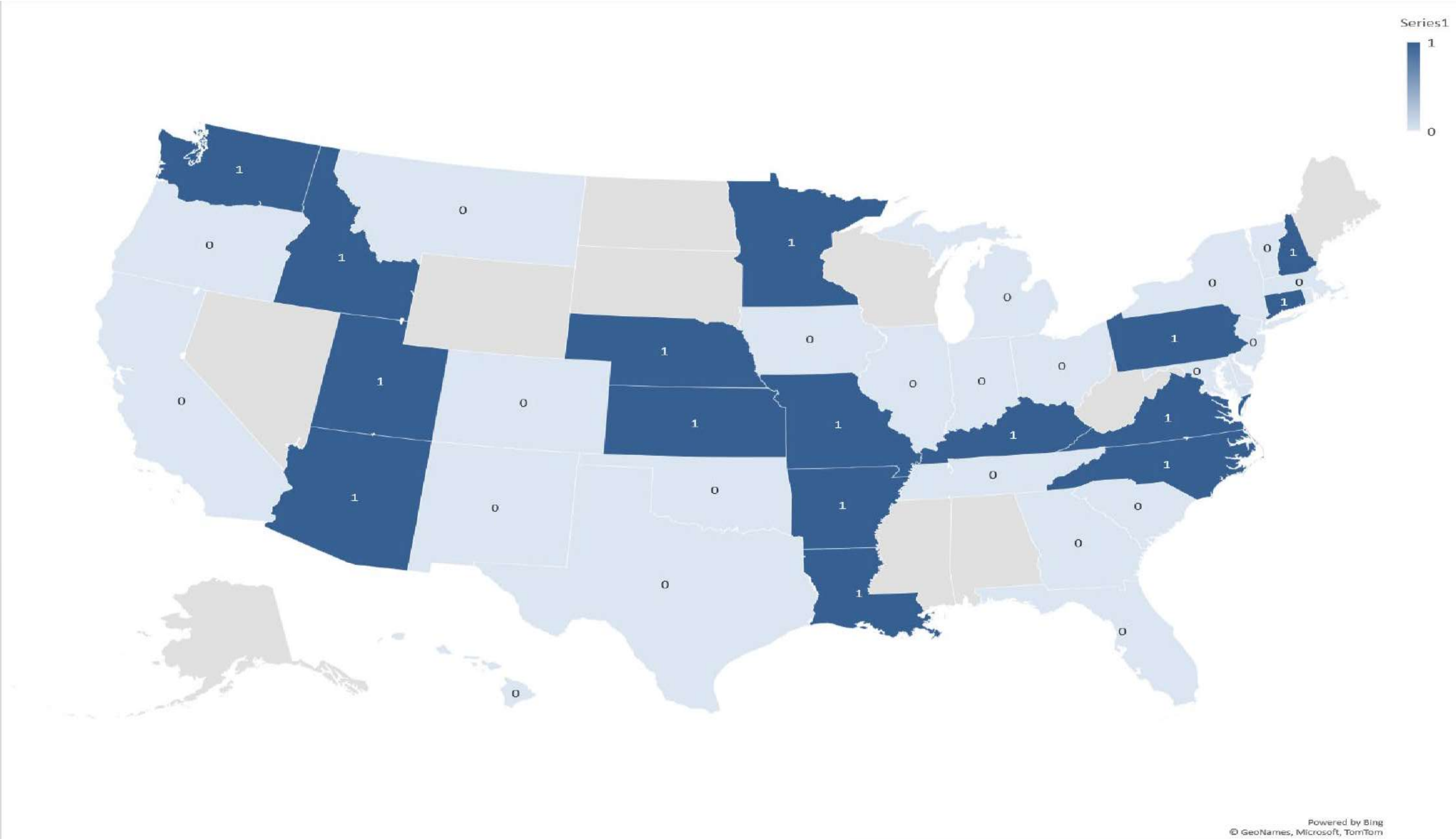
5-1-7 State Female STEM Entrepreneurship During COVID

The Figure 5-7 below shows the positive and negative changes in the number of female STEM entrepreneurs in different states.

There are some states that had missing values for employer and nonemployer female STEM numbers for certain sectors for some years. These states include Alabama, Alaska, Hawaii, Maine, Mississippi, Nevada, New Mexico, North Dakota, South Dakota, West Virginia, and Wyoming.

The missing values in these data are such that the COVID-19 dummy variable coefficient interpretations should be treated with caution. This is because in the case of missing dependent values in earlier years the COVID-19 dummy coefficient could show large positive percentage changes in the pandemic year, or in the case where there are missing dependent values in the pandemic year it could show large negative percentage changes due to the pandemic. We believe that the direction rather than the magnitude of the COVID results is more reliable.

Figure 5-7: Change in Female STEM Entrepreneurs During COVID



Note: 1 represents the states with positive changes and 0 represents the states with negative changes in female STEM entrepreneurship.

The impact of the COVID-19 pandemic on female STEM entrepreneurship in the United States has been varied, with the national trend showing an overall increase in the number of women starting STEM businesses. However, the regional differences reveal a more nuanced picture, with states and regions exhibiting distinct patterns and potential explanations for the observed trends.

At the national level, the increase in female STEM entrepreneurship during the pandemic could be attributed to various factors. Women may have been motivated to start their own businesses due to job losses or career disruptions caused by the pandemic. Additionally, the shift towards remote work and the accelerated adoption of digital technologies may have created new opportunities for women to launch STEM ventures. The pandemic also brought about increased funds from the federal government to support female-led businesses, which could have assisted many women launching STEM businesses.

However, the regional differences suggest that state-specific factors play a crucial role in shaping the impact of the pandemic on female STEM entrepreneurship. In the Northeast region, most states oppose the national trend, with only Connecticut showing an increase. This could be due to the region's heavy reliance on industries that were affected by the pandemic. The economic downturn and the challenges posed by the pandemic may have created a more difficult environment for women to start STEM businesses in these states. Additionally, the region's high cost of living and the concentration of established STEM companies may have made it more challenging for new female-led ventures to emerge.

The Southeast region presents a mixed picture, with some states like North Carolina, Virginia, Arkansas, Kentucky, and Louisiana following the national trend, while others like Florida, Georgia, South Carolina, and Tennessee oppose it. The states following the trend may have benefited from supportive policies, programs, or initiatives that encouraged female STEM entrepreneurship during the pandemic. For example, they may have provided targeted funding, mentorship, or resources to help women start and grow STEM businesses. On the other hand, the states opposing the trend may have faced greater economic challenges or had less supportive ecosystems for female entrepreneurs.

In the Midwest region, there is also a mix of states following and opposing the national trend. States like Kansas, Minnesota, Missouri, and Nebraska, which show increases in female STEM entrepreneurship, may have had more resilient economies or stronger support systems for women entrepreneurs during the pandemic. They may have also benefited from the growth of certain STEM sectors, such as, healthcare, or technology, which remained relatively stable or even thrived during the pandemic. Conversely, states like Illinois, Indiana, Iowa, Michigan, Ohio, and Wisconsin, which have decreases, may have been more heavily impacted by the economic downturn or had less favorable conditions for female STEM entrepreneurship.

The Southwest region exhibits a notable contrast, with Arizona and Utah following the national trend, while Texas, Oklahoma, and New Mexico oppose it. The success of Arizona and Utah in promoting female STEM entrepreneurship during the pandemic could be attributed to factors such as a supportive business environment, strong STEM ecosystems, or targeted initiatives to help women entrepreneurs navigate the challenges posed by the pandemic. In contrast, the states opposing the trend may have faced greater economic disruptions or had less effective support systems in place for female entrepreneurs.

Finally, the West region has a few states, like Idaho and Washington, following the national trend, while most states, including California, Colorado, Hawaii, Montana, and Oregon, oppose it. The states following the trend may have benefited from the growth of certain STEM industries, such as technology or e-commerce, which experienced increased demand during the pandemic. They may have also had more supportive policies or programs in place to help women entrepreneurs adapt to the changing business landscape. On the other hand, the states opposing the trend may have been more heavily impacted by the economic fallout of the pandemic or had less favorable conditions for female STEM entrepreneurship.

5-1-7-A Policy Implications of COVID-19 Results

Based on the analysis of the impact of the COVID-19 pandemic on female STEM entrepreneurship across different states and regions in the United States, several potential policy implications emerge to support and foster the resilience and adaptability of women entrepreneurs in the face of adversity.

In states where there is a positive impact of the COVID-19 pandemic on women STEM entrepreneurship, such as Arizona, Utah, North Carolina, and Virginia, policymakers could focus on identifying and supporting the specific strategies and approaches that women entrepreneurs employed to adapt and succeed during the pandemic. The federal government could support these state governments in conducting studies to examine how women STEM entrepreneurs pivoted to online business models, leveraged digital technologies, or tapped into new markets and opportunities. Based on the findings, the federal government could provide funding to these states to develop programs and initiatives that encourage the continued innovation and adaptability of women STEM entrepreneurs, such as providing access to digital skills training, e-commerce platforms, and online networking opportunities.

On the other hand, in states where there is a negative impact of COVID-19 on women STEM entrepreneurship, such as Texas, Oklahoma, New Mexico, California, and Florida, it is crucial to provide ongoing support and resources to help women-owned businesses navigate economic uncertainties. The federal government could help these state governments establish dedicated funds to provide emergency financial assistance and technical support to women STEM entrepreneurs affected by the pandemic or other economic shocks. Additionally, the SBA could collaborate with local organizations, chambers of commerce, and its own resource networks to develop targeted resources and guidance for women STEM entrepreneurs on business continuity planning, digital transformation, and accessing federal and state aid and assistance programs.

In the Northeast region, where most states oppose the national trend of increased female STEM entrepreneurship during the pandemic, policymakers could focus on investigating the specific challenges and barriers faced by women entrepreneurs in this region. The federal government could support state governments in conducting studies to identify the factors contributing to the negative impact of COVID-19 on women-owned STEM businesses, such as the region's heavy reliance on industries severely affected by the pandemic or the high cost of living and concentration of established STEM companies. Based on the findings, the federal government could provide funding and guidance to states in the Northeast to develop targeted initiatives and support programs that address the specific needs and challenges of women STEM entrepreneurs in the region.

The Southeast and Midwest regions, which have a mix of states following and opposing the national trend, would benefit from a tailored approach based on the specific needs and challenges of each state. Policymakers could focus on identifying and promoting the factors that contribute to the success of women STEM entrepreneurs in states following the national trend, such as supportive policies, programs, or initiatives. In states opposing the trend, the federal government could work with state governments to identify and address the specific barriers and challenges faced by women entrepreneurs, such as limited access to resources, funding, or mentorship.

In the Southwest and West regions, where there are notable contrasts between states following and opposing the national trend, policymakers could focus on learning from the success stories and best practices of states like Arizona, Utah, Idaho, and Washington. The federal government could support the sharing of knowledge and experiences among states in these regions to help replicate the conditions and strategies that have led to increased female STEM entrepreneurship during the pandemic. For states opposing the trend, the federal government could provide funding and guidance to develop targeted interventions and support programs that address the specific challenges and barriers faced by women entrepreneurs in these states.

We describe the individual state results and policy implications below.

5-2 Alabama Model Results and Policy Implications

The data for Alabama from 2012 to 2020 reveals mixed trends across various economic indicators. Venture capital investment in female-founded or co-founded firms shows significant fluctuations, with total investment ranging from a low of $0 in 2014 and 2017 to a peak of $45.1 million in 2019, before declining to $26.525 million in 2020. This volatility suggests an unpredictable environment for female entrepreneurs seeking venture capital in the state, though recent years show some improvement.

Alabama demonstrates modest growth in women's participation in innovation, as evidenced by the number of women patentees, which increased from 108 in 2012 to 127 in 2019, fluctuations in between with a drop to 103 in 2020, and a peak of 141 in 2013. Employment trends show steady growth until 2019, with total employment rising from 1,905,700 in 2012 to 2,077,500 in 2019, before declining to 1,994,400 in 2020 due to the COVID-19 pandemic. Alabama's economic growth is reflected in its per capita income, which rose from $35,564 in 2012 to $45,887 in 2020, showcasing overall economic improvement despite challenges.

In Alabama, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 1,341 to 1,782 over the years, while nonemployer firms in this sector show significant growth from 13,113 to 16,000. The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms, with employer firms ranging from 908 to 1,157 and nonemployer firms from 8,204 to 10,000. Among manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms, ranging from 105 to 177. For nonemployer firms, Miscellaneous Manufacturing shows the highest numbers among manufacturing sectors, while Computer and Electronic Product Manufacturing and Electrical Equipment Manufacturing have the lowest concentration. There are a few hundred nonemployer firms in the Data Processing, Hosting and Related Services sector, but their numbers are below Miscellaneous Manufacturing in earlier years and equal to in later years.

5-2-1 Alabama Model Interpretations

A 1% increase in the number of women patentees in Alabama produces a 0.06% increase in the number of women STEM entrepreneurs in the state. However, without t-statistics, it's difficult to ascertain whether this relationship is statistically significant. Nevertheless, the positive sign of this coefficient aligns with expectations, suggesting that a higher number of women patentees may contribute to the growth of women's STEM entrepreneurship in Alabama. This could be attributed to potential knowledge spillovers, role modeling effects, or mentorship opportunities provided by women patentees.

A 1% increase in venture capital funding in Alabama produces a 0.061% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient contradicts expectations, as increased venture capital funding would typically be expected to support entrepreneurship. This result might indicate other underlying factors influencing the relationship between venture capital funding and women's STEM entrepreneurship in Alabama, such as the distribution of funding into sectors where female entrepreneurs are already dominant leading to increased competition, or the dilution of female ownership with increased funding of STEM businesses.

The estimated effect of the labor force in Alabama is positive, indicating that a 1% increase in the labor force would produce a 0.59% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, suggesting that a larger labor force could potentially provide a greater pool of talent and resources for entrepreneurship in STEM fields in Alabama. Female STEM entrepreneurs can take advantage of increased networking opportunities and better options for childcare due to the large labor force, per the Saksena et al. (2022) USPTO study.

A 1% increase in the number of women STEM graduates nationally produces a 0.43% increase in the number of women STEM entrepreneurs in Alabama. The positive sign of this coefficient aligns with expectations, indicating that a larger pool of women STEM graduates nationally may contribute positively to women's STEM entrepreneurship in Alabama. Efforts to increase the number of women pursuing STEM education at the national level could potentially benefit the entrepreneurial ecosystem in Alabama.

A one percentage point increase in the national mortgage rate produces a 0.081% decrease in the number of women STEM entrepreneurs in Alabama. The negative sign of this coefficient aligns with expectations, suggesting that higher interest rates may hinder women STEM entrepreneurs' access to financing or divert their resources away from entrepreneurial ventures in Alabama.

A 1% increase in per-capita real income in Alabama produces about a 0.27% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as higher per-capita real income would typically be associated with increased financial status and entrepreneurship.

The lack of statistical significance measures in the regression output limits the interpretability of these results. The missing values in the female STEM entrepreneur numbers for Alabama and potential data limitations may affect the reliability of the coefficients and their associated economic interpretations.

5-2-2 Alabama Policy Implications

Based on the Alabama Level CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-1: Alabama Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Federal agencies could work with Alabama state/local agencies to tie institutional funding to female STEM enrollment and exposure. 2. Congress could authorize Alabama state government to use grant funding to establish a commercialization authority. 3. SBA could train Alabama lenders to target less crowded STEM sectors. 4. The federal government could tie K-12 funding to female STEM learning. 5. The federal government can invest in infrastructure projects in Alabama to stimulate growth.	1. Increase female commercialization exposure. 2. Support female academics innovation. 3. Increase access to funding for women businesses underrepresented in certain STEM sectors. 4. Build a strong labor force pipeline for female STEM businesses. 5. Encourages innovation and risk-taking among women STEM entrepreneurs.

These policy measures, can create a more supportive and inclusive environment for women STEM entrepreneurs in Alabama, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, and support for commercialization can help unlock the full potential of women STEM entrepreneurs in Alabama, driving innovation, economic growth, and social progress for the state now and beyond.

5-3 Alaska Model Results and Policy Implications

The data for Alaska from 2012 to 2020 reveals mixed trends for female entrepreneurs and women in STEM fields. Venture capital investment in female-founded or co-founded firms is extremely low and sporadic, with the highest total investment being only $4.64 million in 2019. The number of women patentees fluctuates without a clear trend, indicating inconsistent patent activity. Employment trends show a concerning pattern, with total employment peaking in 2015 and generally declining thereafter, reaching a low of 302,400 in 2020, likely due to the COVID-19 pandemic and broader economic challenges.

Economic indicators show mixed results, with per capita income increasing from $53,340 in 2012 to $61,898 in 2020, albeit with some fluctuations. Overall, Alaska faces challenges in attracting venture capital for female-led businesses and maintaining employment levels.

In Alaska, the Professional, Scientific, and Technical Services sector consistently has the highest concentration nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 268 to 531 over the years, while the number of nonemployer firms ranges from 3069 to 3274. The Ambulatory Health Care Services sector is the most concentrated for employer firms and the second most concentrated nonemployer firms, with the number of employer firms ranging from 441 to 537 and nonemployer firms ranging from 1110 to 1300.

Several manufacturing sectors, such as Chemical Manufacturing, Fabricated Metal Product Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Miscellaneous Manufacturing, do not have employer data over the years. Similarly, many of these manufacturing sectors also have no data on nonemployer firms for most years.

There is some data available for the number of nonemployer firms in the Miscellaneous Manufacturing sector which ranges from 150 to 177, with the highest value in 2015. The number of nonemployer firms in the Data Processing, Hosting, and Related Services ranges from 22 to 33, with the highest value in 2017.

In summary, the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors have the highest concentration of employer and nonemployer firms in Alaska.

5-3-1 Alaska Model Interpretations

The coefficient for women patentees is -0.038, indicating that a 1% increase in the number of women patentees in Alaska is associated with a 0.038% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is surprising, as a higher number of women patentees is generally expected to lead to more women STEM entrepreneurs. Looking at the raw data, the number of women patents in Alaska has been consistently low, with a maximum of 24 in 2013. The low number of women patentees in the state may not be sufficient to generate a significant positive impact on women's STEM entrepreneurship. Additionally, other factors such as limited access to resources, networks, and commercialization support may hinder the translation of patents into successful entrepreneurial ventures for women in Alaska.

The coefficient for venture capital funding is -0.029, suggesting that a 1% increase in venture capital funding in Alaska is associated with a 0.029% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is unexpected, as increased venture capital funding is generally thought to support entrepreneurial activities. The raw data reveals that venture capital funding in Alaska has been low, with a maximum of $4.64 million in 2019. The lack of substantial venture capital investments in the state may limit the growth opportunities for women STEM entrepreneurs. Additionally, the concentration of venture capital funding in specific sectors or stages of venture development may not align with the needs and preferences of women STEM entrepreneurs in Alaska, leading to a negative association.

The coefficient for the labor force is -0.45, indicating that a 1% increase in Alaska's labor force is associated with a 0.45% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is counterintuitive, as a larger labor force is generally expected to provide a broader pool of skilled workers, and support business growth. The raw data shows that the number of employed in Alaska has been relatively stable, with a maximum of 339,100 in 2015. However, the negative coefficient suggests that the size of the labor force alone may not be a determining factor for women's STEM entrepreneurship in Alaska. Other factors such as the education and skill level of the workforce, and the overall economic conditions in the state may play a more significant role in influencing women's STEM entrepreneurship.

The lack of statistical significance measures in the regression output limits the interpretability of these results. In addition, the missing values in the female STEM entrepreneur numbers for Alaska and potential data limitations leads to fewer coefficients being computed and may affect the reliability of the estimated coefficients and their associated economic interpretations.

5-3-2 Alaska Policy Implications

Based on the Alaska Level CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-2: Alaska Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train Alaska lenders to target less crowded sectors. 3. The federal government could provide funding to Alaska for investment in training programs for a skilled workforce.	1. Facilitates the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Creates a more supportive environment for women STEM entrepreneurs.

These policy measures, can create a more supportive and inclusive environment for women STEM entrepreneurs in Alaska, addressing the unique challenges and opportunities identified in the state-level analysis.

5-4 Arizona Model Results and Policy Implications

Arizona shows a positive trend in venture capital investment for female-founded or co-founded firms, growing from $5.7 million in 2012 to $140.9 million in 2020, despite significant fluctuations. Women's participation in innovation is also on the rise, with the number of women patentees increasing from 481 to 818 over the period.

Employment trends in Arizona are generally positive, with total employment growing steadily until 2019, before a slight decline in 2020 due to the COVID-19 pandemic. Economic indicators are also positive, with per capita income increasing from $36,333 to $52,133 over the nine-year period. These trends, combined with the growth in female entrepreneurship and innovation, suggest a favorable environment for women in STEM fields in Arizona, despite some volatility in venture capital funding and the challenges posed by the pandemic in 2020.

In Arizona, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 3,157 to 4,628 over the years. The number of nonemployer firms in this sector is even higher, ranging from 24,678 to 31,500, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Arizona. The number of employer firms in this sector ranges from 2,043 to 3,535, while the number of nonemployer firms ranges from 11,380 to 16,000. This highlights the significance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Several manufacturing sectors don't have data available, or data only for a few years. These include Fabricated Metal Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing. Other manufacturing sectors, such as Chemical Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing, and Miscellaneous Manufacturing, have relatively low numbers of employer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors.

Similarly, the manufacturing sectors also have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, the number of nonemployer firms in the manufacturing sectors is generally higher than the number of employer firms, suggesting the presence of self-employed individuals and small businesses in these fields. Miscellaneous Manufacturing has the highest number of nonemployer firms in the manufacturing sectors. Data Processing, Hosting, and Related Services also has higher nonemployer firm numbers than other manufacturing sectors, but they are lower than Miscellaneous Manufacturing.

5-4-1 Arizona Model Interpretations

A 1% increase in the number of women patentees produces a 0.065% decrease in the number of women entrepreneurs in Arizona. The sign of this coefficient does not conform to expectation. It is possible that female patentees in Arizona gravitate towards sectors that are already concentrated leading to increased competition and failure of firms.

A 1% increase in venture capital funding produces a 0.018% increase in the number of women entrepreneurs in Arizona. Venture capital funds devoted to promotion of women entrepreneurs in the state do have the expected effect.

The estimated effect of the labor force is positive. The estimate indicates a 1% increase in the labor force would produce a 3.675% increase in the number of women entrepreneurs in Arizona.

The increase in the interest rates has a negative relation, a one percentage point rise in interest rates is projected to cause a 0.009% decrease in the number of women STEM entrepreneurs in Arizona. This result is not surprising, as higher interest rates typically increase funding/financing difficulties for entrepreneurs.

The coefficient for women STEM graduates indicates that a 1% increase leads to a 1.455% decrease in the number of women STEM entrepreneurs in Arizona. This negative relationship is the same as the national level results. It is possible that these graduates are in overcrowded sectors leading to increased competition and firm failures.

The per-capita real income variable shows that a 1% increase in per-capita real income is projected to cause about a 0.941% increase in the number of women STEM entrepreneurs in Arizona, all else held constant. This positive relationship is not surprising, as higher per-capita income typically reflects greater demand and opportunity for entrepreneurs. It could also reflect a greater supply as the financial status of women improves with incomes, allowing them the flexibility to start more businesses.

Finally, the COVID-19 dummy is positive. The coefficient suggests an increase in the number of women STEM entrepreneurs during the pandemic, probably because of the health care concentration of these firms and the finding of new opportunities.

5-4-2 Arizona Policy Implications

Based on the Arizona CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-3: Arizona Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Arizona. 3. The federal government could tie K-12 funding in Arizona to female STEM learning in diverse STEM sectors. 4. Federal grant funding for Arizona institutions could be tied to promoting female faculty. 5. The federal government could invest in infrastructure projects in Arizona to foster economic growth. 6. The federal government could provide funding to the state to invest in the continued innovation and adaptability demonstrated by women STEM entrepreneurs during emergencies.	1. Facilitates the growth of women-owned STEM businesses. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Provides female STEM entrepreneurs with access to a skilled workforce, and builds a pipeline of diverse STEM workers. 4. Facilitates the transition from academia to entrepreneurship. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Supports the continued growth and success of women-owned STEM businesses.

By implementing these policy measures, Arizona can foster a more supportive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis.

5-5 Arkansas Model Results and Policy Implications

The data for Arkansas from 2012 to 2020 reveals several interesting trends across various economic and financial indicators. Venture capital investment in female-founded or co-founded firms shows inconsistent patterns, with significant fluctuations year to year. The highest investment was recorded in 2016 at $11.06 million, but other years saw much lower figures. This volatility suggests an unpredictable environment for female entrepreneurs seeking venture capital in the state.

The number of women patentees in Arkansas shows a general upward trend, increasing from 60 in 2012 to 106 in 2020, with a notable jump occurring in 2018. This increase indicates growing participation of women in innovation and intellectual property creation in the state. Employment trends in Arkansas show modest but steady growth, with total employment rising from 1,177,200 in 2012 to 1,282,300 in 2019, before declining slightly to 1,247,400 in 2020, likely due to the impact of the COVID-19 pandemic. Economic indicators also show improvement, with per capita income growing from $36,287 in 2012 to $47,147 in 2020, reflecting overall economic growth in Arkansas during this period.

In Arkansas, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 796 to 1,242 over the years. The number of nonemployer firms in this sector is even higher, ranging from 7,315 to 8,800, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Arkansas. The number of employer firms in this sector ranges from 744 to 1,653, while the number of nonemployer firms ranges from 5,685 to 8,300. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has a high concentration of employer firms in Arkansas, with numbers ranging from 19 to 32 over the years. Miscellaneous Manufacturing also has a relatively consistent presence of employer firms, with numbers ranging from 32 to 49, except for recent years where data is not available. Chemical Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing, have no data or little data for most of the years analyzed. Furthermore, the manufacturing sectors also have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, Chemical Manufacturing and Miscellaneous Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these fields. The Data Processing, Hosting, and Related Services sector in Arkansas has nonemployer firm numbers higher than those of all manufacturing sectors.

5-5-1 Arkansas Model Interpretations

A 1% increase in the number of women patentees in Arkansas produces a 0.119% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient conforms to expectations. The data shows that the number of women patents has been consistently above 50 since 2012, with a maximum of 106 in 2020.

A 1% increase in female venture capital funding in Arkansas produces a 0.007% decrease in the number of women STEM entrepreneurs in the state. It could be that most venture capital funding, even though it is a small amount, goes to female STEM businesses and more specifically STEM businesses in the sectors where female firms are concentrated, leading to increased competition, which could lead to a decline in female-owned STEM businesses, or there is dilution of ownership.

The estimated effect of the labor force in Arkansas is positive. The estimate indicates a 1% increase in the labor force would produce a 1.698% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, suggesting that a larger labor force could potentially provide a greater pool of talent and resources for entrepreneurship in STEM fields in Arkansas. Female STEM entrepreneurs can take advantage of increased networking opportunities and better options for childcare due to the large labor force, per the Saksena et al. (2022) USPTO study.

A 1% increase in the number of women STEM graduates nationally produces a 0.337% increase in the number of women STEM entrepreneurs in Arkansas. The positive relationship conforms to expectations.

A one percentage point increase in the national mortgage rate produces a 0.007% increase in the number of women STEM entrepreneurs in Arkansas. The positive sign of this coefficient is surprising, as higher interest rates typically increase funding/financing difficulties for entrepreneurs. This may be explained by the prevalence of nonemployer firms in the state. Women STEM entrepreneurs operating nonemployer firms may be less sensitive to changes in interest rates due to lower capital requirements and less reliance on external financing. In addition, higher interest rates could lead to a positive wealth effect, allowing more women to open STEM businesses.

A 1% increase in per-capita real income in Arkansas produces a 1.275% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as higher per-capita income typically reflects greater demand and opportunity for entrepreneurs. The data shows that per-capita income has been increasing over the years, which should theoretically support entrepreneurship. However, the supply of these entrepreneurs might go down, because women may find that an improved financial status gives them the flexibility to leave entrepreneurship and raise families.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Arkansas. During the pandemic years, women did not receive funds during the first round of funding but did better during the second round of funding. In addition, women might have benefited from direct cash payments to families. This could have helped them start new businesses including in the STEM fields. Also, the positive results for the number of female STEM entrepreneurs during the COVID years could be related to the focus of the women STEM entrepreneurs in certain sectors – the pandemic could have increased the demand for health care services for instance.

5-5-2 Arkansas Policy Implications

Based on the Arkansas CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-4: Arkansas Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Arkansas state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train Arkansas female lenders to invest in diverse STEM sectors. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to female STEM learning in diverse STEM sectors. 4. Congress could work with the state to tie institutional funding to internships, mentorship, and networking opportunities for female STEM graduates. 5. The federal government could provide grants to the state to provide child care and other care options to female STEM entrepreneurs. 6. The federal government could provide funding to the state to invest in the continued adaptability of women STEM entrepreneurs during emergencies.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs. 6. Supports the continued growth and success of women-owned STEM businesses.

The implementation of these policy measures, can create a more supportive and inclusive environment for women STEM entrepreneurs in Arkansas, addressing the unique challenges and opportunities identified in the state-level analysis.

5-6 California Model Results and Policy Implications

The data for California from 2012 to 2020 reveals significant growth across various economic indicators. Venture capital investment in female-founded or co-founded firms shows a strong upward trend, with total investment increasing dramatically from $2.39 billion in 2012 to $11.87 billion in 2020. This substantial growth indicates a robust and increasingly supportive environment for female entrepreneurs in the state, particularly in tech and innovation-driven sectors.

California also demonstrates impressive growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 10,568 in 2012 to 18,074 in 2020, representing a 71% increase over the period. Employment trends in California show steady growth until 2019, with total employment rising from 14,761,800 in 2012 to 17,429,900 in 2019, before declining to 16,187,000 in 2020 due to the impact of the COVID-19 pandemic. California's economic growth is further reflected in its per capita income, which rose significantly from $47,794 in 2012 to $70,061 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period.

In California, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 21,863 to 30,781 over the years. The number of nonemployer firms in this sector is even more substantial, ranging from 213,180 to 248,000, indicating a thriving ecosystem of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in California. The number of employer firms in this sector ranges from 17,317 to 21,512, while the number of nonemployer firms ranges from 82,201 to 97,000. This highlights the significant presence of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms in California, with numbers ranging from 759 to 1,053 over the years. This sector also has a relatively high number of nonemployer firms, indicating the presence of small-scale and self-employed fabricated metal product manufacturers in the state. Miscellaneous Manufacturing also has a high concentration nonemployer firms. Outside of manufacturing, the Data Processing, Hosting, and Related Services sector has a high number of nonemployer firms, though their numbers are less than Miscellaneous Manufacturing.

On the other hand, several manufacturing sectors have the least concentration of employer firms in California. For example, the Electrical Equipment, Appliance, and Component Manufacturing, has relatively low numbers ranging from 114 to 130.

The Transportation Equipment Manufacturing sector has a low concentration of nonemployer firms compared to other sectors, with numbers ranging from 150 to 203. This suggests that self-employment and small-scale operations are less prevalent in this sector compared to others.

5-6-1 California Model Interpretations

A 1% increase in the number of women patentees in California produces a 0.034% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not conform to expectations, as a higher number of women patentees should lead to more women STEM entrepreneurs. The data shows that the number of women patents has been consistently high in California, with a maximum of 1,316 in 2018. It is possible that the increase in women patentees occurs in sectors that are already concentrated, leading to increased competition and firm failures, or that the patentees face challenges converting their patents to entrepreneurial ventures.

A 1% increase in venture capital funding in California produces a 0.007% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient conforms to expectations, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in California has been consistently high, and that supports entrepreneurship.

The estimated effect of the labor force in California is negative. The estimate indicates a 1% increase in the labor force would produce a 0.182% decrease in the number of women STEM entrepreneurs in the state. The data shows that the number of employed individuals in California has been consistently high. The state's large labor force may provide a conducive environment for women STEM entrepreneurs by supporting their networking and childcare needs. However, increases in the labor force could be in lead to competition amongst firms to recruit these workers, leading to firm failures.

A 1% increase in the number of women STEM graduates nationally produces about a 0.343% increase in the number of women STEM entrepreneurs in California. The positive sign of this coefficient conforms to expectations, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs.

A one percentage point increase in the national interest rate produces about a 0.034% increase in the number of women STEM entrepreneurs in California. The positive sign of this coefficient is surprising, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. However, the data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. This overall favorable financing environment may have supported women STEM entrepreneurship in California. This may also be explained by the prevalence of nonemployer firms in the state. Women STEM entrepreneurs operating nonemployer firms may be less sensitive to changes in interest rates due to lower capital requirements and less reliance on external financing. Female STEM entrepreneurs may also benefit from the wealth effect.

A 1% increase in per-capita real income in California produces a 0.199% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient conforms to expectations, as higher per-capita income should reflect greater demand and opportunity for entrepreneurs. The data shows that per-capita income in California has been consistently high, with a maximum of $70,061 in 2020. The state's strong economic conditions and high per-capita income may provide a supportive environment for women STEM entrepreneurs.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in California. The negative sign of this coefficient conforms to expectations, as the pandemic is expected to have negative impacts on entrepreneurship. The data shows that the number of employer women STEM entrepreneurs in certain sectors in California increased in 2020 despite the pandemic. This may indicate that some women STEM entrepreneurs in the state were able to adapt to the changing economic conditions or that supportive policies and programs helped mitigate the negative impacts of the pandemic.

5-6-2 California Policy Implications

Based on the California CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-5: California Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization. 2. SBA could train new female investors on diverse female STEM business investment. 3. The federal government could provide funding for training programs for a skilled workforce. 4. Congress could work with the state to tie institutional funding to internships, mentorship, and networking opportunities for female STEM graduates. 5. The federal government could invest in infrastructure projects in to foster economic growth. 6. The federal government could help establish a dedicated fund for emergency assistance.	1. Facilitates the growth of women-owned STEM businesses. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Strengthens the pipeline of skilled workers for potential women STEM entrepreneurs. 4. Leads to attraction and retention of female STEM graduates. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in California, leveraging the state's strengths in innovation and entrepreneurship while addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, and support for commercialization and economic growth can help unlock the full potential of women STEM entrepreneurs in California, driving economic growth and social progress for the state and beyond.

5-7 Colorado Model Results and Policy Implications

The data for Colorado from 2012 to 2020 shows notable growth across various economic and financial indicators. Venture capital investment in female-founded or co-founded firms demonstrates a general upward trend, albeit with significant fluctuations. The total investment increased from $69.75 million in 2012 to $417.6 million in 2020, with a peak of $678.907 million in 2019. This overall growth suggests an improving environment for female entrepreneurs in Colorado, particularly in recent years, despite year-to-year volatility.

Colorado also shows steady progress in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 671 in 2012 to 922 in 2020, representing a 37% increase over the period. Employment trends in Colorado demonstrate consistent growth until 2019, with total employment rising from 2,311,700 in 2012 to 2,790,100 in 2019, before declining to 2,652,700 in 2020 due to the impact of the COVID-19 pandemic. Colorado's economic growth is further reflected in its per capita income, which rose significantly from $45,490 in 2012 to $64,852 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period.

In Colorado, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 5,439 to 7,172 over the years. The number of nonemployer firms in this sector is even higher, ranging from 33,618 to 42,000, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Colorado. The number of employer firms in this sector ranges from 2,938 to 4,038, while the number of nonemployer firms ranges from 13,215 to 17,000. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Miscellaneous Manufacturing has the highest concentration of employer firms in Colorado, with numbers ranging from 83 to 116 over the years. Chemical Manufacturing and Fabricated Metal Product Manufacturing also have a relatively consistent presence of employer firms, although in lower numbers compared to Miscellaneous Manufacturing.

The manufacturing sectors have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, Miscellaneous Manufacturing and Chemical Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these fields. The Data Processing, Hosting, and Related Services sector is also well represented in nonemployer firms.

5-7-1 Colorado Model Interpretations

A 1% increase in the number of women patentees in Colorado produces a 0.403% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient conforms to expectations, as a higher number of women patentees should lead to more women STEM entrepreneurs.

A 1% increase in venture capital funding in Colorado produces a 0.022% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient conforms to expectations, as increased venture capital funding should support women STEM entrepreneurship. The data shows that venture capital funding for female-founded firms in Colorado has been growing over the years. This growth in venture capital funding may contribute to a supportive environment for women STEM entrepreneurs in the state.

The labor force estimate indicates a 1% increase in the labor force would produce a 0.586% increase in the number of women STEM entrepreneurs in the state. This coefficient may be due to the growth and diversity of Colorado's labor force. The data shows that the number of employed individuals in Colorado has been consistently increasing. The state's growing labor force may provide a supportive environment for women STEM entrepreneurs, both in terms of access to childcare and a skilled workforce contributing to the positive relationship.

A 1% increase in the number of women STEM graduates nationally produces about a 0.371% decrease in the number of women STEM entrepreneurs in Colorado. The negative sign of this coefficient is surprising, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs. However, the data does not provide information on the number of women STEM graduates specific to Colorado. The negative relationship may indicate that the national trend does not accurately reflect the dynamics of women STEM entrepreneurship in the state, or that other factors such as job market conditions or industry-specific barriers may be influencing this relationship. It is quite possible that the increase in supply leads to increased competition in concentrated sectors, in which both incumbents and entrants fail, especially if the entrants specialize in fields where the incumbents already are in place in Colorado. It may be the case that there are implicit socially binding constraints to push women into specific sectors, and thus generate cutthroat competition.

A one percentage point increase in the interest rate produces about a 0.103% decrease in the number of women STEM entrepreneurs in Colorado. The negative sign of this coefficient conforms to expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The relationship suggests that lower interest rates may be more favorable for women STEM entrepreneurship in Colorado.

A 1% increase in per-capita real income in Colorado produces a 0.492% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as higher per-capita income is expected to reflect greater demand and opportunity for entrepreneurs. The data shows that per-capita income in Colorado has been consistently increasing, with a maximum of $64,852 in 2020.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Colorado. The negative sign of this coefficient aligns with expectations, as the pandemic is expected to have negative impacts on entrepreneurship. However, the data shows that the number of employer firms in the Professional, Scientific, and Technical Services sector, increased from 6,643 in 2019 to 7,172 in 2020. This may indicate that some women STEM entrepreneurs in Colorado were able to adapt to the changing economic conditions during the pandemic or that supportive policies and programs helped mitigate the negative impacts.

5-7-2 Colorado Policy Implications

Based on the CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-6: Colorado Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Federal agencies could work with Colorado state/local agencies to tie institutional funding to female STEM enrollment and exposure. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Colorado. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Federal grant funding could be tied to promotion of female faculty. 5. The federal government could invest in infrastructure projects in Colorado to foster economic growth. 6. The federal government could help the state establish a dedicated fund to provide assistance to women STEM entrepreneurs during emergencies.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Facilitates the transition from academia to entrepreneurship. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

These policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs, leveraging the state's strengths in innovation and entrepreneurship while addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses education, workforce development, access to funding, and support for commercialization can help unlock the full potential of women STEM entrepreneurs in Colorado, driving economic growth and social progress for the state.

5-8 Connecticut Model Results and Policy Implications

The data for Connecticut from 2012 to 2020 reveals interesting trends across various economic indicators. Venture capital investment in female-founded or co-founded firms shows significant fluctuations year to year, with no clear consistent upward trend. The total investment ranged from a low of $19.815 million in 2013 to a high of $190.78 million in both 2019 and 2020. This volatility suggests an unpredictable environment for female entrepreneurs seeking venture capital in the state, although the higher figures in recent years could indicate an improving situation.

Connecticut demonstrates steady growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 558 in 2012 to 786 in 2020, representing a 41% increase over the period. Employment trends in Connecticut show modest growth until 2018, with total employment rising from 1,648,200 in 2012 to 1,699,500 in 2018, before declining to 1,570,700 in 2020, likely due to the impact of the COVID-19 pandemic. Connecticut's economic growth is reflected in its per capita income, which rose from $63,555 in 2012 to $77,383 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In Connecticut, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 1,361 to 1,584 over the years. The number of nonemployer firms in this sector is even higher, ranging from 18,215 to 20,000, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Connecticut. The number of employer firms in this sector ranges from 1,012 to 1,468, while the number of nonemployer firms ranges from 9,050 to 10,500. This highlights the significance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Miscellaneous Manufacturing has the highest concentration of employer firms in Connecticut, with numbers ranging from 38 to 56 over the years. Machinery Manufacturing also has a relatively consistent presence of employer firms, with numbers ranging from 17 to 50.

Several manufacturing sectors do not have data or little data. These include Fabricated Metal Product Manufacturing, and Electrical Equipment, Appliance, and Component Manufacturing and Transportation Equipment Manufacturing.

The manufacturing sectors also have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, Miscellaneous Manufacturing and Chemical Manufacturing have the higher number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these sectors. There is also a visible presence of nonemployer firms in the Data Processing, Hosting, and Related Services sector.

5-8-1 Connecticut Model Interpretations

A 1% increase in the number of women patentees in Connecticut produces a 0.124% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Connecticut has been steadily increasing over the years, with a maximum of 786 in 2020.

A 1% increase in venture capital funding in Connecticut produces a 0.013% decrease in the number of women STEM entrepreneurs in the state. It could be that most venture capital funding even though it is a small amount goes to STEM businesses in the sectors where female firms are concentrated, leading to increased competition amongst female STEM entrepreneurs, or that increased funding leads to dilution of ownership.

The estimated effect of the labor force in Connecticut is positive. The estimate indicates a 1% increase in the labor force would produce a 1.288% increase in the number of women STEM entrepreneurs in the state. This coefficient may be due to the size and composition of Connecticut's labor force. The data shows that the number of employed individuals in Connecticut has remained relatively stable over the years, with a slight decline in 2020 likely due to the COVID-19 pandemic. The positive sign suggests that the presence of a skilled and diverse labor force may be conducive to women STEM entrepreneurship in the state. A large labor force could also provide more childcare options for female STEM entrepreneurs.

A 1% increase in the number of women STEM graduates nationally produces a 0.062% increase in the number of women STEM entrepreneurs in Connecticut.

A one percentage point increase in the national interest rate has no impact on the number of women STEM entrepreneurs in Connecticut as the coefficient is 0. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Connecticut produces a 0.648% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as higher per-capita income is expected to reflect greater demand and opportunity for entrepreneurs. The data shows that per-capita income in Connecticut has been consistently high compared to other states, with a maximum of $77,383 in 2020.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Connecticut. The positive sign of this coefficient is surprising, as the pandemic is expected to have negative impacts on entrepreneurship. However, as mentioned above, the Ambulatory Health Care Services sector is the second most concentrated sector for both employer and nonemployer firms in Connecticut. This shows the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state. These services could have seen growth during the pandemic.

Overall, healthcare spending nationally, dropped between 2019 and 2020. But different models of medical care, increased charges and other aspects of medical care could have increased the demand for the health care sector where women STEM entrepreneurs in Connecticut are concentrated. Grace Hill (2023) discusses these changes in healthcare spending. "The use of telemedicine replaced some in-person visits, mitigating the drop in spending from the pandemic. Furthermore, COVID-related surcharges during urgent visits that could not be delayed or handled remotely, such as emergency dental work, may have further stemmed the drop in 2020 medical services spending. Businesses applied these surcharges due to personal risk to their healthcare providers and the need for additional cleaning supplies, no-contact thermometers, and personal protection equipment."

Singhal and Patel (2022) in a McKinsey report further detail these changes in demand. "The COVID-19 pandemic has accelerated the movement of care from high-cost acute and post-acute sites to lower-cost freestanding and non-acute sites, including increased demand for home-based services and virtual care."

5-8-2 Connecticut Policy Implications

Based on the Connecticut CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-7: Connecticut Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train Connecticut female lenders to invest in diverse STEM sectors. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to female STEM learning in diverse STEM sectors. 4. Congress could work with the state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM graduates. 5. The federal government could invest in infrastructure projects in to foster economic growth. 6. The federal government could provide funding to the state for the continued adaptability of women STEM entrepreneurs.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Supports the continued growth and success of women-owned STEM businesses.

These measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Connecticut, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, economic support, and fostering innovation and resilience can help unlock the full potential of women STEM entrepreneurs in Connecticut, driving economic growth and social progress for the state now and beyond.

5-9 Delaware Model Results and Policy Implications

The data for Delaware from 2012 to 2020 reveals several interesting trends across economic indicators. Venture capital investment in female-founded or co-founded firms shows significant growth and volatility over the period. The total investment increased from $11.5 million in 2012 to $148.95 million in 2020, with notable spikes in 2019 ($155.105 million) and 2018 ($73.745 million). This overall upward trend, despite year-to-year fluctuations, suggests an improving environment for female entrepreneurs in Delaware, particularly in recent years.

Delaware shows mixed trends in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 185 in 2012 to a peak of 253 in 2014, but then declined to 138 in 2020. Employment trends in Delaware demonstrate steady growth until 2019, with total employment rising from 419,300 in 2012 to 466,800 in 2019, before declining to 441,000 in 2020 due to the impact of the COVID-19 pandemic. Delaware's economic growth is reflected in its per capita income, which rose from $43,775 in 2012 to $55,778 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In Delaware, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 374 to 579 over the years. The number of nonemployer firms in this sector is even higher, ranging from 2,663 to 3,700, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Delaware. The number of employer firms in this sector ranges from 201 to 242, while the number of nonemployer firms ranges from 1,597 to 2,100. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Several manufacturing sectors have no or little data on employer firms in Delaware. These include Chemical Manufacturing, Fabricated Metal Product Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing. Similarly, these manufacturing sectors also have no or very little data on nonemployer firms in Delaware.

5-9-1 Delaware Model Interpretations

A 1% increase in the number of women patentees in Delaware produces a 0.24% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Delaware has been fluctuating over the years, with a maximum of 253 in 2014 and a minimum of 126 in 2019.

A 1% increase in venture capital funding in Delaware produces about a 0.023% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that total venture capital funding in Delaware has been relatively low compared to other states, with a maximum of $155.105 million in 2019.

The estimated effect of the labor force in Delaware is negative. The estimate indicates a 1% increase in the labor force would produce a 1.975% decrease in the number of women STEM entrepreneurs in the state. This coefficient may be due to the size and composition of Delaware's labor force. The changes in the labor force could happen such that the pool of skilled workers in specific STEM sectors does not increase, limiting the skilled labor force options for female STEM firms. The data shows that the number of employed individuals in Delaware has been relatively stable over the years, with a slight decline in 2020 likely due to the COVID-19 pandemic.

A 1% increase in the number of women STEM graduates nationally produces a 0.854% increase in the number of women STEM entrepreneurs in Delaware. The positive sign of this coefficient is not surprising, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs.

A one percentage point increase in the national interest rate produces a 0.142% decrease in the number of women STEM entrepreneurs in Delaware. The negative sign of this coefficient aligns with expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Delaware produces a 0.795% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient is not surprising, as higher per-capita income is expected to reflect greater demand and opportunity for entrepreneurs. The data shows that per-capita income in Delaware has been consistently increasing over the years, with a maximum of $55,778 in 2020.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Delaware. The negative sign of this coefficient aligns with expectations, as the pandemic is expected to have negative impacts on entrepreneurship.

5-9-2 Delaware Policy Implications

Based on the Delaware CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-8: Delaware Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Delaware state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Delaware. 3. The federal government could provide funding to Delaware for investment in training programs for a skilled workforce. 4. Congress could work with Delaware state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Delaware to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could help the state establish a dedicated fund to provide assistance to women STEM entrepreneurs during emergencies.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Creates a more favorable environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

A more supportive and inclusive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis can be created through these measures. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and broader economic and social policies can help unlock the full potential of women STEM entrepreneurs in Delaware, driving innovation, economic growth, and social progress for the state.

5-10 District of Columbia Model Results and Policy Implications

The data for the District of Columbia (DC, District) from 2012 to 2020 reveals significant growth across various economic indicators. Venture capital investment in female-founded or co-founded firms shows a strong upward trend, albeit with fluctuations. The total investment increased dramatically from $2.482 million in 2012 to $108.46 million in 2020, with notable peaks of $145.065 million in 2017 and $76.975 million in 2016. This overall growth suggests an increasingly supportive environment for female entrepreneurs in the District, particularly in recent years.

The District demonstrates impressive growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 44 in 2012 to 117 in 2020, representing a 166% increase over the period. Employment trends in the District show steady growth until 2019, with total employment rising from 732,600 in 2012 to 797,200 in 2019, before declining to 743,600 in 2020 due to the impact of the COVID-19 pandemic. The District's economic growth is further reflected in its per capita income, which rose significantly from $67,470 in 2012 to $89,703 in 2020, showcasing the area's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In the District, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both female employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 772 to 1,113 over the years. The number of nonemployer firms in this sector is even higher, ranging from 6,589 to 8,200, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both female employer and nonemployer firms in DC. The number of female employer firms in this sector ranges from 148 to 332, while the number of nonemployer firms ranges from 1,749 to 2000. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the district.

Several manufacturing sectors have no employer data over the years. These include Chemical Manufacturing, Fabricated Metal Product Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing. Similarly, these manufacturing sectors have no data of nonemployer firms in DC. Miscellaneous Manufacturing and Data Processing, Hosting, and Related services show small numbers of nonemployer firms in DC.

5-10-1 DC Model Interpretations

A 1% increase in the number of women patentees in the District produces about a .14% increase in the number of women STEM entrepreneurs. The positive sign of this coefficient conforms to expectations, as a higher number of women patentees should lead to more women STEM entrepreneurs. The data shows that the number of women patentees in the District has been generally increasing over the years, with a maximum of 117 in 2020. This growing pool of women patentees may contribute to the positive relationship with women STEM entrepreneurship in the state.

A 1% increase in venture capital funding in the District produces a .04% increase in the number of women STEM entrepreneurs. The positive sign of this coefficient conforms to expectations, as increased venture capital funding should support women STEM entrepreneurship. Furthermore, it could be that most venture capital funding even though it is a small amount goes to STEM businesses and more specifically STEM businesses in the sectors where female firms are concentrated alleviating any resource crunch, leading to increases in the number of female STEM entrepreneurs. Or, the funding could be directed to nonconcentrated sectors leading to new business formation.

The estimated effect of the labor force in the District is positive. The estimate indicates a 1% increase in the labor force would produce about a 1.5% increase in the number of women STEM entrepreneurs. This coefficient may be due to the unique characteristics of the District of Columbia's labor force. The data shows that the number of employed individuals in the District has remained relatively stable over the years, with a slight decline in 2020 likely due to the COVID-19 pandemic. The positive sign suggests that the presence of a skilled and diverse labor force may be conducive to women STEM entrepreneurship in the state. A large labor force could also provide more childcare options for female STEM entrepreneurs.

A 1% increase in the number of women STEM graduates nationally produces about a .09% decrease in the number of women STEM entrepreneurs in DC. The negative sign of this coefficient is surprising, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs. The data does not provide information on the number of women STEM graduates specific to DC, making it difficult to draw conclusions about the District-level dynamics. However, the negative relationship may suggest that other factors, such as job market conditions, industry-specific barriers, or the attractiveness of other career paths, may be influencing the transition from education to entrepreneurship for women in STEM fields in the District. These STEM graduates could also be in highly concentrated sectors, increasing competition and leading to business failures.

A one percentage point increase in the national interest rate produces about a .12% decrease in the number of women STEM entrepreneurs in the District. The negative sign of this coefficient conforms to expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. It suggests that lower interest rates may be more favorable for women STEM entrepreneurship in the District.

A 1% increase in per-capita real income in DC produces about a 1% decrease in the number of women STEM entrepreneurs. The negative sign of this coefficient is surprising, as higher per-capita income is expected to reflect greater demand and opportunity for entrepreneurs. The data shows that per-capita income in the District has been consistently high compared to other states, with a maximum of $89,703 in 2020. The negative relationship may indicate that other factors, such as the cost of living, industry-specific dynamics, or the availability of alternative career opportunities, may be influencing women STEM entrepreneurship in the District. Specific factors, such as concentration of women STEM entrepreneurs in certain sectors in the District, may influence this result. It could also be that women are pushed into starting businesses because of income disparity and business ceilings, and higher incomes could mean a decline in the number of women starting businesses. Another reason could be higher incomes leading to the abandonment of entrepreneurship by women to raise families.

The COVID-19 dummy variable indicates that the pandemic is associated with a decrease in the number of women STEM entrepreneurs in DC.

5-10-2 DC Policy Implications

Based on the DC CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-9: DC Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with the District to condition institutional funding on increased female commercialization exposure. 2. SBA could train new female investors and educate them on investing in female STEM businesses in DC. 3. Congress could provide childcare stabilization grants to DC to improve childcare wages and benefits. 4. The federal government could tie K-12 funding in DC to female STEM learning in diverse STEM sectors. 5. Federal grant funding for DC institutions could be tied to training and promoting female faculty. 6. The federal government could provide grants to the state government to provide child care and other care options to female STEM entrepreneurs. 7. The federal government could help the state establish a dedicated fund to provide assistance to women STEM entrepreneurs during emergencies. during economy wide shocks.	1. Increase female patentees and female STEM businesses. 2. Provide more funding options to female STEM firms. 3. Make child care options accessible for female STEM businesses. 4. Provide a skilled workforce pipeline to female STEM firms. 5. Facilitates the transition from academia to entrepreneurship. 6. Reduce barriers to entry for female STEM entrepreneurs. 7. Increase the resilience and business creation of women in DC.

These policy measures will result in a more supportive and inclusive environment for women STEM entrepreneurs in the District, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and broader economic and social policies can help unlock the full potential of women STEM entrepreneurs in the District of Columbia, driving innovation, economic growth, and social progress for the state now and beyond.

5-11 Florida Model Results and Policy Implications

The data for Florida from 2012 to 2020 reveals significant growth across the different economic indicators used in the analysis. Venture capital investment in female-founded or co-founded firms shows a strong upward trend, albeit with fluctuations. The total investment increased dramatically from $66.783 million in 2012 to $358.164 million in 2020, with a notable peak of $583.975 million in 2019. This overall growth suggests an increasingly supportive environment for female entrepreneurs in Florida, particularly in recent years, despite year-to-year volatility.

Florida demonstrates impressive growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 762 in 2012 to 1,267 in 2020, representing a 66% increase over the period. Employment trends in Florida show strong and consistent growth until 2019, with total employment rising from 7,402,300 in 2012 to 8,974,300 in 2019, before declining to 8,535,400 in 2020 due to the impact of the COVID-19 pandemic. Florida's economic growth is further reflected in its per capita income, which rose from $41,204 in 2012 to $56,561 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In Florida, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both female employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 15,681 to 21,340 over the years. The number of nonemployer firms in this sector is significantly higher, ranging from 86,046 to 127,000, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both female employer and nonemployer firms in Florida. The number of employer firms in this sector ranges from 10,002 to 11,912, while the number of nonemployer firms ranges from 73,886 to 111,000. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Miscellaneous Manufacturing has the highest concentration of employer firms in Florida, with numbers ranging from 270 to 372 over the years. Chemical Manufacturing and Fabricated Metal Product Manufacturing also have a relatively consistent presence of employer firms, although in lower numbers compared to Miscellaneous Manufacturing.

There is little data on Electrical Equipment, Appliance, and Component Manufacturing. Computer Electronic Product Manufacturing has a relatively low concentration of employer firms, with numbers ranging from 46 to 56.

The manufacturing sectors generally have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, Miscellaneous Manufacturing and Chemical

Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these fields. The Data Processing, Hosting, and Related Services also has lower concentration of nonemployer firms compared to the professional services sector, however the number of firms in this sector is higher than Miscellaneous Manufacturing and Chemical Manufacturing.

5-11-1 Florida Model Interpretations

A 1% increase in the number of women patentees in Florida produces a 0.278% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not conform to expectations, as a higher number of women patentees should lead to more women STEM entrepreneurs. This could happen if the increase in female patentees happens in more concentrated STEM sectors, leading to greater competition and firm failures. The data shows that the number of women patentees in Florida has been consistently high compared to other states, with a maximum of 1,267 in 2020.

Florida is a highly urbanized state. This is relevant for the above finding, because it has been argued that inventor networks, which may be correlated with urbanization in some cases, are highly correlated with invention, and thus patenting. Tahmooresnejad and Turkina (2023) find that "While research on co-inventor networks has mostly been conducted at the individual level, some works have started to look at the effects of inventor networks on regional innovation. For instance, research on the United States (US) urban system has shown that metropolitan regions with more local and non-local co-inventor linkages outperform cities whose economic agents are isolated [41]. In a similar vein, Fleming et al. [42] analyzed co-inventor networks between different regions and found that shorter pathlengths and stronger connectedness correlates with increased innovation."

In addition, at least five universities in Florida perform well in terms of patenting: the University of Florida, the University of South Florida, the University of Central Florida, Florida International University and Florida State University[xlii]. This might especially be the case in South Florida. The University of South Florida has seen high growth in funding of research (Freeman 2024) and has a number of patentees[xliii]. The University of Florida is home to the Empowering Women in Technology Startups (EWITS) program that helps women understand the process of commercializing an invention. The University also has the Pathways Collaboratory for Inclusive Entrepreneurship that provides innovation learning and mentorship opportunities for founders of color and women in STEM fields. It is possible that while Florida universities are conducive to highly technical patents, there is a need for these patents to be translated into entrepreneurship. It may be the case that the urbanized atmosphere and research-oriented universities lead to women patentees but not women STEM entrepreneurs. So, there is a need to support the transition from patent holder to entrepreneur for female STEM entrepreneurs in Florida.

A 1% increase in venture capital funding in Florida produces about a 0.11% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as increased venture capital funding is expected to support women STEM entrepreneurship. It is possible that as mentioned above the path to entrepreneurship may not be easy for female STEM entrepreneurs in Florida. This result may also be due to a dilution effect of adding more capital to female-owned businesses, which are described as having 51 percent or more of ownership of assets. Additionally, the allocation of venture capital funding may not be evenly distributed across all sectors, which could influence its impact on women STEM entrepreneurship in Florida. The data shows that venture capital funding in Florida has been growing over the years, with a maximum of $583.975 million in 2019. The relationship suggests that the dynamics of venture capital allocation and its impact on women STEM entrepreneurship in Florida may be more complex than expected.

The estimated effect of the labor force in Florida is negative. The estimate indicates a 1% increase in the labor force would produce a 27.151% decrease in the number of women STEM entrepreneurs in the state. The negative sign suggests that the presence of a large and growing labor force may not be conducive to women STEM entrepreneurship in the state. A larger labor force could lead to increased competition amongst firms as they try to recruit workers, especially skilled workers leading to firm failures and exits.

A 1% increase in the number of women STEM graduates nationally produces a 14.929% increase in the number of women STEM entrepreneurs in Florida. The positive sign of this coefficient aligns with expectations, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs. The data does not provide information on the number of women STEM graduates specific to Florida, making it difficult to draw conclusions about the state-level dynamics. It is possible that the Florida universities mentioned above help women STEM graduates in their entrepreneurship journey to some extent.

A one percentage point increase in the national interest rate produces a 0.022% increase in the number of women STEM entrepreneurs in Florida. The positive sign of this coefficient is surprising, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The positive relationship could be because of a large number of nonemployer firms that don't need traditional financing, or the wealth effect of higher interest rates.

A 1% increase in per-capita real income in Florida produces a 0.208% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient can be explained by the opportunity cost of starting a business. As per-capita income rises, the opportunity cost of becoming an entrepreneur increase, as individuals may have more attractive employment options or may be less willing to take on the risks associated with starting a business. Women may also leave entrepreneurship to start families. The data shows that per-capita income in Florida has been consistently increasing over the years, with a maximum of $56,561 in 2020.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Florida.

5-11-2 Florida Policy Implications

Based on the Florida CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-10: Florida Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train Florida lenders to target less crowded sectors. 3. The federal government could provide funding to support childcare and training of workers in the state. 4. Congress could work with Florida state government to tie institutional funding to internships, mentorship, and networking opportunities to female STEM graduates. 5. The federal government could provide grants to the state government to provide child care and other care options to female STEM entrepreneurs. 6. The federal government could help the state establish a dedicated fund to provide assistance to women STEM entrepreneurs during emergencies.	1. Facilitates the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

These policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Florida, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of Florida women STEM entrepreneurs.

5-12 Georgia Model Results and Policy Implications

The data for Georgia from 2012 to 2020 reveals growth and fluctuations across the different economic indicators used in the analysis. Venture capital investment in female-founded or co-founded firms shows a volatile trend with notable peaks and troughs. The total investment changed from $170.861 million in 2012 to $114.2 million in 2020, with a remarkable peak of $369.394 million in 2017. This overall trend suggests an improving, albeit unpredictable, environment for female entrepreneurs in Georgia, with substantial year-to-year variations.

Georgia demonstrates steady growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 612 in 2012 to 868 in 2020, representing a 42% increase over the period. Employment trends in Georgia show strong and consistent growth until 2019, with total employment rising from 3,953,900 in 2012 to 4,632,300 in 2019, before declining to 4,425,100 in 2020 due to the impact of the COVID-19 pandemic. Georgia's economic growth is further reflected in its per capita income, which rose from $37,251 in 2012 to $51,469 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In Georgia, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer female STEM firms among the STEM sectors. The number of employer firms in this sector ranges from 5,938 to 7,434 over the years. The number of nonemployer firms in this sector is even higher, ranging from 42,945 to 55,000, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Georgia. The number of employer firms in this sector ranges from 3,680 to 5,255, while the number of nonemployer firms ranges from 24,105 to 30,000. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms in Georgia, with numbers ranging from 88 to 131 over the years. Miscellaneous Manufacturing and Machinery Manufacturing also have a relatively consistent presence of employer firms, although in lower numbers compared to Fabricated Metal Product Manufacturing.

Computer and Electronic Product Manufacturing and Transportation Equipment Manufacturing have little to no data on employer firms in Georgia. Electrical Equipment, Appliance, and Component Manufacturing has a relatively low concentration of employer firms.

The manufacturing sectors generally have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, Miscellaneous Manufacturing and Chemical

Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these fields. The number of nonemployer firms in Data Processing, Hosting, and Related Services is higher than Miscellaneous Manufacturing.

5-12-1 Georgia Model Interpretations

A 1% increase in the number of women patentees in Georgia produces about a 0.843% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Georgia has been consistently high compared to other states, with a maximum of 868 in 2020. The positive relationship suggests that the large pool of women patentees in Georgia may be contributing to the growth of women STEM entrepreneurship in the state, possibly by providing role models, mentorship, and knowledge spillovers that encourage more women to pursue entrepreneurial ventures in the STEM fields.

A BusinessWire report[xliv] found that Georgia was number one in the states, and Atlanta was number three in the metropolitan areas where the number, employment and revenue of women-owned businesses grew between 2014 and 2019. Atlanta provides a lot of resources for female entrepreneurs[xlv] including resources directed specifically for women in the STEM fields. The non-profit Women in Technology[xlvi] supports the women STEM pipeline from educating middle and high school female students about STEM opportunities, to educating professionals, to organizing programs and events for them. StartupChicks[xlvii] is a community of female technology founders, co-founders, and early-stage startup executives that provides mentoring, networking and educational events to help female technology founders succeed.

There are other support groups for women entrepreneurs in Atlanta (Parham 2024). The Fearless Fund[xlviii], built by women of color for women of color aims to close the gap in venture capital funding for women of color founders. The Women's Entrepreneurial Opportunity Project (WEOP)[xlix] provides education, and training, to women entrepreneurs from underserved Atlanta communities. WEOP also facilitates their access to capital and markets. Access to Capital for Entrepreneurs (ACE)[l] provides loans and financial literacy resources to women and minority entrepreneurs in Atlanta and across Georgia.

Georgia Tech in Atlanta, a top ten engineering school produces the most female engineers in the country. Many of these graduates are able to start their own technology companies sometimes as students, given their exposure to professors who serve as role models. There are funding programs specifically for female entrepreneurs. The City of Atlanta supports the Women's Entrepreneurship Initiative (WEI)[li], an incubator for female founders. JP Morgan Chase finances the Ascend 2020 Atlanta program[lii] to support minority- and women-owned tech companies and small businesses[liii].

There are several other efforts related to Georgia Tech to support innovation and innovators. Georgia Advanced Technology Ventures (GATV) is an affiliated organization that supports innovation coming out of Georgia Tech through specialized programs[liv], such as Create-X[lv] which sponsors exhibitions for Georgia Tech affiliated startups. GATV also supports the state's startup incubator, the Advanced Technology Development Center (ATDC)[lvi]. There is a Georgia Tech affiliated venture capital group, Fowler Street Ventures[lvii] which is an alumni venture capital fund for Georgia Tech graduates.   Georgia Tech also has a Female Founders program[lviii] and the InVenture Prize[lix], an innovation competition that is open to all undergraduates and recent graduates.

In addition to Georgia Tech, other universities in Georgia support innovation. Georgia State University has an Entrepreneurship and Innovation Institute[lx]. The institute hosts events that showcase the innovative initiatives of the Georgia State Community. Georgia College and State University hosts a Center for Innovation and Entrepreneurship that has many activities to support businesses including educational events, partnering with other entities to launch a business incubator, providing business consultancy services, supporting faculty grant funded research, helping students manage a growth focused portfolio and offering web-based support services.

These initiatives from Georgia Tech and other universities in the state complement the resources and support provided by other groups for female entrepreneurs and especially female STEM entrepreneurs in Atlanta and across Georgia. This creates an entrepreneurial ecosystem that allows female patentees to translate their innovations into businesses and could explain the relatively high positive coefficient for women patentees in Georgia. The supportive atmosphere for women STEM entrepreneurs in Atlanta is scheduled to receive international recognition when The Global Women in STEM Leadership Summit is held in Atlanta, September 16-17, 2024[lxi].

A 1% increase in venture capital funding in Georgia produces a 0.035% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as increased venture capital funding is generally expected to support women STEM entrepreneurship. The data shows that venture capital funding in Georgia has been relatively high compared to other states, with a maximum of $369.394 million in 2017. The negative relationship, although small in magnitude, suggests that other factors beyond venture capital funding may be influencing women STEM entrepreneurship in Georgia, such as the concentration of funding in specific sectors or the potential for dilution effects.

The estimated effect of the labor force in Georgia is negative. The estimate indicates a 1% increase in the labor force would produce a 9.786% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is counterintuitive, as a larger labor force is generally expected to provide a broader pool of skilled workers that support the growth of businesses across sectors. The data shows that the number of employed individuals in Georgia has been consistently growing. The negative coefficient suggests that the size of the labor force alone may not be a determining factor for women STEM entrepreneurship in Georgia, and other state-specific factors such as the education system, and skill development programs, may play a more direct role. The larger labor force might not necessarily be skilled in STEM, and greater competition amongst firms to recruit skilled workers might lead to business failures and exits.

A 1% increase in the number of women STEM graduates nationally produces a 0.842% increase in the number of women STEM entrepreneurs in Georgia. The positive sign of this coefficient aligns with expectations, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs. The positive relationship suggests that the national trend in women STEM graduates may have a spillover effect on women STEM entrepreneurship in Georgia, possibly by increasing the pool of potential entrepreneurs and providing role models and networks that encourage more women to pursue entrepreneurial ventures in STEM fields.

A one percentage point increase in the interest rate produces a 0.121% increase in the number of women STEM entrepreneurs in Georgia. The positive sign of this coefficient is surprising, as higher interest rates are generally expected to make it more difficult for women STEM entrepreneurs to access financing for their ventures. It is possible that interest rates don't impact these entrepreneurs much. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The positive relationship, although small in magnitude, suggests that other factors beyond interest rates may be more influential in determining women STEM entrepreneurship in Georgia, such as access to alternative financing options, the financial resources provided by different support groups, the wealth effect, or the overall economic conditions in the state.

A 1% increase in per-capita real income in Georgia produces a 7.027% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as higher per-capita income is generally expected to support entrepreneurial activity and provide more opportunities for individuals to start and grow their businesses. The data shows that per-capita income in Georgia has been consistently increasing over the years, with a maximum of $51,469 in 2020. The positive relationship suggests that rising income levels in Georgia may create a more favorable environment for women STEM entrepreneurship, as individuals may have more financial resources and opportunities to pursue entrepreneurial ventures. In addition, the positive entrepreneurial climate created by Georgia institutions and support groups could make it easier for them to pursue STEM ventures.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Georgia. The negative sign of this coefficient aligns with expectations, as the pandemic is expected to have negative impacts on entrepreneurship.

5-12-2 Georgia Policy Implications

Based on the Georgia CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-11: Georgia Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Federal agencies could work with Georgia state/local agencies to tie institutional funding to female STEM enrollment and exposure. 2. SBA can train Georgia female lenders to invest in diverse STEM sectors. 3. The federal government could provide funding to Georgia for investment in training programs for a skilled workforce. 4. Congress could work with Georgia's state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Georgia to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could help Georgia establish a dedicated fund to provide assistance to women STEM entrepreneurs during emergencies.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

Implementing these policy measures will create a more supportive and inclusive environment for women STEM entrepreneurs in Georgia, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Georgia, driving innovation, economic growth, and social progress for the state and beyond the state.

5-13 Hawaii Model Results and Policy Implications

The data for Hawaii from 2012 to 2020 reveals modest growth and some fluctuations across various economic indicators. Venture capital investment in female-founded or co-founded firms shows a generally upward trend, albeit with very low overall figures. The total investment increased from $0.738 million in 2012 to $12 million in 2020, with a high recorded investment of $10.1 million in 2019. While these figures are relatively small compared to larger states, they do indicate a slow but steady improvement in the funding environment for female entrepreneurs in Hawaii.

Hawaii shows a mixed trend in women's participation in innovation, as evidenced by the number of women patentees. This figure fluctuated over the years, starting at 24 in 2012, peaking at 40 in 2018, and then returning to 24 in 2020. Employment trends in Hawaii demonstrate steady growth until 2019, with total employment rising from 607,600 in 2012 to 658,600 in 2019, before declining sharply to 560,000 in 2020 due to the impact of the COVID-19 pandemic. This significant drop likely reflects the state's heavy reliance on tourism, which was severely affected by the pandemic. Hawaii's economic growth is reflected in its per capita income, which rose from $43,531 in 2012 to $57,036 in 2020, showcasing the state's overall economic improvement and increasing standard of living during this period, despite challenges in other areas.

In Hawaii, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both female employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 438 to 885 over the years. The number of nonemployer firms in this sector is significantly higher, ranging from 6,166 to 7,200, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both female employer and nonemployer firms in Hawaii. The number of employer firms in this sector ranges from 490 to 677, while the number of nonemployer firms ranges from 3,233 to 3,900. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Chemical Manufacturing, Fabricated Metal Product Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, Transportation Equipment Manufacturing, and Miscellaneous Manufacturing have little or no employer information for most of the years analyzed. Similarly, these manufacturing sectors have little or no information on nonemployer firms. The Data Processing, Hosting, and Related services sector also has very little information on employer firms.

Miscellaneous Manufacturing is the most concentrated sector for nonemployer firms in manufacturing. There are a few nonemployer firms in the Data Processing, Hosting, and Related Services sector.

5-13-1 Hawaii Model Interpretations

A 1% increase in the number of women patentees in Hawaii is associated with a 0.001% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is unexpected, as a higher number of women patentees is generally expected to lead to more women STEM entrepreneurs. Looking at the raw data, the number of women patentees in Hawaii has been relatively low, with a maximum of 40 in 2018. The low number of women patentees in the state may not be sufficient to generate a significant positive impact on women's STEM entrepreneurship. Additionally, other factors such as limited access to resources, networks, and commercialization support may hinder the translation of patents into successful entrepreneurial ventures for women in Hawaii. It is also possible that these patentees are in concentrated sectors, leading to competition and failures of firms.

A 1% increase in venture capital funding in Hawaii is associated with a 0.001% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as increased venture capital funding is generally thought to support entrepreneurial activities. The raw data reveals that venture capital funding in Hawaii has been extremely low, with a maximum of $12 million in 2020. The small magnitude of the coefficient suggests that while venture capital funding may have a positive impact on women's STEM entrepreneurship in Hawaii, the effect may be limited due to the low levels of funding available.

A 1% increase in Hawaii's labor force is associated with a 0.392% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is surprising, as a larger labor force is generally expected to provide a broader pool of skilled workers and support business growth. The raw data shows that the number of employed individuals in Hawaii has been relatively stable, with a maximum of 658,600 in 2019. The negative coefficient suggests that the size of the labor force alone may not be a determining factor for women's STEM entrepreneurship in Hawaii, and other state-specific factors such as the education system and skill development programs may play a direct role. The increased labor force may not be skilled in the STEM sectors where women entrepreneurs need workers, there might be increased competition amongst firms to recruit these workers leading to firm failures and exits.

A 1% increase in the number of women STEM graduates nationally is associated with a 0.34% increase in the number of women STEM entrepreneurs in Hawaii. This positive relationship aligns with expectations, as a larger pool of women STEM graduates is generally expected to contribute positively to women's STEM entrepreneurship. While the raw data does not provide information on the number of women STEM graduates specific to Hawaii, the positive coefficient suggests that the national trend may have a spillover effect on women's STEM entrepreneurship in the state. As more women graduate with STEM degrees nationally, there may be increased opportunities for them to pursue entrepreneurial ventures, including in Hawaii.

A one percentage point increase in the interest rate is associated with a 0.019% increase in the number of women STEM entrepreneurs in Hawaii. This positive relationship is surprising, as higher interest rates are generally expected to make it more difficult for entrepreneurs to access financing for their ventures. The raw data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The positive coefficient suggests that factors such as the positive wealth effect, access to alternate financing etc. may be influential in determining women's STEM entrepreneurship in Hawaii.

A 1% increase in Hawaii's real income is associated with a 0.161% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as higher income levels are generally expected to support entrepreneurial activity and provide more opportunities for individuals to start and grow their businesses. The raw data shows that per-capita income in Hawaii has been consistently increasing over the years, with a maximum of $57,036 in 2020. The positive coefficient suggests that rising income levels in Hawaii may create a more favorable environment for women's STEM entrepreneurship, as individuals may have more financial resources and opportunities to pursue entrepreneurial ventures.

The coefficient for the COVID-19 dummy variable is negative, indicating that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Hawaii compared to the pre-pandemic period. This negative relationship aligns with expectations, as the pandemic is generally expected to have negative impacts on entrepreneurial activity.

The lack of statistical significance measures in the regression output limits the interpretability of these results. In addition, the missing values in the female STEM entrepreneur numbers for Hawaii may also affect the reliability of the coefficients that are estimated and their associated economic interpretations.

Despite the statistical limitations and lack of data availability, the economic interpretations provide insights into the potential factors influencing women's STEM entrepreneurship in Hawaii. The small magnitudes of the coefficients for women patentees and venture capital funding suggest that these factors may have a limited impact on women's STEM entrepreneurship in the state. The negative coefficient for the labor force highlights the need for further research to understand the complex dynamics between the size of the workforce and women's STEM entrepreneurship in Hawaii. The positive coefficients for the number of women STEM graduates nationally and real income indicate that these factors may support women's STEM entrepreneurship in the state. The negative coefficient for the COVID-19 dummy variable suggests that the pandemic may have had a negative impact on women STEM entrepreneurs in Hawaii, highlighting the need for targeted support and resources during challenging times.

5-13-2 Hawaii Policy Implications

Based on the Hawaii CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-12: Hawaii Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participate in SBIR/STTR programs to support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Hawaii. 3. The federal government could provide funding to Hawaii for investment in training programs for a skilled workforce. 4. Congress could work with Hawaii's state government to tie institutional funding to internships, mentorship and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Hawaii to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government can help Hawaii establish a dedicated fund to provide emergency assistance to help women STEM entrepreneurs.	1. Facilitates the growth of women-owned STEM businesses. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

Implementing these policy measures, can create a more supportive and inclusive environment for women STEM entrepreneurs in Hawaii, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Hawaii, driving innovation, economic growth, and social progress for the state now and beyond.

5-14 Idaho Model Results and Policy Implications

The data for Idaho from 2012 to 2020 reveals modest growth and some fluctuations across the different economic indicators. Venture capital investment in female-founded or co-founded firms shows a volatile trend with no clear upward trajectory. The total investment fluctuated significantly, starting at $1.89 million in 2012, peaking at $38.983 million in 2019, and then dropping sharply to $2.1 million in 2020. This pattern suggests an unpredictable environment for female entrepreneurs seeking venture capital in the state, with occasional years of significant investment.

Idaho demonstrates steady growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 142 in 2012 to 204 in 2020, representing a 44% increase over the period. Employment trends in Idaho show strong and consistent growth until 2019, with total employment rising from 621,700 in 2012 to 760,100 in 2019, before slightly declining to 754,800 in 2020 due to the impact of the COVID-19 pandemic. Idaho's economic growth is further reflected in its per capita income, which rose from $34,825 in 2012 to $49,691 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period. Despite challenges in venture capital funding, Idaho shows positive trends in employment, innovation, and overall economic growth.

In Idaho, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 500 to 1086 over the years. The number of nonemployer firms in this sector is also consistently high, ranging from 6,082 to 8,400, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Idaho. The number of employer firms in this sector ranges from 452 to 620 while the number of nonemployer firms ranges from 2,787 to 3,800. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms in Idaho, with numbers ranging from 7 to 52 over the years. Miscellaneous Manufacturing also has a relatively consistent presence of employer firms, although in lower numbers compared to Fabricated Metal Product Manufacturing.

On the other hand, some manufacturing sectors have little or no data on employer firms in Idaho. These include Chemical Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing. The Data Processing, Hosting, and Related services sector also has very little information on employer firms.

Miscellaneous Manufacturing is the highest concentrated sector for nonemployer firms in the manufacturing sectors. There are a small number of Data Processing, Hosting, and Related services nonemployer firms.

5-14-1 Idaho Model Interpretations

A 1% increase in the number of women patentees in Idaho produces a 0.420% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient conforms to expectations, as a higher number of women patentees should lead to more women STEM entrepreneurs. The data shows that the number of women patents in Idaho has been generally increasing over the years, with a maximum of 204 in 2020.

A 1% increase in venture capital funding in Idaho produces a 0.051% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in Idaho has been relatively low compared to other states, with a maximum of $38.983 million in 2019. The negative relationship may indicate that the allocation of venture capital funding in the state is not effectively supporting women STEM entrepreneurs in specific sectors. Greater funding in concentrated sectors could lead to greater competition and exit of firms, or there could also be dilution of ownership.

The estimated effect of the labor force in Idaho is relatively high. The estimate indicates a 1% increase in the labor force would produce a 14.449% increase in the number of women STEM entrepreneurs in the state. The large magnitude of this coefficient may be due to the size and composition of Idaho's labor force. The labor force could contain skilled workers needed by female STEM entrepreneurs. The data shows that the number of employed individuals in Idaho has been steadily increasing over the years, with a slight decline in 2020 likely due to the COVID-19 pandemic. The positive coefficient sign suggests that the presence of a growing labor force may be conducive to women STEM entrepreneurship in the state.

A 1% increase in the number of women STEM graduates nationally produces a 3.653% decrease in the number of women STEM entrepreneurs in Idaho. The negative sign of this coefficient is surprising, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs. The data does not provide information on the number of women STEM graduates specific to Idaho, making it difficult to draw conclusions about the state-level dynamics. However, the negative relationship may suggest that other factors, such as job market conditions, industry-specific barriers, or the attractiveness of other career paths, may be influencing the transition from education to entrepreneurship for women in STEM fields in Idaho. Women STEM graduates could also flock to highly concentrated sectors increasing competition and leading to firm failures.

A one percentage point increase in the national interest rate produces a 0.157% decrease in the number of women STEM entrepreneurs in Idaho. The negative sign of this coefficient conforms to expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. Lower rates may be more favorable for women STEM entrepreneurship in Idaho.

A 1% increase in per-capita real income in Idaho produces a 6.851% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient can be explained by the opportunity cost of starting a business. As per-capita income rises, the opportunity cost of becoming an entrepreneur increase, as individuals may have more attractive employment options or may be less willing to take on the risks associated with starting a business. The data shows that per-capita income in Idaho has been consistently increasing over the years, with a maximum of $49,691 in 2020. Higher per-capita income may discourage some women from pursuing STEM entrepreneurship in Idaho due to the increased opportunity cost. In addition, with increased financial flexibility, some women may leave entrepreneurship to start families.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Idaho. The positive sign of this coefficient is surprising, as the pandemic is expected to have negative impacts on entrepreneurship. The data shows that the number of employer firms in the Professional, Scientific, and Technical Services sector, increased from 966 in 2019 to 1,086 in 2020. Additionally, the number of nonemployer firms in this sector increased from 8,300 in 2019 to 8,400 in 2020. This may suggest that some women STEM entrepreneurs in Idaho were able to adapt to the challenging economic conditions during the pandemic by starting new ventures.

5-14-2 Idaho Policy Implications

Based on the Idaho CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-13: Idaho Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Idaho state/local jurisdictions to conditional institutional funding on increased female commercialization exposure. 2. SBA could train Idaho female lenders to invest in diverse STEM sectors. 3. Congress could provide childcare stabilization grants and the federal governments could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. The federal government could provide grants to Idaho's state government to provide childcare and other care options to female STEM entrepreneurs. 5. The federal government could provide funding to the state for the continued adaptability of women STEM entrepreneurs.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Reduces barriers to entry for women STEM entrepreneurs. 5. Supports the continued growth and success of women STEM entrepreneurs.

Implementing these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Idaho, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Idaho, driving innovation, economic growth, and social progress for the state and beyond the state.

5-15 Illinois Model Results and Policy Implications

The data for Illinois from 2012 to 2020 reveals significant growth and fluctuations across various economic indicators. Venture capital investment in female-founded or co-founded firms shows a strong upward trend, albeit with considerable year-to-year volatility. The total investment increased dramatically from $89.098 million in 2012 to $486.392 million in 2020, with a notable peak of $681.2 million in 2017. This overall growth suggests an increasingly supportive environment for female entrepreneurs in Illinois, particularly in recent years, despite the unpredictable nature of venture capital funding.

Illinois demonstrates steady growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 1,277 in 2012 to 1,865 in 2020, representing a 46% increase over the period. Employment trends in Illinois show modest but consistent growth until 2019, with total employment rising from 5,751,100 in 2012 to 6,124,600 in 2019, before declining to 5,698,600 in 2020 due to the impact of the COVID-19 pandemic. Illinois' economic growth is further reflected in its per capita income, which rose from $45,932 in 2012 to $61,587 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In Illinois, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 7,269 to 9,244 over the years. The number of nonemployer firms in this sector is even higher, ranging from 50,903 to 54,500, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Illinois. The number of employer firms in this sector ranges from 5,118 to 6,374, while the number of nonemployer firms ranges from 25,390 to 27,000. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms in Illinois, with numbers ranging from 272 to 405 over the years. Machinery Manufacturing also has a relatively consistent presence of employer firms, with numbers ranging from 124 to 285.

On the other hand, Transportation Equipment Manufacturing has the least concentration of employer firms in Illinois, with numbers ranging from 25 to 26. Electrical Equipment, Appliance, and Component Manufacturing also has a relatively low concentration of employer firms, with numbers ranging from 47 to 75. There are a few employer firms in the Data Processing, Hosting, and Related Services sectors.

The manufacturing sectors generally have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health

Care Services sectors. However, Miscellaneous Manufacturing and Chemical Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these fields. The number of nonemployer firms in Data Processing, Hosting, and Related Services is higher than in Miscellaneous Manufacturing.

5-15-1 Illinois Model Interpretations

A 1% increase in the number of women patentees in Illinois produces a 0.027% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Illinois has been consistently high compared to other states, with a maximum of 1,956 in 2019. Despite this large pool of women patentees, the negative relationship suggests that other factors may be hindering the transition from patenting to entrepreneurship for women in STEM fields in Illinois. These factors could include challenges in commercializing patents, accessing funding and resources, or navigating the entrepreneurial ecosystem in the state. In addition, if these women patentees gravitate towards the highly concentrated sectors, they could cause competition among firms and firm exits.

A 1% increase in venture capital funding in Illinois produces a 0.023% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in Illinois has been relatively high compared to other states, with a maximum of $681.2 million in 2017. The negative relationship suggests that access to venture capital funding alone may not be sufficient to drive women's STEM entrepreneurship in Illinois, and other factors such as the overall entrepreneurial ecosystem, access to other forms of financing, and support networks may play a more crucial role. It is also possible that this funding goes to concentrated sectors leading to competition of firms and exits or the higher funding causes ownership dilution.

The estimated effect of the labor force in Illinois is negative. The estimate indicates a 1% increase in the labor force would produce a 1.535% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is counterintuitive, as a larger labor force is generally expected to provide a broader pool of skilled workers and support the growth of businesses across STEM sectors. The data shows that the number of employed individuals in Illinois has been consistently growing, with a maximum of 73,495,200 in 2019. The negative coefficient suggests that the size of the labor force alone may not be a determining factor for women's STEM entrepreneurship in Illinois, and other state-specific factors such as the education system and skill development programs may play a more direct role. For example, the increase in the labor force might not increase the skilled labor force, and this might not help female STEM entrepreneurs, or increased competition by them to hire these workers may result in firm failures and exits. It is also possible that the economy in the state is not conducive to supporting more STEM entrepreneurs.

A 1% increase in the number of women STEM graduates nationally produces a 0.586% increase in the number of women STEM entrepreneurs in Illinois. The positive sign of this coefficient aligns with expectations, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs. The data does not provide information on the number of women STEM graduates specific to Illinois, making it difficult to draw conclusions about the state-level dynamics. However, the positive relationship may suggest that the national trend in women STEM graduates may have a spillover effect on women's STEM entrepreneurship in Illinois, possibly by increasing the pool of potential entrepreneurs and providing role models and networks that encourage more women to pursue entrepreneurial ventures in the STEM fields.

A one percentage point increase in the national interest rate produces a 0.028% increase in the number of women STEM entrepreneurs in Illinois. The positive sign of this coefficient is surprising, as higher interest rates are expected to make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The positive relationship, although small in magnitude, suggests that other factors beyond mortgage rates may be more influential in determining women's STEM entrepreneurship in Illinois, such as access to alternative financing options, the wealth effect or the overall economic conditions in the state.

A 1% increase in per-capita real income in Illinois produces a 0.360% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient can be explained by the opportunity cost of starting a business. As per-capita income rises, the opportunity cost of becoming an entrepreneur increase, as individuals may have more attractive employment options or may be less willing to take on the risks associated with starting a business. The data shows that per-capita income in Illinois has been consistently increasing over the years, with a maximum of $61,587 in 2020. The negative relationship suggests that higher per-capita income may discourage some women from pursuing STEM entrepreneurship in Illinois due to the increased opportunity cost or with better financial status, they may leave entrepreneurship to raise families.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Illinois. The negative coefficient aligns with expectations, as the pandemic is expected to have negative impacts on entrepreneurship.

5-15-2 Illinois Policy Implications

Based on the Illinois CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-14: Illinois Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the states. 2. SBA could train Illinois leaders to invest in less crowded sectors. 3. The federal government could provide funding to Illinois for investment in training for a skilled workforce. 4. Congress could work with Illinois state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide grants to the state government to provide childcare and other care options to female STEM entrepreneurs. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs.	1. Facilitates the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

Implementing these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Illinois, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and emergency assistance can help unlock the full potential of women STEM entrepreneurs in Illinois, driving innovation, economic growth, and social progress for the state.

5-16 Indiana Model Results and Policy Implications

The data for Indiana from 2012 to 2020 reveals significant growth and fluctuations across various economic indicators. Venture capital investment in female-founded or co-founded firms shows a volatile trend with notable peaks and troughs. The total investment increased from $51.295 million in 2012 to $63.07 million in 2020, with a remarkable peak of $262.448 million in 2019. This overall trend suggests an improving, albeit unpredictable, environment for female entrepreneurs in Indiana, with substantial year-to-year variations.

Indiana demonstrates steady growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 414 in 2012 to 663 in 2020, representing a 60% increase over the period. Employment trends in Indiana show strong and consistent growth until 2019, with total employment rising from 2,903,200 in 2012 to 3,159,900 in 2019, before declining to 2,994,100 in 2020 due to the impact of the COVID-19 pandemic. Indiana's economic growth is further reflected in its per capita income, which rose from $39,150 in 2012 to $51,719 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In Indiana, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 2,031 to 2,962 over the years. The number of nonemployer firms in this sector is even higher, ranging from 17,344 to 20,000, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Indiana. The number of employer firms in this sector ranges from 1,519 to 1,783, while the number of nonemployer firms ranges from 8,076 to 9,500. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms in Indiana, with numbers ranging from 120 to 192 over the years. Transportation Equipment Manufacturing and Miscellaneous Manufacturing also have a relatively consistent presence of employer firms, although in lower numbers compared to Fabricated Metal Product Manufacturing.

On the other hand, Computer and Electronic Product Manufacturing has little employer data. Electrical Equipment, Appliance, and Component Manufacturing has a relatively low concentration of employer firms.

The manufacturing sectors generally have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, Miscellaneous Manufacturing and Chemical Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these fields. There are a few hundred nonemployer firms in Data Processing, Hosting, and Related Services sectors, though their numbers are less than in Miscellaneous Manufacturing.

5-16-1 Indiana Model Interpretations

A 1% increase in the number of women patentees in Indiana produces a 0.003% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Indiana reached a maximum of 710 in 2019. The negative relationship suggests that factors other than patenting activity may be more influential in determining women's STEM entrepreneurship in Indiana. These factors could include challenges in commercializing patents, limited access to resources and networks, or preferences for other career paths. In addition, if the women patentees are mostly present in the concentrated STEM sectors, this could result in increased competition and failure of firms.

A 1% increase in venture capital funding in Indiana produces a 0.004% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as increased venture capital funding should support women STEM entrepreneurship. The data shows that venture capital funding in Indiana has been higher compared to other states, with a maximum of $262.448 million in 2019. It is possible that the increased funding is directed towards concentrated sectors, leading to increased competition and failure of firms, or it leads to dilution of ownership.

The estimated effect of the labor force in Indiana is negative. The estimate indicates a 1% increase in the labor force would produce a 5.771% decrease in the number of women STEM entrepreneurs in the state. The data shows that the number of employed individuals in Indiana has been relatively stable. The negative sign of this coefficient does not align with expectations, suggesting that a larger labor force does not provide a greater pool of talent and resources for entrepreneurship in STEM fields in Indiana. Female STEM entrepreneurs can take advantage of increased networking opportunities and better options for childcare due to a larger labor force, per the Saksena et al. (2022) USPTO study. It is possible that the larger labor force does not lead to a larger skilled workforce to support female STEM entrepreneurs. It is also possible that there is increased competition amongst firms trying to recruit these workers, leading to competition and firm failures.

A 1% increase in the number of women STEM graduates nationally produces a 1.181% increase in the number of women STEM entrepreneurs in Indiana. The positive relationship aligns with expectations, as an increase in the supply of women STEM graduates could potentially lead to more women STEM entrepreneurs. This suggests that the national trend in women's STEM education may have some influence on the entrepreneurial landscape in Indiana, with more women pursuing STEM degrees potentially translating into a larger pool of potential entrepreneurs in the state.

A one percentage point increase in the national mortgage rate produces a 0.035% increase in the number of women STEM entrepreneurs in Indiana. The positive sign of this coefficient does not align with expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. However, higher interest rates could create a wealth effect, driving entrepreneurship. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Indiana produces a 1.35% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as higher per-capita income typically reflects greater demand and opportunity for entrepreneurs. The data shows that per-capita income has been increasing over the years, which should theoretically support entrepreneurship.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Indiana compared to the pre-pandemic period. The negative sign of this coefficient aligns with expectations, as it suggests that women's STEM entrepreneurship in Indiana may have been negatively impacted by the pandemic.

5-16-2 Indiana Policy Implications

Based on the Indiana CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-15: Indiana Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors and educate them on investing in diverse STEM sectors in Indiana. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Congress could work with Indiana's state government to tie institutional funding to internships, mentorship and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Indiana to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government can help Indiana establish a dedicated fund to provide emergency assistance to help women STEM entrepreneurs.	1. Facilitates the growth of women-owned STEM businesses. 2. Supports the growth and scaling of women STEM ventures. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Facilitates increased female STEM entrepreneurship. 5. Creates demand for women STEM entrepreneurs' services. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

Implementing these policy measures, can create a more supportive and inclusive environment for women STEM entrepreneurs in Indiana, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and emergency assistance can help unlock the full potential of women STEM entrepreneurs in Indiana, driving innovation, economic growth, and social progress for the state and beyond.

5-17 Iowa Model Results and Policy Implications

The data for Iowa from 2012 to 2020 reveals moderate growth and fluctuations across various economic indicators. Venture capital investment in female-founded or co-founded firms shows an inconsistent trend with significant year-to-year variations. The total investment ranged from a low of $2 million in 2014 to a peak of $33 million in 2018, before declining to $17 million in 2020. This volatility suggests an unpredictable environment for female entrepreneurs seeking venture capital in the state, though there are signs of improvement in recent years.

Iowa demonstrates steady growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 178 in 2012 to 217 in 2020, with a peak of 266 in 2019, representing a 22% overall increase. Employment trends in Iowa show modest but consistent growth until 2019, with total employment rising from 1,508,800 in 2012 to 1,587,200 in 2019, before declining to 1,508,600 in 2020 due to the impact of the COVID-19 pandemic. Iowa's economic growth is further reflected in its per capita income, which rose from $42,541 in 2012 to $52,586 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period.

In Iowa, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 1,074 to 1,341 over the years. The number of nonemployer firms in this sector is even higher, ranging from 8,419 to 9,400, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Iowa. The number of employer firms in this sector ranges from 777 to 1059, while the number of nonemployer firms ranges from 4,205 to 4,600. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms in Iowa, with numbers ranging from 31 to 56 over the years. Miscellaneous Manufacturing also has a relatively consistent presence of employer firms, although in lower numbers compared to Fabricated Metal Product Manufacturing.

Several manufacturing sectors have no data or little data on employer firms in Iowa. These include Chemical Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing. Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing have no to little data on nonemployer firms. Miscellaneous

Manufacturing has the highest number of nonemployer firms in the manufacturing sectors. Data Processing, Hosting, and Related Services has a higher number of nonemployer firms than manufacturing sectors, except for Miscellaneous Manufacturing.

5-17-1 Iowa Model Interpretations

A 1% increase in the number of women patentees produces a 0.029% decrease in the number of women entrepreneurs. This could be because women patentees in Iowa are present in highly concentrated sectors, leading to overcrowding, competition, and failure amongst firms.

Similarly, a 1% increase in venture capital funding produces a .004% decrease in the number of women entrepreneurs. Venture capital funds devoted to promotion of women entrepreneurs do not have the expected effect. It is possible that these funds are directed to concentrated sectors leading to competition and firm closures, or they lead to ownership dilution.

The estimated effect of the labor force is positive. The estimate indicates a 1% increase in the labor force would produce about a 1.7% decrease in the number of women entrepreneurs. It is possible that this increase in the labor force does not lead to increases in the skilled workforce, existing firms compete to hire these workers, leading to firm failures.

The increase in the interest rates has a positive sign, a 1% rise in interest rates is projected to cause a 0.03% increase in the number of women STEM entrepreneurs. This implies that interest rates do not impact these firms greatly in Iowa.

Increasing women STEM graduates by 1% would produce about a 0.35% increase in women entrepreneurs. This sign conforms to expectations.

Per-capita real income should reflect demand, in that more demand should lead to more women STEM entrepreneurs, so that the sign for this coefficient should be positive. In this regression, a 1% increase in per-capita real income is projected to cause 0.371% increase in the number of women STEM entrepreneurs, all else held constant.

Finally, the COVID-19 dummy is negative. This sign should be negative - the pandemic should have decreased the number of women STEM entrepreneurs.

5-17-2 Iowa Policy Implications

Based on the Iowa CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-16: Iowa Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors and educate them on investing in diverse STEM sectors in Iowa. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Congress could work with Iowa's state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Iowa to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government can help Iowa establish a dedicated fund to provide emergency assistance to help women STEM entrepreneurs.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Supports the growth and scaling of women STEM ventures. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Facilitates female STEM entrepreneurship. 5. Increases the demand for women STEM entrepreneurs' services. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

Implementing these policies and programs that cover the areas of patenting and commercialization, funding, education and workforce development, economic growth, and emergency assistance will create an entrepreneurial ecosystem in Iowa that will help female STEM entrepreneurs thrive and succeed.

5-18 Kansas Model Results and Policy Implications

From 2012 to 2020, Kansas reveals modest growth and fluctuations across various economic indicators. Venture capital investment in female-founded or co-founded firms shows an inconsistent trend with significant year-to-year variations. The total investment ranged from a low of $3.2 million in 2012 to a peak of $14.224 million in 2020, with notable fluctuations in between. This volatility suggests an unpredictable environment for female entrepreneurs seeking venture capital in the state, though there are signs of improvement in recent years, particularly in 2020.

Kansas demonstrates a mixed trend in women's participation in innovation, as evidenced by the number of women patentees. This figure fluctuated over the years, starting at 203 in 2012, peaking at 253 in 2013, and ending at 182 in 2020. Employment trends in Kansas show modest but generally consistent growth until 2019, with total employment rising from 1,358,100 in 2012 to 1,423,800 in 2019, before declining to 1,358,900 in 2020 due to the impact of the COVID-19 pandemic. Kansas's economic growth is further reflected in its per capita income, which rose from $44,914 in 2012 to $55,041 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In Kansas, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 1,227 to 1,651 over the years. The number of nonemployer firms in this sector is even higher, ranging from 9,201 to 10,500, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Kansas. The number of employer firms in this sector ranges from 654 to 1003, while the number of nonemployer firms ranges from 3,453 to 4,400. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Miscellaneous Manufacturing has the highest concentration of employer firms in Kansas, with numbers ranging from 35 to 52 over the years. Fabricated Metal Product Manufacturing and Machinery Manufacturing also have a relatively consistent presence of employer firms, although in lower numbers compared to Miscellaneous Manufacturing. Chemical Manufacturing also has a relatively low concentration of employer firms,

Some manufacturing sectors have little to no data on employer firms in Kansas. These include Computer and Electronic Product Manufacturing and Electrical Equipment, Appliance, and Component Manufacturing.

The manufacturing sectors also have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, Miscellaneous Manufacturing and Chemical

Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these fields. Data Processing, Hosting, and Related Services has a few hundred nonemployer firms, though the numbers are less than for Miscellaneous Manufacturing.

5-18-1 Kansas Model Interpretations

A 1% increase in the number of women patentees is associated with a 0.062% increase in the number of women STEM entrepreneurs in Kansas. The positive sign aligns with expectations, suggesting that policies increasing the number of women patentees could potentially increase the number of women entrepreneurs in STEM fields.

The impact of venture capital funding on the number of women STEM entrepreneurs in Kansas remains positive. A 1% increase in venture capital funding is projected to lead to a 0.028% increase in the number of women STEM entrepreneurs.

The labor force variable has a positive coefficient, indicating that a 1% increase in the labor force is associated with a 1.446% increase in the number of women STEM entrepreneurs in Kansas. The positive sign suggests that growth in Kansas's labor force might provide increased opportunities for women to hire skilled and child care workers.

The effect of interest rates on the number of women STEM entrepreneurs in Kansas is negative. A 1% rise in interest rates is projected to cause a 0.031% decrease in the number of women STEM entrepreneurs.

The impact of women STEM graduates on the number of women STEM entrepreneurs in Kansas is positive. A 1% increase in women STEM graduates is associated with a 0.214% increase in the number of women STEM entrepreneurs.

The per-capita real income variable has a negative coefficient, indicating that a 1% increase in per-capita real income is projected to cause a 0.251% decrease in the number of women STEM entrepreneurs in Kansas. This negative relationship might be due to women abandoning entrepreneurship to raise families as per-capita real income increases.

Finally, the COVID-19 dummy variable has a positive coefficient, suggesting that the pandemic was associated with an increase in the number of women STEM entrepreneurs in Kansas.

5-18-2 Kansas Policy Implications

Based on the Kansas CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-17: Kansas Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Federal agencies could work with Kansas state/local agencies to tie institutional funding to female STEM enrollment and exposure. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Kansas. 3. The federal government could provide funding to Kansas for investment in training programs for a skilled workforce. 4. Congress could work with Kansas state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM student and graduates. 5. The federal government could provide grants to the state government to fund childcare and other care options to female STEM entrepreneurs. other care support. 6. The federal government could provide funding to the state to invest in the continued innovation and adaptability demonstrated by women STEM entrepreneurs.	1. Strengthens the pipeline of potential women STEM entrepreneurs. 2. Supports the growth and scaling of women STEM ventures. 3. Creates a more inclusive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs. 6. Supports the continued growth and success of women-owned STEM businesses.

These policy solutions that cover education, funding, child care, resiliency and other areas will result in an entrepreneurial climate conducive for the growth and success of female STEM entrepreneurs in Kansas.

5-19 Kentucky Model Results and Policy Implications

From 2012 to 2020, the data on Kentucky reveals significant growth and fluctuations across various economic indicators. Venture capital investment in female-founded or co-founded firms shows a dramatic upward trend, particularly in the later years. The total investment increased from $6.4 million in 2012 to $149.813 million in 2020, with a notable surge in 2019 and 2020. This substantial growth suggests an increasingly supportive environment for female entrepreneurs in Kentucky, especially in recent years.

Kentucky demonstrates modest growth in women's participation in innovation, as evidenced by the number of women patentees. This figure increased from 168 in 2012 to 200 in 2020, representing a 19% increase over the period. Employment trends in Kentucky show steady growth until 2019, with total employment rising from 1,811,200 in 2012 to 1,945,400 in 2019, before declining to 1,838,000 in 2020 due to the impact of the COVID-19 pandemic. Kentucky's economic growth is further reflected in its per capita income, which rose from $35,631 in 2012 to $47,026 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period, despite challenges in other areas.

In Kentucky, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both female employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector ranges from 1,489 to 1,970 over the years. The number of nonemployer firms in this sector is even higher, ranging from 11,188 to 13,000, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both female employer and nonemployer firms in Kentucky. The number of employer firms in this sector ranges from 985 to 1,660, while the number of nonemployer firms ranges from 5,912 to 7,400. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms in Kentucky, with numbers ranging from 43 to 150 over the years. Miscellaneous Manufacturing also has a relatively consistent presence of employer firms, with numbers ranging from 42 to 54.

Several manufacturing sectors have no to little data on employer firms in Kentucky. These include Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing.

The manufacturing sectors also have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health Care Services sectors. However, Miscellaneous Manufacturing and Chemical Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these sectors. There are approximately 200 nonemployer firms in the Data Processing, Hosting, and Related Services sector over the years. There numbers are less than Miscellaneous Manufacturing for most years except for 2020, when they are equal.

5-19-1 Kentucky Model Interpretations

A 1% increase in the number of women patentees is associated with a 0.149% increase in the number of women STEM entrepreneurs in Kentucky. This positive relationship aligns with expectations, suggesting that policies supporting women in the patenting process could lead to an increase in women STEM entrepreneurs in the state.

The impact of venture capital funding on the number of women STEM entrepreneurs in Kentucky is positive. A 1% increase in venture capital funding is projected to lead to a 0.025% increase in the number of women STEM entrepreneurs. This finding suggests that venture capital funds dedicated to promoting women entrepreneurs in the state are having the expected positive effect, albeit small in magnitude.

The labor force variable has a positive effect. A 1% increase in the labor force is associated with a 0.796% increase in the number of women STEM entrepreneurs in Kentucky. This relationship is expected, as an increase in the labor force provides women with better child care resources, networking opportunities, and representation in entrepreneurial environments.

The effect of interest rates on the number of women STEM entrepreneurs in Kentucky is negative. A one percentage point rise in interest rates is projected to cause a 0.001% decrease in the number of women STEM entrepreneurs. This small coefficient suggests that the impact of interest rates on women STEM entrepreneurs in Kentucky is not significant.

The coefficient for women STEM graduates indicates that a 1% increase leads to a 0.131% increase in the number of women STEM entrepreneurs in Kentucky. This positive relationship aligns with expectations, as a larger supply of female STEM graduates should contribute to an increase in women STEM entrepreneurship.

The per-capita real income variable shows that a 1% increase in per-capita real income is projected to cause a 0.353% decrease in the number of women STEM entrepreneurs in Kentucky. With higher incomes, women may decide to raise families, rather than pursue entrepreneurship.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Kentucky. This positive effect could be related to factors such as increased demand for services provided by women STEM entrepreneurs during the pandemic or financial support received by women-owned businesses during this period.

5-19-2 Kentucky Policy Implications

Based on the Kentucky CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-18: Kentucky Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Kentucky state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Kentucky. 3. Congress could provide childcare stabilization grants the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Congress could work with Kentucky state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide grants to the state government to fund childcare and other care options to female STEM entrepreneurs. 6. The federal government could provide funding to the state to invest in the continued innovation and adaptability demonstrated by women STEM entrepreneurs during emergencies.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs. 6. Supports the continued growth and success of women-owned STEM businesses.

By implementing these policy measures, Kentucky can foster a more supportive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis.

5-20 Louisiana Model Results and Policy Implications

The data for Louisiana reveals modest growth and fluctuations across various economic indicators from 2012 to 2020. Venture capital investment in female-founded or co-founded firms shows an overall upward trend, albeit with significant year-to-year variations. The total investment increased from $1.232 million in 2012 to $14.8 million in 2020, with notable growth in the last two years. This trend suggests an improving environment for female entrepreneurs in Louisiana, particularly in recent years, despite the relatively low overall investment amounts compared to some other states.

Louisiana demonstrates inconsistent trends in women's participation in innovation, as evidenced by the number of women patentees. This figure fluctuated over the years, starting at 75 in 2012, dropping to a low of 55 in 2017, and then rising to 88 in 2020. Employment trends in Louisiana show modest growth until 2019, with total employment rising from 1,929,600 in 2012 to 1,993,600 in 2019, before declining sharply to 1,843,600 in 2020 due to the impact of the COVID-19 pandemic. Louisiana's economic growth is reflected in its per capita income, which rose from $40,662 in 2012 to $50,243 in 2020, showcasing the state's overall economic improvement and increasing standard of living during this period, despite challenges in other areas.

In Louisiana, the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among the STEM sectors. The number of employer firms in this sector is high, ranging from 1,665 to 1,912 over the years. The number of nonemployer firms in this sector is also substantial, ranging from 16,124 to 18,500, indicating a strong presence of self-employed professionals and small businesses in this field.

The Ambulatory Health Care Services sector is the second most concentrated for both employer and nonemployer firms in Louisiana. The number of employer firms in this sector ranges from 1,289 to 1,597, while the number of nonemployer firms ranges from 11,825 to 15,500. This highlights the importance of healthcare services provided by small clinics, medical practices, and self-employed healthcare professionals in the state.

Among the manufacturing sectors, Fabricated Metal Product Manufacturing has the highest concentration of employer firms in Louisiana, with numbers ranging from 72 to 89 over the years. However, in recent years, there is no employer firm data in this sector.

Several manufacturing sectors have the little to no data on employer firms in Louisiana. These include Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing.

The manufacturing sectors also have a lower concentration of nonemployer firms compared to the Professional, Scientific, and Technical Services and Ambulatory Health

Care Services sectors. However, Miscellaneous Manufacturing and Chemical Manufacturing have the highest number of nonemployer firms among the manufacturing sectors, indicating the presence of self-employed individuals and small businesses in these fields. Data Processing, Hosting, and Related Services has approximately equal number of nonemployer firms as Miscellaneous Manufacturing.

5-19-1 Louisiana Model Interpretations

A 1% increase in the number of women patentees is associated with a 0.018% decrease in the number of women STEM entrepreneurs in Louisiana. The negative sign does not conform to expectations. This could be due to various factors, such as barriers to entrepreneurship beyond the patenting process, or a lack of support and resources for women inventors to transition into entrepreneurial roles. It is also possible that the patentees are clustered in the highly concentrated fields, leading to increased competition and firm failures.

The impact of venture capital funding on the number of women STEM entrepreneurs in Louisiana is positive, but the magnitude is small. A 1% increase in venture capital funding is projected to lead to a 0.004% increase in the number of women STEM entrepreneurs. This suggests that while venture capital funding may have a positive effect on women STEM entrepreneurship in Louisiana, the impact is limited. Factors such as the allocation of funds across sectors, the level of competition, and the overall entrepreneurial ecosystem in the state may influence the effectiveness of venture capital in promoting women STEM entrepreneurs.

The labor force variable has a negative coefficient, indicating that a 1% increase in the labor force is associated with a 0.476% decrease in the number of women STEM entrepreneurs in Louisiana. This unexpected relationship could be attributed to various factors, such as the composition of the labor force, the availability of resources and support for entrepreneurs, and the overall economic conditions in the state. It is possible that an increase in the labor force may not necessarily translate into better opportunities for women STEM entrepreneurs in Louisiana. The increase in labor force may not be related to an increase in the skilled labor force in specific STEM sectors, depriving female STEM entrepreneurs of the opportunity to hire them, or leading to great competition in hiring and failure of some firms.

The effect of interest rates on the number of women STEM entrepreneurs in Louisiana is positive. A one percentage point rise in interest rates is projected to cause a 0.101% increase in the number of women STEM entrepreneurs. This relationship is counterintuitive, as higher interest rates typically make it more challenging for entrepreneurs to access financing. However, it is possible that other factors, such as the availability of alternative funding sources or the overall economic conditions in the state, may mitigate the impact of interest rates on women STEM entrepreneurs in Louisiana. It is also possible that women entrepreneurs in Louisiana don’t rely on traditional financing, and therefore interest rate changes do not impact them, or that they experience wealth effects.

The coefficient for women STEM graduates indicates that a 1% increase leads to a 0.342% increase in the number of women STEM entrepreneurs in Louisiana. This positive relationship aligns with expectations, as a larger pool of women with STEM education should contribute to an increase in women STEM entrepreneurship. However, the small magnitude of the effect suggests that other factors, such as the entrepreneurial ecosystem, access to resources, and societal barriers, may also play a role in determining the number of women STEM entrepreneurs in the state.

The per-capita real income variable shows that a 1% increase in per-capita real income is projected to cause a 1.564% decrease in the number of women STEM entrepreneurs in Louisiana. This negative relationship is surprising, as higher per-capita income typically reflects greater demand and opportunity for entrepreneurs. However, per-capita income could be acting as a supply variable in this case, with women taking advantage of improved financial conditions to leave entrepreneurship and raise families.

Finally, the COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Louisiana. This positive effect suggests that the pandemic may have created some opportunities for women STEM entrepreneurs in the state. Factors such as the increased demand for certain products and services, the availability of financial support for small businesses, and the shift towards remote work and digital platforms may have contributed to this positive impact.

5-19-2 Louisiana Policy Implications

Based on the Louisiana CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-19: Louisiana Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors on investing in female STEM businesses in Louisiana. 3. The federal government could provide funding to Louisiana for investment in training programs for a skilled workforce. 4. Congress could work with Louisiana state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide childcare and other care options to female STEM entrepreneurs. 6. The federal government could provide funding to the state to invest in the continued innovation and adaptability demonstrated by women STEM entrepreneurs during emergencies.	1. Facilitates the growth of women-owned STEM businesses. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs. 6. Supports the continued growth and success of women-owned STEM businesses in challenging times.

By implementing these policy measures, Louisiana can foster a more supportive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis.

5-21 Maine Model Results and Policy Implications

Maine's entrepreneurial landscape has shown varying trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a moderate increase in the number of women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, there is little data on the number of employer firms. Miscellaneous Manufacturing has the most notable presence in employer firms. The number of nonemployer firms in Chemical Manufacturing, Fabricated Metal Product manufacturing and Miscellaneous Manufacturing has remained relatively stable, with Miscellaneous Manufacturing having the highest number of nonemployer firms in manufacturing.

The Professional, Scientific, and Technical Services sector had a moderate number of employer firms, ranging from 482 to 829 firms throughout the period, although data was not consistently available for all years. The nonemployer firms in this sector have shown a general increase over time, going from 5,626 to 6,800 firms.

In the health care sector, Ambulatory Health Care Services had a small presence of employer firms, with numbers ranging from 492 to 675. The number of nonemployer firms in this sector remained relatively stable, with around 3,100 to 3,600 firms.

Maine witnessed a moderate increase in the number of women patentees during this period, rising from 66 in 2012 to 74 in 2020, with a peak of 90 in 2017. While this trend indicates a growing participation of women in innovation and intellectual property creation, the overall numbers remain relatively low compared to other states.

Venture capital funding in Maine remained relatively low throughout the period, with total funding ranging from $1.5 million in 2012 to $8.652 million in 2020.

Maine's total employed population aged 16 and above remained relatively stable, with a slight decrease from 598,500 in 2012 to 597,600 in 2020. However, the state's per capita income consistently increased from $39,993 in 2012 to $54,301 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, Maine's entrepreneurial ecosystem has shown limited activity in the manufacturing, professional, scientific, and technical services, and health care sectors, with a stronger presence of nonemployer firms compared to employer firms. The state has witnessed a moderate increase in women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs. However, venture capital funding has remained relatively low throughout the period. Despite the challenges posed by the COVID-19 pandemic, Maine's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-21-1 Maine Model Interpretations

The coefficient for women patentees is 0.669, indicating that a 1% increase in the number of women patentees in Maine is associated with a 0.669% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as a higher number of women patentees is generally expected to lead to more women STEM entrepreneurs. The positive coefficient suggests that efforts to support and encourage women to obtain patents in Maine may have a beneficial impact on women's STEM entrepreneurship in the state.

Maine has a highly entrepreneurial environment for women STEM entrepreneurs. "In 2017, Maine was the top state for revenue growth among women-owned businesses and second-best for job growth, according to last year's American Express report." (Anderson 2018). Maine provides resources, lower startup overhead costs, and opportunity to these businesses.

Maine's institutions of higher learning promote female STEM entrepreneurship. The Frank & Eileen™ Center for Women's Entrepreneurial Leadership (F&E CWEL)[lxii] at Babson College educates leaders to create impact through industry and innovation. It is a source for business acceleration, entrepreneurship research and leadership. These resources probably help women transition from creating patents to becoming entrepreneurs.

The coefficient for venture capital funding is -0.034, suggesting that a 1% increase in venture capital funding in Maine is associated with a 0.034% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is unexpected, as increased venture capital funding is generally thought to support entrepreneurial activities. The negative coefficient may indicate that the current allocation of venture capital funding in Maine is not effectively supporting women's STEM entrepreneurship, or that there are other factors limiting the impact of venture capital on women-owned STEM ventures in the state. Venture funding could be going to STEM sectors that are concentrated, leading to competition and firm failures, or venture funding could be leading to dilution of ownership.

The coefficient for the labor force is 0.46, indicating that a 1% increase in Maine's labor force is associated with a 0.46% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as a larger labor force is generally expected to provide a broader pool of childcare and skilled workers. The positive coefficient suggests that policies and initiatives aimed at increasing labor force participation in Maine may have a positive effect on women's STEM entrepreneurship in the state.

The coefficient for national women STEM graduates is -1.82, suggesting that a 1% increase in the number of women STEM graduates nationally is associated with a 1.82% decrease in the number of women STEM entrepreneurs in Maine. This negative relationship is surprising, as a larger pool of women STEM graduates is generally expected to contribute positively to women's STEM entrepreneurship. The negative coefficient may indicate that there are state-specific factors in Maine that are limiting the translation of the national trend in women's STEM education into increased entrepreneurial activity within the state. It is also possible that these graduates are in the concentrated STEM sectors, leading to increased competition and failure amongst firms.

The coefficient for the national interest rate is 0.17, indicating that a one-unit increase in the interest rate is associated with a 0.17% increase in the number of women STEM entrepreneurs in Maine. This positive relationship is counterintuitive, as higher interest rates may make it more difficult for entrepreneurs to access financing for their ventures. The positive coefficient may suggest that other factors, such as the overall economic environment or the availability of alternative financing options, are mitigating the potential negative impact of higher interest rates on women's STEM entrepreneurship in Maine, or that higher interest rates lead to positive wealth effects.

The coefficient for real income is 5.36, indicating that a 1% increase in Maine's real income is associated with a 5.36% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as higher income levels are generally expected to support entrepreneurial activity and provide more opportunities for individuals to start and grow their businesses. The positive coefficient suggests that policies and initiatives aimed at increasing real income in Maine may have a positive impact on women's STEM entrepreneurship in the state. This is probably due to the support provided to women entrepreneurs mentioned above.

It is important to note that the presence of missing values in the regression output limits the interpretability of the results. The lack of statistical significance measures and potential data limitations may affect the reliability of the coefficients and their associated economic interpretations. Despite these limitations, the regression results provide insights into the potential factors influencing women's STEM entrepreneurship in Maine. The positive coefficients for women patentees, labor force, and real income suggest that efforts to support these areas may have a positive impact on women's STEM entrepreneurship in the state. The negative coefficients for venture capital funding and national women STEM graduates highlight the need for further research to understand the specific dynamics and challenges related to these factors in the context of Maine's entrepreneurial ecosystem.

5-21-2 Maine Policy Implications

Based on the Maine CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-20: Maine Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Maine state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train Maine female lenders to invest in diverse STEM sectors. 3. Congress could provide stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Federal grant funding for Arizona institutions could be tied to promoting female faculty. 5. The federal government could invest in infrastructure projects in Maine to foster economic growth and create a supportive environment for entrepreneurship.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Facilitates female STEM entrepreneurship. 5. Encourages innovation and risk-taking among women STEM entrepreneurs.

Implementing these policy measures will create a more supportive and inclusive environment for women STEM entrepreneurs in Maine, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering economic growth can help unlock the full potential of women STEM entrepreneurs in Maine, driving innovation, economic and social progress for the state and beyond.

5-22 Maryland Model Results and Policy Implications

In Maryland, the data from 2012 to 2020 shows that the Professional, Scientific, and Technical Services sector consistently has the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 3,884 to 4,856 over the years, while nonemployer firms show even higher numbers, ranging from 31,430 to 35,500. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 2,676 to 3,490 and nonemployer firms from 19,571 to 23,000, highlighting the importance of healthcare services in the state.

Among manufacturing sectors, Fabricated Metal Product Manufacturing shows the highest concentration of employer firms, though the numbers are much lower compared to the service sectors, ranging from 33 to 86 firms. Chemical Manufacturing and Miscellaneous Manufacturing show a consistent presence in nonemployer firms. There is little to no data for both employer and nonemployer firms in the Electrical Equipment, Appliance, and Component Manufacturing sector. Transportation Equipment Manufacturing, shows very low nonemployer numbers throughout most of the period. Computer and Electronic Product Manufacturing shows a moderate presence in both employer and nonemployer categories, but with relatively low numbers compared to the top sectors. Data Processing, Hosting, and Related Services has a few hundred firms over the years, with fewer firms than Miscellaneous Manufacturing in the former years and equal in the latter years. This distribution suggests that Maryland's STEM economy is heavily tilted towards professional services and healthcare, with a smaller but notable presence in certain manufacturing sectors and the data processing sector in later years.

Maryland has witnessed a consistent rise in the number of women patentees from 576 in 2012 to 1047 in 2020, demonstrating the growing involvement of women in innovation and intellectual property creation. This upward trend suggests that more women in the state are actively developing new technologies and securing patents for their inventions, which is a positive sign for fostering a diverse and inclusive innovation ecosystem.

Venture capital funding in Maryland has experienced fluctuations over the years, with notable increases in 2014 (128.75 million) and 2016 ($182.336 million). In 2020, the state saw a significant surge in total venture capital funding, indicating a growing interest among investors in supporting startups and innovative businesses. It's important to note that venture capital funding can be broken down into two categories: funding for firms founded by both men and women or co-founded firms and funding for female-founded firms. The data shows that both co-founded and female-founded investments have contributed to the overall growth in venture capital funding in Maryland, with investments experiencing a substantial increase in 2020. That said, co-founded funding was significantly larger than female-founded funding in every year of the analysis.

The state's labor force, represented by the total number of employed people, remained relatively stable, close to 2,600,000 to 2,700,000 throughout the period, with a slight increase from 2012 to 2019. However, there was a decline in 2020 from 2019, which could be attributed to the impact of the COVID-19 pandemic on employment levels.

The per capita income in the state consistently increased from $52, 490 in 2012 to $64,825 in 2020, indicating an improvement in the standard of living for Maryland residents.

In summary, Maryland's entrepreneurial ecosystem has shown promising trends, particularly in the growth of nonemployer firms in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The rise in women patentees and the increase in venture capital funding, especially for female-founded firms, demonstrate the state's commitment to fostering innovation and supporting diverse entrepreneurship. Despite the challenges posed by the COVID-19 pandemic, Maryland's entrepreneurial landscape remains resilient and well-positioned for future growth and development.

5-22-1 Maryland Model Interpretations

A 1% increase in the number of women patentees is associated with a 0.190% decrease in the number of women STEM entrepreneurs in Maryland. This suggests that the relationship between women patentees and women STEM entrepreneurs in Maryland is complex and requires further investigation. It is possible that factors such as the commercialization process, access to resources, or the specific industries in which the patents are concentrated may influence the translation of women's patents into entrepreneurial ventures in the state.

A 1% increase in venture capital funding is associated with a 0.014% decrease in the number of women STEM entrepreneurs in Maryland. This indicates that the relationship between venture capital funding and women's STEM entrepreneurship in Maryland is not as expected. It is possible that the allocation of venture capital funding in the state may not be effectively supporting female STEM ventures, or that there are other factors limiting the impact of venture capital on women's entrepreneurship in this sector. Venture capital could be directed to concentrated sectors leading to increased competition and firm failures.

The coefficient for the labor force suggests that a 1% increase in Maryland's labor force is associated with an 8.814% decrease in the number of women STEM entrepreneurs in the state. This unexpected relationship may be due to the specific dynamics of Maryland's labor market. For example, if the growth in the labor force is concentrated in industries or positions that do not provide the necessary skills or resources for workers to be useful to female STEM entrepreneurs, it could lead to a negative association between labor force growth and women's STEM entrepreneurship in the state.

A 1% increase in the number of women STEM graduates nationally is associated with a 2.098% increase in the number of women STEM entrepreneurs in Maryland. This relationship conforms to expectations.

A one percentage point increase in the national interest rate is associated with a 0.048% increase in the number of women STEM entrepreneurs in Maryland. This unexpected relationship may be influenced by other economic factors, such as the overall entrepreneurial environment or the availability of alternative financing options, which could mitigate the potential negative impact of higher interest rates on women's STEM entrepreneurship in the state. It could also be due to a wealth effect experienced by these entrepreneurs.

A 1% increase in Maryland's real income is associated with a 0.614% increase in the number of women STEM entrepreneurs in the state. This suggests that the relationship between real income and women's STEM entrepreneurship in Maryland is positive. Increased incomes provide women the financial cushion to start STEM businesses.

The COVID-19 dummy variable suggests that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Maryland.

5-22-2 Maryland Policy Implications

Based on the Maryland CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-21: Maryland Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train Maryland female lender to invest in diverse STEM sectors. 3. The federal government could provide funding to Maryland for investment in training programs for a skilled workforce. 4. Congress could work with Maryland's state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Maryland to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could help Maryland establish a dedicated fund to provide assistance to women STEM entrepreneurs during emergencies.	1. Facilitates the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

By implementing these policy measures, Maryland can foster a more supportive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis.

5-23 Massachusetts Model Results and Policy Implications

In Massachusetts from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 2,962 to 4,561 over the years, while nonemployer firms show even higher numbers, ranging from 39,476 to 43,500. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 2,241 to 3,166 and nonemployer firms from 16,792 to 18,500, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing shows the highest concentration of employer firms, though the numbers are much lower compared to the service sectors, ranging from 78 to 92 firms (with some years showing zero, which indicates missing data rather than actual absence). Chemical Manufacturing and Miscellaneous Manufacturing also show a consistent presence in both employer and nonemployer categories. The least concentrated sector for employer firms is Electrical Equipment, Appliance, and Component Manufacturing. Transportation Equipment Manufacturing is the least concentrated sector for nonemployer firms. Computer and Electronic Product Manufacturing shows a moderate presence in both employer and nonemployer categories, but with relatively low numbers compared to the top sectors. There are a few hundred nonemployer firms in Data Processing, Hosting, and Related Services over the years, though their numbers are lower than Miscellaneous Manufacturing. This distribution suggests that Massachusetts' STEM economy is heavily focused on professional services and healthcare, with a smaller but notable presence in certain manufacturing sectors, particularly those related to chemicals and fabricated metal products.

A notable aspect of Massachusetts' entrepreneurial landscape is the substantial growth in the number of women patentees. From 2012 to 2020, the state witnessed a remarkable increase in women patentees, rising from 2,046 in 2012 to 3,377 in 2020. This upward trend highlights the growing participation and success of women in innovation and intellectual property creation, showcasing Massachusetts' commitment to fostering a diverse and inclusive entrepreneurial ecosystem.

Female venture capital funding in Massachusetts has shown impressive growth over the years, with a significant increase in total funding from $439.73 million in 2012 to $3,006.072 million in 2020. However, it is crucial to distinguish between the two categories of venture capital funding: funding for co-founded firms versus female-founded firms.

Throughout the period, co-founded investments consistently outpaced female-founded investments, indicating a disparity in funding allocation between male and female entrepreneurs. While both categories of funding experienced growth, the gap between these investments remained significant. In 2020, co-founded investments reached $2,897.1 million, while female-founded investments stood at $108.972 million, highlighting the need for continued efforts to bridge the funding gap and ensure equal access to capital for female-founded firms.

The state's labor force, represented by the total number of employed people, exhibited steady growth from 2012 (3,310,200) to 2019 (3,709,800), before experiencing a slight decline in 2020 (3,402,000), likely due to the impact of the COVID-19 pandemic. Despite this setback, Massachusetts' per capita income consistently increased throughout the period, from $56,269 in 2012 to $77,393 in 2020, reflecting an overall improvement in the standard of living for residents.

In conclusion, Massachusetts' entrepreneurial ecosystem has demonstrated remarkable growth and resilience, particularly in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state's strong focus on innovation and intellectual property creation, as evidenced by the substantial increase in women patentees, highlights its commitment to fostering a diverse and inclusive entrepreneurial environment. However, the disparity between co-founded and female-founded investments underscores the need for continued efforts to ensure equal access to funding for female founders. Despite the challenges posed by the COVID-19 pandemic, Massachusetts' entrepreneurial landscape remains robust and well-positioned for future growth and development, driven by a growing labor force and a supportive ecosystem.

5-23-1 Massachusetts Model Interpretations

A 1% increase in the number of women patentees is associated with a 0.014% increase in the number of women STEM entrepreneurs in Massachusetts. This positive relationship aligns with expectations, suggesting that policies increasing the number of women patentees could potentially increase the number of women entrepreneurs in STEM fields in the state.

A 1% increase in venture capital funding is associated with a 0.014% decrease in the number of women STEM entrepreneurs in Massachusetts. This negative relationship is unexpected, as venture capital funding is generally thought to support entrepreneurial activities. One possible explanation for this negative coefficient is that venture capital funds may be concentrated in sectors with a high number of women entrepreneurs, leading to increased competition. Furthermore, the influx of venture capital funding could lead to dilution effects, where the ownership and control of women-owned businesses by women are reduced as a result of additional funding rounds. These factors may contribute to the negative relationship between venture capital funding and the number of women STEM entrepreneurs in Massachusetts.

The coefficient for the labor force suggests that a 1% increase in Massachusetts' labor force is associated with a 7.491% decrease in the number of women STEM entrepreneurs in the state. This unexpected relationship may be due to the specific dynamics of Massachusetts' labor market. For example, if the growth in the labor force is concentrated in industries or positions that do not provide the necessary skills to workers for STEM industries, it could lead to a negative association between labor force growth and women's STEM entrepreneurship in the state.

A 1% increase in the number of women STEM graduates nationally is associated with a 2.369% increase in the number of women STEM entrepreneurs in Massachusetts. This positive relationship aligns with expectations, as a larger pool of women with STEM education should contribute to an increase in women's STEM entrepreneurship. However, the extent to which this national trend translates into increased women's STEM entrepreneurship in Massachusetts may also depend on other state-specific factors, such as the entrepreneurial ecosystem and access to resources.

A one percentage point increase in the national mortgage rate is associated with a 0.004% increase in the number of women STEM entrepreneurs in Massachusetts. This positive relationship is unexpected, as higher interest rates typically make it more difficult for entrepreneurs to access financing for their ventures. The positive association may be influenced by other economic factors, such as the overall entrepreneurial environment or the availability of alternative financing options, which could mitigate the potential negative impact of higher mortgage rates on women's STEM entrepreneurship in the state, or it could be due to wealth effects.

A 1% increase in Massachusetts' real income is associated with a 0.234% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as higher income levels are generally expected to support entrepreneurial activity and provide more opportunities for individuals to start and grow their businesses.

The COVID-19 dummy variable suggests that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Massachusetts. This negative relationship indicates that the pandemic may have had an adverse impact on women's STEM entrepreneurship in the state. Factors such as the specific industries affected, access to support programs, and the overall resilience of the entrepreneurial ecosystem in Massachusetts may have influenced this outcome.

5-23-2 Massachusetts Policy Implications

Based on the Massachusetts CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-22: Massachusetts Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train Massachusetts lenders to target less targeted STEM sectors. 3. Congress could work with Massachusetts state government to tie institutional funding to internships, mentorship and networking opportunities for female STEM students and graduates. 4. The federal government could invest in infrastructure projects in Massachusetts to foster economic growth and create a supportive environment for entrepreneurship. 5. The federal government could help Massachusetts establish a dedicated fund to provide assistance to women STEM entrepreneurs during emergencies.	1. Increase female commercialization exposure and facilitate increases in women patentees. 2. Increase access to funding for women businesses underrepresented in certain STEM sectors while avoiding overcrowding in concentrated sectors. 3. Build a strong pipeline of female-owned STEM businesses. 4. Increase the number of female startups within STEM. 5. Help female STEM firms sustain their businesses during difficult times.

The implementation of these policy measures can foster a more supportive environment for women STEM entrepreneurs in Massachusetts, addressing the unique challenges and opportunities identified in the state-level analysis.

5-24 Michigan Model Results and Policy Implications

In Michigan from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 3,762 to 5,249 over the years, while nonemployer firms show even higher numbers, ranging from 33,528 to 37,000. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 3,287 to 4,062 and nonemployer firms from 23,712 to 26,000, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing shows the highest concentration of employer firms, with numbers ranging from 234 to 395 firms. Machinery Manufacturing and Miscellaneous Manufacturing also show a consistent presence in both employer and nonemployer categories, with Miscellaneous Manufacturing having the greatest number of nonemployer firms in the manufacturing sectors. The least concentrated sector for nonemployer firms is Electrical Equipment, Appliance, and Component Manufacturing. Chemical Manufacturing and Computer and Electronic Product Manufacturing show a moderate presence in both employer and nonemployer categories, but with relatively low numbers compared to the top sectors. There are a few hundred nonemployer firms in the Data Processing, Hosting, and Related Services sectors, but their numbers are less than Miscellaneous Manufacturing. This distribution suggests that Michigan's STEM economy is heavily focused on professional services and healthcare, with a notable presence in certain manufacturing sectors, particularly those related to fabricated metal products and machinery.

Michigan has also seen a remarkable increase in the number of women patentees during this period. From 980 women patentees in 2012, the state witnessed a significant growth, reaching 1,755 in 2019 and 1,659 in 2020. This upward trend highlights the growing participation and success of women in innovation and intellectual property creation, showcasing Michigan's commitment to fostering a diverse and inclusive entrepreneurial ecosystem.

Venture capital funding in Michigan has shown growth over the years, with total funding increasing from $43.71 million in 2012 to $128.436 million in 2020. Throughout the period, co-founded firms' investments consistently outpaced female-founded firms' investments, indicating a disparity in funding allocation between male and female entrepreneurs. While both categories of funding experienced growth, the gap between these investments remained significant for most years. In 2020, co-founded investments reached $107.836 million, while female-founded investments stood at $20.6 million, highlighting the need for continued efforts to bridge the funding gap and ensure equal access to capital for female entrepreneurs.

The state's labor force, represented by the total number of employed individuals (both men and women), showed growth from 2012 (4,038,400) to 2019 (4,442,800), before experiencing a decline in 2020 (4,039,300), likely due to the impact of the COVID-19 pandemic. Despite this setback, Michigan's per capita income consistently increased throughout the period from $39,043 in 2012 to $52,786 in 2020, reflecting an overall improvement in the standard of living for residents.

In conclusion, Michigan's entrepreneurial ecosystem has demonstrated growth and resilience, particularly in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state's strong focus on innovation and intellectual property creation, as evidenced by the substantial increase in women patentees, highlights its commitment to fostering a diverse and inclusive entrepreneurial environment. However, the disparity between co-founded and female-founded investments underscores the need for continued efforts to ensure equal access to funding for female entrepreneurs. Despite the challenges posed by the COVID-19 pandemic, Michigan's entrepreneurial landscape remains robust and well-positioned for future growth and development, driven by a growing labor force and a supportive ecosystem.

5-24-1 Michigan Model Interpretations

A 1% increase in the number of women patentees in Michigan is associated with a 0.018% decrease in the number of women STEM entrepreneurs in the state. This suggests that the relationship between women patentees and women STEM entrepreneurs in Michigan may not be as strong as previously thought. Factors such as the commercialization process, access to resources, or the specific industries in which the patents are concentrated may influence the translation of women's patents into entrepreneurial ventures in the state.

A 1% increase in venture capital funding in Michigan is associated with a 0.007% decrease in the number of women STEM entrepreneurs in the state. The negative coefficient is unexpected, as increased venture capital funding is generally thought to support entrepreneurial activities. One possible explanation for this negative relationship is that venture capital funds may be concentrated in sectors with a high number of women entrepreneurs, leading to increased competition. Furthermore, the influx of venture capital funding could lead to dilution effects, where the ownership and control of women-owned businesses by women are reduced as a result of additional funding rounds. These factors may contribute to the negative relationship between venture capital funding and the number of women STEM entrepreneurs in Michigan.

The coefficient for the labor force suggests that a 1% increase in Michigan's labor force is associated with a 4.738% decrease in the number of women STEM entrepreneurs in the state. The unexpected relationship may be due to the specific dynamics of Michigan's labor market. For example, if the growth in the labor force is concentrated in industries or positions that do not provide the necessary skills to workers that they can apply in STEM industries, it could lead to a negative association between labor force growth and women's STEM entrepreneurship in the state.

A 1% increase in the number of women STEM graduates nationally is associated with a 1.398% increase in the number of women STEM entrepreneurs in Michigan. This positive relationship aligns with expectations, as a larger pool of women with STEM education should contribute to an increase in women's STEM entrepreneurship. However, the extent to which this national trend translates into increased women's STEM entrepreneurship in Michigan may also depend on other state-specific factors, such as the entrepreneurial ecosystem and access to resources.

A one-unit increase in the interest rate is associated with a 0.044% increase in the number of women STEM entrepreneurs in Michigan. This positive relationship is unexpected, as higher interest rates typically make it more difficult for entrepreneurs to access financing for their ventures. The positive association may be influenced by other economic factors, such as the overall entrepreneurial environment or the availability of alternative financing options, which could mitigate the potential negative impact of higher mortgage rates on women's STEM entrepreneurship in the state, or the creation of a wealth effect.

A 1% increase in Michigan's real income is associated with a 0.032% decrease in the number of women STEM entrepreneurs in the state. This negative relationship may be explained by the opportunity costs associated with pursuing entrepreneurship. As real income levels rise, women in STEM fields may face increased opportunity costs in terms of foregone wages and benefits from traditional employment, which may discourage them from starting their own ventures. Additionally, women may decide to leave to raise families.

The COVID-19 dummy variable suggests that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Michigan. This negative relationship indicates that the pandemic may have had an adverse impact on women's STEM entrepreneurship in the state. Factors such as the specific industries affected, access to support programs, and the overall resilience of the entrepreneurial ecosystem in Michigan may have influenced this outcome.

5-24-2 Michigan Policy Implications

Based on the Michigan CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-23: Michigan Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train Michigan female lenders to invest in diverse STEM sectors. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. The federal government could provide child care and other care options for female STEM entrepreneurs. 5. Congress could work with Michigan state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates 6. The federal government could provide funding to the state to invest in a fund to support Michigan female STEM entrepreneurs during emergencies.	1. Increases the pool of potential women STEM entrepreneurs in Michigan. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Builds a strong pipeline of diverse talent for Michigan's STEM industries and entrepreneurship. 4. Creates a favorable environment for women STEM entrepreneurs to start businesses. 5. Builds a pipeline of women STEM entrepreneurs. 6. Help female STEM firms sustain their businesses during difficult times.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Michigan, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in Michigan, driving innovation, economic growth, and social progress for the state and beyond.

5-25 Minnesota Model Results and Policy Implications

In Minnesota from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 3,528 to 4,017 over the years (with data missing for 2019 and 2020), while nonemployer firms show even higher numbers, ranging from 25,005 to 27,000. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 1,479 to 1,746 and nonemployer firms from 7,118 to 8,500, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing and Miscellaneous Manufacturing show the highest concentration of employer firms, with numbers ranging from 88 to 129 firms for each sector. Chemical Manufacturing and Machinery Manufacturing also show a consistent presence in both employer and nonemployer categories. The least concentrated sectors for both employer and nonemployer firms include Electrical Equipment, Appliance, and Component Manufacturing and Transportation Equipment Manufacturing, which show zero or very low numbers throughout most of the period. Computer and Electronic Product Manufacturing shows a minimal presence in both employer and nonemployer categories. This distribution suggests that Minnesota's STEM economy is heavily focused on professional services and healthcare, with a notable presence in certain manufacturing sectors, particularly those related to fabricated metal products and miscellaneous manufacturing.

Minnesota has also witnessed a notable increase in the number of women patentees during this period. From 1,222 women patentees in 2012, the state saw significant growth, reaching a peak of 1,584 in 2017. Despite a slight decline in subsequent years, the number of women patentees remained high, with 1,365 in 2020. This upward trend highlights the growing participation and success of women in innovation and intellectual property creation, showcasing Minnesota's commitment to fostering a diverse and inclusive entrepreneurial ecosystem.

Venture capital funding in Minnesota has shown growth over the years, with total funding increasing from $65.728 million in 2012 to $350.217 million in 2020. It is crucial to differentiate between the two categories of venture capital funding: funding for firms founded by both men and women, co-founded firms, and funding for female-founded firms.

Throughout the period, co-founded investments consistently outpaced female-founded investments, indicating a disparity in funding allocation between male and female entrepreneurs. While both categories of funding experienced growth, the gap between these investments remained significant. In 2020, co-founded investments reached $315.46 million, while female-founded investments stood at $34.757 million, highlighting the need for continued efforts to bridge the funding gap and ensure equal access to capital for female entrepreneurs.

The state's labor force, represented by the total number of employed individuals (both men and women), showed overall growth from 2012 to 2019, before experiencing a decline in 2020, likely due to the impact of the COVID-19 pandemic. Despite this setback, Minnesota's per capita income consistently increased throughout the period, reflecting an overall improvement in the standard of living for residents.

In conclusion, Minnesota's entrepreneurial ecosystem has demonstrated growth and resilience, particularly in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state's strong focus on innovation and intellectual property creation, as evidenced by the substantial increase in women patentees, highlights its commitment to fostering a diverse and inclusive entrepreneurial environment. However, the disparity between female-founded and co-founded investments underscores the need for continued efforts to ensure equal access to funding for female entrepreneurs. Despite the challenges posed by the COVID-19 pandemic, Minnesota's entrepreneurial landscape remains robust and well-positioned for future growth and development, driven by a growing labor force and a supportive ecosystem.

5-25-1 Minnesota Model Interpretations

A 1% increase in the number of women patentees in Minnesota produces about a 0.233% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Minnesota has been consistently high compared to other states, with a maximum of 1,584 in 2017. There could be several reasons for these results. The high number of women patentees may not necessarily translate into a higher number of women STEM entrepreneurs if there are barriers to commercializing these patents. Factors such as access to funding, mentorship, or networks may hinder the transition from patent holder to entrepreneur. Secondly, the patents held by women in Minnesota may be concentrated in specific industries that do not align with the sectors typically associated with STEM entrepreneurship. If the patents are in fields with limited entrepreneurial opportunities or high barriers to entry, the negative relationship may occur.

The Minneapolis-St. Paul region has a high concentration of patent activity, per the Saksena et al. (2022) USPTO study. IBM and the Mayo Clinic in Minnesota have been responsible for a number of patents[lxiii] and Minnesota is one of the locations for Procter and Gamble (P&G)[lxiv]. Many of the patents in Minnesota might have been done under the auspices of these large companies, making it difficult for women STEM startups to flourish.

A 1% increase in venture capital funding in Minnesota produces about a 0.088% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as increased venture capital funding is expected to support women STEM entrepreneurship. The dominance of the large firms mentioned above could explain the difficulties in entrepreneurship for female STEM entrepreneurs. The data shows that total venture capital funding in Minnesota has been relatively high compared to other states, with a maximum of $350.217 million in 2020. The negative relationship suggests that venture capital funding alone may not be sufficient to drive women's STEM entrepreneurship in Minnesota, and other factors such as competition in concentrated sectors could drive this relationship.

Furthermore, dilution effects can be another potential explanation for the negative relationship between venture capital funding and women's STEM entrepreneurship in Minnesota. Dilution refers to the reduction in ownership percentage that occurs when a company issues new shares to investors, such as venture capital firms, in exchange for funding.

The estimated effect of the labor force in Minnesota is high. The estimate indicates a 1% increase in the labor force would produce a 13.94% increase in the number of women STEM entrepreneurs in the state. The large magnitude of this coefficient may be due to the general trend that a growing labor force can create more job opportunities and potentially encourage entrepreneurship across sectors, including STEM fields. The data shows that the number of employed individuals in Minnesota has been relatively stable, with a maximum of 2,983,400 in 2019. The significant positive relationship suggests that the size of the labor force may be an important factor in driving women's STEM entrepreneurship in Minnesota, possibly by providing larger networks and child care options.

A 1% increase in the number of women STEM graduates nationally produces about a 3.409% decrease in the number of women STEM entrepreneurs in Minnesota. The negative sign of this coefficient is counterintuitive, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level. The data does not provide information on the number of women STEM graduates specific to Minnesota, making it difficult to draw conclusions about the state-level dynamics. However, the negative relationship may suggest that Minnesota's this relationship may be influenced by other factors such as the state's economic structure, industry conditions, and other characteristics that affect the entrepreneurial ecosystem.

A one percentage point increase in the interest rate produces about a 0.158% increase in the number of women STEM entrepreneurs in Minnesota. The positive sign of this coefficient is surprising, as higher rates are expected to make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The positive relationship, may suggest that other factors, such as the availability of alternative financing options, grants, state-specific economic conditions, and the wealth effect may be more influential in determining women's STEM entrepreneurship in Minnesota.

A 1% increase in per-capita real income in Minnesota produces about a 0.983% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as higher per-capita income levels are generally expected to support entrepreneurial activity, including in STEM fields. The data shows that per-capita income in Minnesota has been consistently increasing over the years, with a maximum of $61,278 in 2020. The positive relationship suggests that higher per-capita income may create a more favorable environment for women's STEM entrepreneurship in Minnesota, possibly by providing more financial resources and opportunities for starting and growing STEM ventures.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Minnesota compared to the pre-pandemic period. The positive sign of this coefficient is interesting, as it suggests that women's STEM entrepreneurship in Minnesota may have shown some resilience or adaptability during the pandemic. This could be due to the nature of STEM businesses, such as their ability to pivot to digital operations or the increased demand for certain STEM products and services during the crisis. The data shows that the number of nonemployer firms in the Professional, Scientific, and Technical Services sector decreased from 27,000 in 2018 and 2019 to 25,500 in 2020, whereas it increased in the Ambulatory Health Care Services sector from 8,200 in 2018 and 8,400 in 2019 to 8,500 in 2020. This suggests that the pandemic's impact on women's STEM entrepreneurship in Minnesota may have been complex and varied across different types of businesses. The positive relationship highlights the need for further investigation into the pandemic's impact on women's STEM entrepreneurship in Minnesota, taking into account the different STEM sectors.

5-25-2 Minnesota Policy Implications

Based on the Minnesota CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-24: Minnesota Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train Minnesota lenders to target less crowded sectors. 3. The federal government could tie K-12 funding in Minnesota to female STEM learning in diverse STEM sectors. 4. Federal grant funding for Minnesota institutions could be tied to promoting female faculty. 5. The federal government could invest in infrastructure projects in Minnesota to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could help the state to invest in the continued innovation and adaptability of women STEM entrepreneurs during emergencies.	1. Facilitates the transition from patent holder to successful entrepreneur. 2. Addresses sectoral allocation of venture capital, promoting growth and innovation. 3. Maintains a skilled and diverse talent pool for STEM entrepreneurship. 4. Fosters a supportive environment for women to transition from academia to entrepreneurship. 5. Creates a favorable environment for women STEM entrepreneurs to thrive. 6. Helps women STEM entrepreneurs navigate challenges and maintain business continuity.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Minnesota, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Minnesota, driving innovation, economic growth, and social progress for the state and beyond.

5-26 Mississippi Model Results and Policy Implications

In Mississippi from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 610 to 880 over the years, while nonemployer firms show significantly higher numbers, ranging from 7,415 to 8,900. This indicates a strong presence of self-employed professionals and small businesses in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 527 to 599 (with data missing for some years) and nonemployer firms from 6,180 to 8,800, highlighting the importance of healthcare services in the state's economy.

Among manufacturing sectors, Chemical Manufacturing shows the highest concentration of employer firms, though the numbers are relatively low, ranging from 8 to 11 firms. For nonemployer firms, Chemical Manufacturing and Fabricated Metal Product Manufacturing show the highest numbers among manufacturing sectors, but still with relatively low figures compared to the service sectors. The least concentrated sectors for both employer and nonemployer firms include Electrical Equipment, Appliance, and Component Manufacturing, Transportation Equipment Manufacturing, and Computer and Electronic Product Manufacturing, which show zero or very low numbers throughout most of the period. The Miscellaneous Manufacturing sector has the highest number of nonemployer firms amongst the manufacturing sectors. The Data Processing, Hosting, and Related Services sector has nonemployer firm numbers close to the Miscellaneous Manufacturing sector. This distribution suggests that Mississippi's STEM economy is heavily tilted towards professional services and healthcare, with a much smaller presence in manufacturing sectors and some presence in data processing.

The number of women patentees in Mississippi has shown fluctuations throughout the period. From 27 women patentees in 2012, the state saw an increase to 48 in 2014 and 2015. However, the number of women patentees declined in subsequent years, reaching a low of 24 in 2020. The inconsistent trend in women patentees suggests potential challenges in promoting and sustaining women's participation in innovation and intellectual property creation in Mississippi.

Venture capital funding data for Mississippi is limited, with no reported funding for female-founded firms from 2016 to 2020 and minimal funding for firms founded by both men and women throughout the period. The lack of available data makes it challenging to assess the state's venture capital landscape and its impact on entrepreneurship, particularly for women-owned ventures.

Mississippi's labor force, represented by the total number of employed individuals (both men and women), remained relatively stable from 2012 to 2019, with a slight increase over the years. However, the state experienced a decline in the labor force in 2020, likely due to the impact of the COVID-19 pandemic. Despite this setback, Mississippi's per capita income consistently increased throughout the period, reflecting an overall improvement in the standard of living for residents.

In conclusion, Mississippi's entrepreneurial ecosystem has shown mixed trends, with limited data availability in some sectors and years, making it difficult to draw definitive conclusions. The Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector have shown some growth in nonemployer firms, suggesting potential opportunities for self-employment and small business ownership. However, the fluctuations in the number of women patentees and the limited venture capital funding data indicate potential challenges in fostering a diverse and inclusive entrepreneurial environment. To support the growth and development of Mississippi's entrepreneurial landscape, particularly for women entrepreneurs, efforts should be made to address data gaps, promote innovation and intellectual property creation, and ensure access to funding and resources. By addressing these challenges and leveraging the state's strengths, Mississippi can work towards building a more robust and inclusive entrepreneurial ecosystem.

5-26-1 Mississippi Interpretations

First, the coefficient for women patentees reveals that a one percent increase in the number of female patentees results in a 0.09% decrease in the number of female STEM entrepreneurs in the state. This finding is somewhat unexpected, as one might assume that more women holding patents would lead to more women starting STEM businesses. However, this negative relationship could be due to various factors. For example, women patentees in Mississippi may face challenges in commercializing their inventions or may lack access to necessary resources and support to turn their patents into successful ventures. Additionally, there may be limited opportunities or a less supportive entrepreneurial ecosystem for women in STEM fields in the state.

The coefficient for venture capital funding is 0.012. This positive coefficient indicates that a one percent increase in venture capital funding in Mississippi is associated with a slight increase of about 0.012% in the number of female STEM entrepreneurs. While the magnitude of the coefficient is relatively small, it suggests that access to venture capital funding can play a role in encouraging women to start STEM businesses in the state. However, the limited impact of venture capital funding on female STEM entrepreneurship in Mississippi may be due to various factors, such as the overall availability of venture capital in the state, the distribution of funding across different sectors, or the existence of other barriers that women entrepreneurs face in accessing capital.

The coefficient for the labor force is -0.539. This negative coefficient suggests that a one percent increase in the overall labor force is associated with a 0.539% decrease in the number of female STEM entrepreneurs. This finding may seem counterintuitive, as a larger labor force could potentially provide more networking and child care opportunities. However, this negative relationship could be due to various factors. For example, if the growth in the labor force is primarily driven by non-STEM sectors or if there is a lack of skilled workers in STEM fields, it may not necessarily translate into increased female STEM entrepreneurship. Additionally, if the labor market conditions in Mississippi are challenging or if there are limited support systems for women entrepreneurs, a larger labor force may not necessarily lead to more women starting STEM businesses.

The coefficient for the national women STEM graduates is 0.521. This positive coefficient indicates that a one percent increase in national women STEM graduates is associated with an increase of about 0.521% in the number of female STEM entrepreneurs in Mississippi. This finding suggests that the overall national trend in women's participation in STEM education can have a positive influence on female STEM entrepreneurship in the state. As more women graduate with STEM degrees across the country, it may create a more supportive and encouraging environment for women to pursue entrepreneurship in STEM fields, even in states like Mississippi.

The coefficient for the national interest rate is 0.153. This positive coefficient suggests that a one percentage point increase in the interest rate is associated with a 0.153% increase in the number of female STEM entrepreneurs in Mississippi. This finding may seem counterintuitive, as higher interest rates could potentially make it more challenging for entrepreneurs to secure financing for their businesses. However, this positive relationship could be due to various factors. For example, higher interest rates may reflect a stronger overall economy, or create a wealth effect which could create more favorable conditions for entrepreneurship.

The lack of statistical significance measures in the regression output limits the interpretability of these results. In addition, the missing values in the female STEM entrepreneur numbers for Mississippi and potential data limitations leads to some coefficients such as for real per-capita income and COVID-19 not being computed. The missing values may also affect the reliability of the coefficients that are estimated and their associated economic interpretations.

5-26-2 Mississippi Policy Implications

Based on the Mississippi CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-25: Mississippi Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train female investors and educate them on investing in female STEM businesses in Mississippi. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Congress could work with Mississippi state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates.	1. Encourages and facilitates women's innovation and entrepreneurship in STEM fields. 2. Promotes the growth and scaling of female STEM businesses. 3. Provides female STEM entrepreneurs with access to a skilled and diverse workforce and childcare support. 4. Fosters a supportive environment for women STEM graduates to start businesses in the state.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Mississippi, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, and support for commercialization can help unlock the full potential of women STEM entrepreneurs in Mississippi, driving innovation, economic growth, and social progress for the state and beyond.

5-27 Missouri Model Results and Policy Implications

In Missouri from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 2,583 to 3,258 over the years, while nonemployer firms show significantly higher numbers, ranging from 18,176 to 21,000. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 1,153 to 2,452 (with data missing for some years) and nonemployer firms from 8,051 to 9,900, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing shows a high concentration of employer firms, with numbers ranging from 67 to 222 firms. Miscellaneous Manufacturing also shows a consistent presence in both employer and nonemployer categories. Miscellaneous Manufacturing has the highest number of nonemployer firms in the manufacturing sectors, over the years. The least concentrated sector for employer firms is Electrical Equipment, Appliance, and Component Manufacturing. Chemical Manufacturing and Machinery Manufacturing show a moderate presence in both categories, but with relatively low numbers compared to the top sectors. There are a few hundred nonemployer firms in the Data Processing, Hosting, and Related Services sectors, but their numbers are less than Miscellaneous Manufacturing. This distribution suggests that Missouri's STEM economy is heavily focused on professional services and healthcare, with a notable presence in certain manufacturing sectors, particularly those related to fabricated metal products and miscellaneous manufacturing.

Missouri has witnessed a remarkable increase in the number of women patentees during this period. From 324 women patentees in 2012, the state saw significant growth, reaching a peak of 517 in 2019. Despite a slight decline to 516 in 2020, the overall trend demonstrates a strong commitment to innovation and intellectual property creation among women entrepreneurs in Missouri.

Venture capital funding in Missouri has shown growth over the years, with total funding increasing from $2.691 million in 2012 to $101.35 million in 2019 and $101.2 million in 2020. However, it is essential to differentiate between the two categories of venture capital funding: funding for firms founded by both men and women and funding for female-founded firms.

Throughout the period, co-founded investments mostly outpaced female-founded investments, indicating a disparity in funding allocation between male and female entrepreneurs. While both categories of funding experienced growth, the gap between these investments remained noticeable. In 2020, co-founded investments reached $97.5 million, while female-founded investments stood at $3.7 million, highlighting the need for continued efforts to bridge the funding gap and ensure equal access to capital for female entrepreneurs.

Missouri's labor force, represented by the total number of employed individuals (both men and women), showed overall growth from 2012 (2,697,800) to 2019 (2,914,600), before experiencing a decline in 2020 (2,776,100), likely due to the impact of the COVID-19 pandemic. Despite this setback, Missouri's per capita income consistently increased throughout the period, from $39,983 in 2012 to $52,095 in 2020, reflecting an overall improvement in the standard of living for residents.

In conclusion, Missouri's entrepreneurial ecosystem has demonstrated growth and resilience, particularly in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state's strong focus on innovation and intellectual property creation, as evidenced by the substantial increase in women patentees, highlights its commitment to fostering a diverse and inclusive entrepreneurial environment. However, the disparity between co-founded and female-founded investments underscores the need for continued efforts to ensure equal access to funding for female entrepreneurs. Despite the challenges posed by the COVID-19 pandemic, Missouri's entrepreneurial landscape remains robust and well-positioned for future growth and development, driven by a growing labor force and a supportive ecosystem.

5-27-1 Missouri Model Interpretations

A 1% increase in the number of women patentees in Missouri produces about a 0.18% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Missouri has been consistently increasing over the years, with a maximum of 517 in 2019. The positive relationship suggests that the presence of a strong pool of women patentees in Missouri may be contributing to the growth of women's STEM entrepreneurship in the state, possibly by providing role models, mentorship, and knowledge spillovers that encourage more women to pursue entrepreneurial ventures in STEM fields.

A 1% increase in venture capital funding in Missouri produces about a 0.004% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that total venture capital funding in Missouri has been relatively low compared to other states, with a maximum of $101.35 million in 2019. This negative relationship could be attributed to the fact that there are many female-owned firms concentrated in specific sectors. Increasing investment in these sectors may lead to heightened competition, making it more challenging for both incumbent and new entrant firms to succeed. As a result, the increased supply of venture capital funding might not necessarily translate into a higher number of successful female STEM entrepreneurs in Missouri. Instead, it could lead to market saturation and increased competition, potentially causing some firms to fail. To address this issue, venture capital funding could be more strategically allocated to support female STEM entrepreneurs in diverse sectors, fostering a more balanced and sustainable entrepreneurial ecosystem in the state.

Additionally, the negative relationship between venture capital funding and women's STEM entrepreneurship in Missouri may be influenced by potential dilution effects. As venture capital firms invest in STEM ventures, they often receive a significant portion of the company's equity in return, which can lead to a dilution of the founder's ownership stake and a reduction in their control over the company's strategic direction. Furthermore, the concentration of venture capital funding in certain sectors or stages of venture development may not always align with the needs and preferences of women STEM entrepreneurs, leading to a mismatch between the supply and demand for venture capital funding in the state.

The estimated effect of the labor force in Missouri is positive. The estimate indicates a 1% increase in the labor force would produce a 2.99% increase in the number of women STEM entrepreneurs in the state. This may be due to the general trend that a growing labor force can create more job opportunities and potentially encourage entrepreneurship across sectors, including in the STEM fields. The data shows that the number of employed individuals in Missouri has been relatively stable, with a maximum of 2,914,600 in 2019. The positive relationship suggests that the size of the labor force may be an important factor in driving women's STEM entrepreneurship in Missouri, possibly by providing a larger pool of skilled and childcare workers supporting the growth of STEM businesses.

A 1% increase in the number of women STEM graduates nationally produces about an 0.41% decrease in the number of women STEM entrepreneurs in Missouri. The negative sign of this coefficient is counterintuitive, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level. The data does not provide information on the number of women STEM graduates specific to Missouri, making it difficult to draw conclusions about the state-level dynamics. It is possible that the increase in supply leads to increased competition, in which both incumbents and entrants fail, especially if the entrants specialize in fields where the incumbents already are in place in Missouri. It may be the case that there are implicit socially binding constraints to push women into specific sectors, and thus generate cutthroat competition. In addition, it is possible that STEM education is a pipeline to academia rather than to entrepreneurship in Missouri.

A one percentage point increase in the interest rate produces a 0.04% decrease in the number of women STEM entrepreneurs in Missouri. The negative sign of this coefficient is not surprising, as higher interest rates are expected to make it more difficult for women STEM entrepreneurs to access financing. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Missouri produces about an 0.34% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient can be explained by the concept of opportunity cost. As per-capita real income increases, the opportunity cost of pursuing entrepreneurship also increases, as individuals may have more attractive employment options or may be less willing to take on the risks associated with starting a business. The data shows that per-capita income in Missouri has been consistently increasing over the years, with a maximum of $52,095 in 2020. The negative relationship suggests that higher per-capita income may discourage some women from pursuing STEM entrepreneurship in Missouri due to the increased opportunity cost of forgoing other employment opportunities or the reduced necessity to start a business as a means of income generation.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Missouri compared to the pre-pandemic period. The positive sign of this coefficient is interesting, as it suggests that women's STEM entrepreneurship in Missouri may have shown some resilience or adaptability during the pandemic. This could be due to the nature of STEM businesses, such as their ability to pivot to digital operations or the increased demand for certain STEM products and services during the crisis. The data shows that the number of nonemployer firms in the Ambulatory Health Care Services sector increased from 9600 in 2019 to 9900 in 2020, potentially reflecting some of this resilience.

5-27-2 Missouri Policy Implications

Based on the Missouri CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-26: Missouri Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Missouri state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train new female investors and educate them on investing in diverse female STEM sectors. 3. The federal government could tie K-12 funding in Arizona to female STEM learning in diverse STEM sectors 4. The federal government could tie institutional funding to the promotion of female faculty. 5. The federal government could provide grants to the state government to provide childcare and other care options to female STEM entrepreneurs. 6. The federal government could provide funding to the state to invest in the continued innovation and adaptability of women STEM entrepreneurs in emergencies.	1. Fosters a strong pool of women patentees, promoting women's STEM entrepreneurship. 2. Increases access to funding for women-owned STEM businesses in diverse sectors. 3. Supports the growth of women-owned STEM ventures by providing access to a skilled and diverse workforce. 4. Fosters a supportive environment for women to transition from academia to entrepreneurship. 5. Helps offset the opportunity cost of entrepreneurship and reduces financial and personal barriers. 6. Fosters an agile and responsive entrepreneurial ecosystem that supports women STEM entrepreneurs during challenging times.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Missouri, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Missouri, driving innovation, economic growth, and social progress for the state and beyond.

5-28 Montana Model Results and Policy Implications

Montana's entrepreneurial landscape has shown varying trends from 2012 to 2020, with notable changes in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state has also witnessed fluctuations in the number of women patentees, indicating potential challenges in fostering a diverse and inclusive innovation ecosystem.

In Montana from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 582 to 1,049 over the years, while nonemployer firms show significantly higher numbers, ranging from 4,656 to 5,800. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 443 to 482 (with data missing for some years) and nonemployer firms from 1,809 to 2,500, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing shows the highest concentration of employer firms, though the numbers are relatively low, ranging from 15 to 40 firms. For nonemployer firms, Fabricated Metal Product Manufacturing and Miscellaneous Manufacturing show the highest numbers among manufacturing sectors, but still with relatively low figures compared to the service sectors. The least concentrated sector for nonemployer firms is Chemical Manufacturing. This distribution suggests that Montana's STEM economy is heavily tilted towards professional services and healthcare, with a much smaller presence in manufacturing sectors.

The Miscellaneous Manufacturing sector showed a decline in the number of employer firms from 2012 to 2016, with data not available for 2018 and 2019. In 2020, the sector reported 12 employer firms. Nonemployer firms in this sector remained relatively stable from 2012 to 2019, with a decline in 2020 to 150 firms.

Data for the Data Processing, Hosting, and Related Services sector is only available for nonemployer firms. The number of nonemployer firms in this sector fluctuated throughout the period, with a peak of 70 firms in 2019 and 2020.

The number of women patentees in Montana has shown fluctuations throughout the period. From 19 women patentees in 2012, the state saw an increase to 36 in 2019. However, the number of women patentees declined to 28 in 2020. The inconsistent trend in women patentees suggests potential challenges in promoting and sustaining women's participation in innovation and intellectual property creation in Montana.

Venture capital funding in Montana has been relatively low compared to other states, with total funding reaching a peak of $26.6 million in 2019. The majority of venture capital funding has been allocated to firms founded by both men and women, with limited funding for female-founded firms. The lack of substantial venture capital funding may pose challenges for entrepreneurs, particularly women-founded ventures, in accessing the necessary capital to start and grow their businesses.

Montana's labor force, represented by the total number of employed individuals (both men and women), showed overall growth from 2012 (443,700) to 2019 (487,200), with a slight decline in 2020 (480,100), likely due to the impact of the COVID-19 pandemic. Despite this setback, Montana's per capita income consistently increased throughout the period, from $40,220 to $53,546 over the study period, reflecting an overall improvement in the standard of living for residents.

In conclusion, Montana's entrepreneurial ecosystem has shown mixed trends, with growth in some sectors and challenges in others. The Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector have demonstrated growth in nonemployer firms, suggesting opportunities for self-employment and small business ownership. However, the fluctuations in the number of women patentees and the limited venture capital funding highlight potential barriers to fostering a diverse and inclusive entrepreneurial environment. To support the growth and development of Montana's entrepreneurial landscape, particularly for women entrepreneurs, efforts should be made to address data gaps, promote innovation and intellectual property creation, and ensure access to funding and resources. By leveraging the state's strengths and addressing its challenges, Montana can work towards building a more robust and inclusive entrepreneurial ecosystem.

5-28-1 Montana Model Interpretations

A 1% increase in the number of women patentees in Montana produces a 0.04% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. However, the data shows that the number of women patents in Montana has been consistently low compared to other states, with a maximum of 36 in 2019. The small magnitude of the coefficient suggests that other factors such as a supportive entrepreneurial climate may be more influential in determining women's STEM entrepreneurship in Montana than the number of women patentees alone.

A 1% increase in venture capital funding in Montana produces about a 0.01% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in Montana has been extremely low compared to other states, with a maximum of $26.6 million in 2019. The negative relationship suggests that venture capital funding alone may not be sufficient to drive women's STEM entrepreneurship in Montana, and other factors such as, the targeting of specific STEM sectors, the overall entrepreneurial ecosystem, access to other forms of financing, and support networks may play a more crucial role.

Additionally, the negative relationship between venture capital funding and women's STEM entrepreneurship in Montana may be influenced by potential dilution effects. As venture capital firms invest in STEM ventures, they often receive a significant portion of the company's equity in return, which can lead to a dilution of the founder's ownership stake and a reduction in their control over the company's strategic direction. Furthermore, the concentration of venture capital funding in certain sectors or stages of venture development may not always align with the needs and preferences of women STEM entrepreneurs, leading to a mismatch between the supply and demand for venture capital funding in the state.

The estimated effect of the labor force in Montana is negative. The estimate indicates a 1% increase in the labor force would produce a 0.81% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as a larger labor force is generally expected to provide broader networks and child care options, and support the growth of businesses across sectors, including STEM fields. The data shows that the number of employed individuals in Montana has been relatively stable, with a maximum of 487,200 in 2019. The counterintuitive sign of the coefficient suggest that the size of the labor force alone may not be a determining factor for women's STEM entrepreneurship in Montana, and other state-specific factors such as the education system, skill development programs, and entrepreneurial culture may play a more direct role.

A 1% increase in the number of women STEM graduates nationally produces about a 0.37% increase in the number of women STEM entrepreneurs in Montana. The positive sign of this coefficient aligns with expectations, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level.

A one percentage point increase in the national interest rate produces a 0.002% increase in the number of women STEM entrepreneurs in Montana. The positive sign of this coefficient does not align with expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The positive coefficient suggests that interest rates alone may not have a strong direct impact on women's STEM entrepreneurship in Montana, and other factors such as access to alternative financing options, grants, state-specific economic conditions and the wealth effect may be more influential.

A 1% increase in per-capita real income in Montana produces a 0.87% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations. There are several potential reasons why this positive relationship may occur in Montana. First, as per-capita real income increases, individuals in the state may have more disposable income to invest in starting and growing their own businesses. This increased financial capacity can be particularly important for women entrepreneurs in STEM fields, who may face challenges in accessing traditional funding sources such as venture capital or bank loans. With more personal financial resources, women in Montana may be more likely to take the risk of starting their own STEM ventures.

Second, higher per-capita real income in Montana may reflect a stronger overall economy and more favorable business conditions in the state. A thriving economy can create more opportunities for entrepreneurship, as well as a more supportive ecosystem for startups and small businesses. This can include factors such as access to markets, customers, suppliers, and talent, as well as a more favorable regulatory and policy environment. In such conditions, women entrepreneurs in STEM fields may find it easier to establish and grow their businesses, leading to an increase in their numbers.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Montana compared to the pre-pandemic period. The negative impact of the COVID-19 pandemic on female STEM entrepreneurship in Montana, as indicated by the dummy variable, suggests that the economic and social disruptions caused by the pandemic have created significant challenges for women entrepreneurs in the state. There are several potential reasons why the presence of the pandemic may be associated with a decrease in the number of women STEM entrepreneurs in Montana. First, the economic downturn and uncertainty caused by the pandemic may have made it more difficult for women to start or grow their businesses, particularly in STEM fields that often require significant upfront investments in research, development, and technology. Women entrepreneurs may have faced challenges in accessing capital, customers, and markets, as well as navigating the rapidly changing business environment. Second, the pandemic may have exacerbated existing barriers and challenges faced by women entrepreneurs in Montana, such as limited access to networks, mentorship, and support systems. With social distancing measures and remote work arrangements, women may have found it harder to build and maintain the relationships and connections necessary for successful entrepreneurship. Third, the pandemic may have increased the burden of caregiving and household responsibilities on women, particularly as schools and childcare facilities closed or reduced their operations. This additional burden may have made it more difficult for women to focus on their entrepreneurial ventures or pursue new business opportunities. Lastly, the psychological and emotional toll of the pandemic, including increased stress, anxiety, and uncertainty, may have discouraged some women from taking the risk of starting or growing their businesses in STEM fields.

5-28-2 Montana Policy Implications

Based on the Montana CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-27: Montana Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Montana state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train Montana lenders to target less crowded sectors. 3. The federal government could provide funding to Montana for investment in training programs for a skilled workforce. 4. Congress could work with Montana state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Montana to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government can help establish a dedicated fund to provide emergency assistance to help women STEM entrepreneurs.	1. Fosters women's STEM entrepreneurship by promoting and supporting women's patenting activity. 2. Increases access to funding for women-owned STEM businesses in diverse sectors. 3. Supports and encourages women's engagement in STEM entrepreneurship through availability of skilled workers. 4. Leverages the talent and skills of women STEM graduates to promote women's STEM entrepreneurship. 5. Provides financial flexibility for women to start STEM businesses. 6. Provides assistance to female STEM entrepreneurs during challenging times.

Implementing these policy measures, can create a more supportive and inclusive environment for women STEM entrepreneurs in Montana, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Montana, driving innovation, economic growth, and social progress for the state and beyond.

5-29 Nebraska Model Results and Policy Implications

Nebraska's entrepreneurial landscape has shown mixed trends from 2012 to 2020, with notable changes in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state has also witnessed fluctuations in the number of women patentees, indicating potential challenges in fostering a diverse and inclusive innovation ecosystem.

In Nebraska from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows high concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 658 to 887 over the years (with some missing data in 2018-2019), while nonemployer firms show significantly higher numbers, ranging from 5,355 to 6,300. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is also concentrated, with employer firms ranging from 661 to 983 (with data missing for 2020) and nonemployer firms from 2,775 to 3,400, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, the concentration is generally low across all categories. Chemical Manufacturing, and Fabricated Metal Product Manufacturing show some presence in the nonemployer category, but with relatively low numbers compared to the service sectors. Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing, show zero or very low numbers for the employer and nonemployer categories throughout most of the period. This distribution suggests that Nebraska's STEM economy is heavily focused on professional services and healthcare, with a minimal presence in manufacturing sectors. The Data Processing, Hosting, and Related Services sector also shows a consistent but low presence in the nonemployer category compared to the Miscellaneous Manufacturing sector.

The number of women patentees in Nebraska has shown fluctuations throughout the period. From 66 women patentees in 2012, the state saw an increase to 91 in 2019. However, the number of women patentees declined to 72 in 2020. The inconsistent trend in women patentees suggests potential challenges in promoting and sustaining women's participation in innovation and intellectual property creation in Nebraska.

Venture capital funding in Nebraska has been relatively low compared to other states, with total funding reaching a peak of $62.769 million in 2016. The majority of venture capital funding has been allocated to firms founded by both men and women, with limited funding for female-founded firms. The lack of substantial venture capital funding may pose challenges for entrepreneurs, particularly women-founded ventures, in accessing the necessary capital to start and grow their businesses.

Nebraska's labor force, represented by the total number of employed individuals (both men and women), showed overall growth from 2012 (968,700) to 2019 (1,026,900), with a slight decline in 2020 (988,300), likely due to the impact of the COVID-19 pandemic. Despite this setback, Nebraska's per capita income consistently increased throughout the period, from $46,391 in 2012 to $56,733 in 2020, reflecting an overall improvement in the standard of living for residents.

In conclusion, Nebraska's entrepreneurial ecosystem has shown mixed trends, with growth in some sectors and challenges in others. The Professional, Scientific, and Technical services sector and the Ambulatory Health Care Services sector have demonstrated growth in nonemployer firms, suggesting opportunities for self-employment and small business ownership. However, the fluctuations in the number of women patentees and the limited venture capital funding highlight potential barriers to fostering a diverse and inclusive entrepreneurial environment. To support the growth and development of Nebraska's entrepreneurial landscape, particularly for women entrepreneurs, efforts should be made to address data gaps, promote innovation and intellectual property creation, and ensure access to funding and resources. By leveraging the state's strengths and addressing its challenges, Nebraska can work towards building a more robust and inclusive entrepreneurial ecosystem.

5-29-1 Nebraska Model Interpretations

First, the coefficient for women patentees is -0.046, suggesting that a one percent increase in the number of women patentees in Nebraska is associated with a slight decrease of about 0.046% in the number of female STEM entrepreneurs. This finding is somewhat unexpected, as one might assume that more women holding patents would lead to more women starting STEM businesses. However, this negative relationship could be due to various factors, such as challenges in commercializing inventions or limited access to resources and support for women patentees in the state.

Second, the coefficient for venture capital funding is -0.008, indicating that a one percent increase in venture capital funding in Nebraska is associated with a very slight decrease of about 0.008% in the number of female STEM entrepreneurs. This finding suggests that venture capital funding may not be allocated efficiently across different STEM sectors. It is possible that most funds are being directed towards sectors in which there already is many female entrepreneurs. Thus, there could be increased competition, leading to the failure of female owned STEM businesses.

The coefficient for the labor force is 2.3, suggesting that an increase in the overall labor force is associated with an increase of about 2.3% in the number of female STEM entrepreneurs. This positive relationship highlights the importance of a strong and diverse labor market in fostering entrepreneurship among women in STEM fields. As the labor force grows, there may be more opportunities for women to start and grow their own businesses in STEM sectors.

The coefficient for the national women STEM graduates is -0.073, indicating that a one percent increase in the national women STEM graduates is associated with a slight decrease of about 0.073% in the number of female STEM entrepreneurs in Nebraska.

This finding may suggest that the state's entrepreneurial ecosystem or support systems for women in STEM may not be keeping pace with the national trends in women's STEM education.

The coefficient for the national interest rate is -0.035, suggesting that a one percentage point increase in the national mortgage rate is associated with a slight decrease of about 0.035% in the number of female STEM entrepreneurs in Nebraska. This negative relationship may indicate that higher borrowing costs or a less favorable economic environment can discourage women from starting STEM businesses in the state.

The coefficient for real income is -0.226, indicating that a one percent increase in real income in Nebraska is associated with a decrease of about 0.23% in the number of female STEM entrepreneurs. This finding may seem counterintuitive, as one might expect higher income levels to support entrepreneurship. However, it could be that as real income increases, women in STEM fields may have more attractive employment opportunities or face higher opportunity costs in starting their own businesses.

The presence of the pandemic is associated with an increase in the number of female STEM entrepreneurs in Nebraska compared to the pre-pandemic period. This finding may indicate that women in STEM fields in the state have been able to adapt to the challenges posed by the pandemic or have identified new opportunities for entrepreneurship in response to the changing economic and social landscape.

5-29-2 Nebraska Policy Implications

Based on the Nebraska CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-28: Nebraska Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train female investors and educate them on investing in diverse female STEM businesses in Nebraska. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state female STEM learning in diverse STEM sectors. 4. Federal agencies could tie institutional grant funding to promotion of female faculty. 5. The federal government could provide grants to the state government to provide childcare and other care options to female entrepreneurs. 6. The federal government could provide funding to the state to invest in the continued innovation and adaptability of women STEM entrepreneurs in emergencies.	1. Supports women STEM patentees in commercializing their patents and starting STEM ventures. 2. Increases access to funding for women-owned STEM businesses in diverse sectors. 3. Fosters women's STEM entrepreneurship by building a strong pipeline of diverse talent and creating a supportive environment. 4. Supports female STEM faculty and facilitates the transition from academia to entrepreneurship. 5. Helps offset the opportunity cost of entrepreneurship and reduces financial and personal barriers. 6. Fosters an agile and responsive entrepreneurial ecosystem that supports women STEM entrepreneurs during challenging times.

The implementation of these policy measures will create more supportive and inclusive environment for women STEM entrepreneurs in Nebraska, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Nebraska, driving innovation, economic growth, and social progress for the state and beyond.

5-30 Nevada Model Results and Policy Implications

Nevada's entrepreneurial landscape has undergone notable changes from 2012 to 2020, with interesting trends in the manufacturing sectors and the health care sector. The state has also seen an increase in the number of women patentees, indicating growing participation of women in innovation.

In Nevada from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 1,582 to 2,096 over the years, while nonemployer firms show significantly higher numbers, ranging from 10,123 to 14,000. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 775 to 1,388 and nonemployer firms from 4,430 to 7,000, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, the concentration is generally low across all categories. Fabricated Metal Product Manufacturing shows a high concentration of employer firms, though the numbers are relatively low, ranging from 20 to 27 firms. Miscellaneous Manufacturing shows the highest numbers for both employer and nonemployer firms among manufacturing sectors, but still with relatively low figures compared to the service sectors. The Data Processing, Hosting, and Related Services sector also shows a consistent presence in the nonemployer category, though its numbers are fairly close to Miscellaneous Manufacturing in the early years and higher in 2019 and 2020. This distribution suggests that Nevada's STEM economy is heavily focused on professional services and healthcare, with a minimal presence in manufacturing sectors.

Nevada witnessed a significant increase in the number of women patentees, rising from 130 in 2012 to 153 in 2020, with a peak of 158 in 2013. This growth highlights the increasing participation of women in innovation and intellectual property creation.

Venture capital funding in Nevada showed volatility over the years. Total funding peaked at $477.62 million in 2015 but declined to $52.686 million in 2020. Funding for female-founded firms was consistently lower than funding for firms co-founded by men and women, indicating a gender gap in access to capital.

Nevada's labor force, represented by the total employed population aged 16 and above, grew steadily from 1.14 million in 2012 to 1.42 million in 2019 before declining to 1.28 million in 2020, likely due to the COVID-19 pandemic. Despite this setback, Nevada's per capita income consistently increased from $39,671 in 2012 to $54,650 in 2020, reflecting an overall improvement in residents' standard of living.

In conclusion, Nevada's entrepreneurial ecosystem has experienced shifts in the manufacturing and health care sectors, with a trend towards nonemployer firms and self-employment. The increase in women patentees highlights growing participation in innovation, although the gender gap in venture capital funding remains a challenge.

Despite the impact of the COVID-19 pandemic on employment, Nevada's per capita income has steadily increased, reflecting overall economic growth. As the state navigates the post-pandemic landscape, supporting diverse entrepreneurship and addressing funding disparities will be crucial for fostering a resilient and inclusive entrepreneurial environment.

5-30-1 Nevada Model Interpretations

The coefficient for women patentees is 0.214, suggesting that a one percent increase in the number of women patentees in Nevada is associated with an increase of 0.214% in the number of female STEM entrepreneurs. This finding aligns with the expectation that women who hold patents are more likely to commercialize their inventions and start their own businesses in STEM fields. The positive relationship highlights the importance of supporting and encouraging women's participation in innovation and patenting activities as a pathway to entrepreneurship.

The coefficient for venture capital funding is -0.018, indicating that a one percent increase in female venture capital funding in Nevada is associated with a slight decrease of 0.018% in the number of female STEM entrepreneurs. This finding may seem counterintuitive, as venture capital is often seen as a key driver of entrepreneurship. However, it could be that the venture capital ecosystem may heavily favor certain STEM sectors that already have many female STEM entrepreneurs. As a result, increased funds may lead to increased competition, causing some female-led STEM businesses to be pushed out of the market.

The coefficient for the labor force is -0.095, suggesting that a one percent increase in the overall labor force in Nevada is associated with a slight decrease of 0.095% in the number of female STEM entrepreneurs. This finding may indicate that the growth in the labor force may not be translating into increased opportunities or support for women entrepreneurs in STEM sectors. It could be that the type of labor force growth in the state may not be conducive to fostering female STEM entrepreneurship.

The coefficient for the national women STEM graduates is 0.667, indicating that a one percent increase in the national average of women STEM graduates is associated with an increase of about 0.67% in the number of female STEM entrepreneurs in Nevada. This positive relationship suggests that the state's entrepreneurial ecosystem is benefiting from the national trends in women's STEM education. As more women graduate with STEM degrees across the country, it may create a more supportive and encouraging environment for women to pursue entrepreneurship in STEM fields in Nevada.

Next, the coefficient for the national interest rate is -0.011, suggesting that a one percentage point increase in the interest rate is associated with a slight decrease of 0.011% in the number of female STEM entrepreneurs in Nevada. While the impact appears to be minimal, it may indicate that higher borrowing costs or a less favorable economic environment can have a small negative effect on women's decision to start STEM businesses in the state.

The coefficient for real income is 0, indicating that changes in real income in Nevada have no significant association with the number of female STEM entrepreneurs. This finding suggests that other factors beyond income levels may be more influential in shaping women's participation in STEM entrepreneurship in the state.

The lack of statistical significance measures in the regression output limits the interpretability of these results. In addition, the missing values in the female STEM entrepreneur numbers for Nevada and potential data limitations leads to the COVID-19 coefficient not being computed. The missing values may also affect the reliability of the coefficients that are estimated and their associated economic interpretations.

5-30-2 Nevada Policy Implications

Based on the Nevada CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-29: Nevada Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Neveda state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train new female investors and educate them on investing in diverse female STEM sectors. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Congress could work with Neveda state government to tie institutional funding to internships mentorship, and networking opportunities for female STEM students and graduates.	1. Encourages women inventors to translate their patented technologies into viable business ventures. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Attracts women STEM graduates to pursue entrepreneurship in Nevada, bolstering the state's innovation ecosystem.

Implementing these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Nevada, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, and support for commercialization can help unlock the full potential of women STEM entrepreneurs in

Nevada, driving innovation, economic growth, and social progress for the state and beyond.

5-31 New Hampshire Model Results and Policy Implications

New Hampshire's entrepreneurial landscape has shown interesting trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed an increase in the number of women patentees, indicating a growing focus on innovation among women entrepreneurs.

In New Hampshire from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 589 to 865 over the years, while nonemployer firms show significantly higher numbers, ranging from 6,663 to 7,300. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 341 to 776 (with some missing data in 2018 and 2019) and nonemployer firms from 2,611 to 3,100, highlighting the significant role of health care services in the state's economy.

Among manufacturing sectors, the concentration is generally low across all categories. Fabricated Metal Product Manufacturing shows the highest concentration of employer firms, though the numbers are relatively low, ranging from 13 to 38 firms. For nonemployer firms, Miscellaneous Manufacturing shows the highest numbers among manufacturing sectors, but still with relatively low figures compared to the service sectors. This distribution suggests that New Hampshire's STEM economy is heavily focused on professional services and healthcare, with a minimal presence in manufacturing sectors. The Data Processing, Hosting, and Related Services sector also shows a consistent but low presence in the nonemployer category.

New Hampshire witnessed an increase in the number of women patentees during this period, rising from 143 in 2012 to 200 in 2020. This trend highlights the growing participation and success of women in innovation and intellectual property creation.

Venture capital funding in New Hampshire showed some fluctuations over the years. Total funding peaked at $91.9 million in 2020, primarily driven by funding for firms co-owned by men and women. Funding for female-founded firms remained relatively low throughout the period.

New Hampshire's total employed population aged 16 and above remained relatively stable, with an increase from 631,300 in 2012 to 684,300 in 2019 and a slight decline to 639,500 in 2020. The state's per capita income consistently increased from $50,719 in 2012 to $67,883 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, New Hampshire's entrepreneurial ecosystem has shown mixed trends in the manufacturing sectors, with a stronger presence of nonemployer firms compared to employer firms. The Professional, Scientific, and Technical Services sector has seen a decline in employer firms, while the health care sector has shown growth in both employer and nonemployer firms. The increase in women patentees highlights the state's focus on fostering innovation among women entrepreneurs. Despite the challenges posed by the COVID-19 pandemic, New Hampshire's per capita income has consistently increased, reflecting overall economic growth.

5-31-1 New Hampshire Model Interpretations

The coefficient for women patentees is -0.006, suggesting that a one percent increase in the number of women patentees in New Hampshire is associated with a slight decrease of 0.006% in the number of female STEM entrepreneurs. While the impact is minimal, this finding may indicate that the commercialization of patents or the transition from patenting to entrepreneurship may face some challenges for women in the state.

The coefficient for venture capital funding is -0.012, indicating that a one percent increase in venture capital funding in New Hampshire is associated with a slight decrease of 0.012% in the number of female STEM entrepreneurs. This finding may suggest that the venture capital funding may not be allocated efficiently. It is possible that funds are being directed to sectors that have a high concentration of female STEM entrepreneurs.

The coefficient for the labor force is -0.153, suggesting that a one percent increase in the overall labor force is associated with a decrease of 0.153% in the number of female STEM entrepreneurs. This negative relationship may indicate that the growth in the labor force may not be translating into increased opportunities or support for women entrepreneurs in STEM sectors. It could be that the labor market dynamics or the nature of workers' skills in the state may not be conducive to fostering female STEM entrepreneurship.

The coefficient for the national women STEM graduates is 0.171, indicating that a one percent increase in national women STEM graduates is associated with an increase of about 0.171% in the number of female STEM entrepreneurs in New Hampshire. This positive relationship suggests that the state's entrepreneurial ecosystem is benefiting from the national trends in women's STEM education. As more women graduate with STEM degrees across the country, it may create a more supportive and encouraging environment for women to pursue entrepreneurship in STEM fields in New Hampshire.

The coefficient for the interest rate is 0.011, suggesting that a one percent increase in the national interest rate is associated with a very slight increase of 0.011%in the number of female STEM entrepreneurs in New Hampshire. While the impact appears to be minimal, it may indicate that changes in borrowing costs or economic conditions have a small positive effect on women's decision to start STEM businesses in the state, possibly because of alternative financing being available, or higher interest rates being a reflection of better economic conditions combined with a supportive entrepreneurial climate in the state, or increased wealth effects.

The coefficient for real per-capita income is -0.133, indicating that a one percent increase in real income in New Hampshire is associated with a decrease of about 0.133% in the number of female STEM entrepreneurs. This finding may seem counterintuitive, as one might expect higher income levels to support entrepreneurship. However, it could be that as real income increases, women in STEM fields may have more attractive employment opportunities or face higher opportunity costs in starting their own businesses.

Lastly, the coefficient for the COVID-19 dummy variable is positive, suggesting that the presence of the pandemic is associated with an increase in the number of female STEM entrepreneurs in New Hampshire compared to the pre-pandemic period. This finding may indicate that women in STEM fields in the state have been able to adapt to the challenges posed by the pandemic or have identified new opportunities for entrepreneurship in response to the changing economic and social landscape.

5-31-2 New Hampshire Policy Implications

Based on the New Hampshire CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-30: New Hampshire Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train female investors and educate them in investing in diverse female STEM businesses. 3. The federal government could provide funding for investment in training programs for a skilled workforce. 4. Congress could work with the state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM graduates. 5. The federal government could provide grants to the state government to provide childcare and other care options to female STEM entrepreneurs. 6. The federal government can help establish a dedicated fund to invest in the continued adaptability of women STEM entrepreneurs.	1. Facilitates the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs. 6. Fosters the continued growth and success of women STEM entrepreneurs by providing financial assistance and access to networks.

The implementation of these policy measures will lead to a more supportive and inclusive environment for women STEM entrepreneurs in New Hampshire, addressing the unique challenges and opportunities identified in the state-level analysis.

5-32 New Jersey Model Results and Policy Implications

New Jersey's entrepreneurial landscape has shown diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a significant number of women patentees, indicating a strong focus on innovation.

In New Jersey from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 5,014 to 5,974 over the years, while nonemployer firms show significantly higher numbers, ranging from 41,520 to 47,500. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 3,765 to 5,500 and nonemployer firms from 18,959 to 22,500, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing shows the highest concentration of employer firms, with numbers ranging from 68 to 115 firms. Chemical Manufacturing and Miscellaneous Manufacturing also show a consistent presence in both employer and nonemployer categories. The least concentrated sector for employer firms is Electrical Equipment, Appliance, and Component Manufacturing, and the least concentrated sector for nonemployer firms is Transportation Equipment Manufacturing. Computer and Electronic Product Manufacturing shows a moderate presence in both employer and nonemployer categories, but with relatively low numbers compared to the top sectors. This distribution suggests that New Jersey's female STEM economy is heavily focused on professional services and healthcare, with a notable but smaller presence in certain manufacturing sectors, particularly those related to fabricated metal products, chemicals, and miscellaneous manufacturing. The Data Processing, Hosting, and Related Services sector has a higher number of nonemployer firms than the Miscellaneous Manufacturing sector in all the study years, though much smaller than the service sectors. So, New Jersey’s female STEM field has a notable presence in data processing and hosting services.

New Jersey had a high number of women patentees during this period, with over 1,800 women patentees each year, reaching a peak of 2,194 in 2014 and 2104 patentees in 2020. This trend highlights the strong participation and success of women in innovation and intellectual property creation.

Venture capital funding in New Jersey showed growth over the years. Total funding increased from $23.586 million in 2012 to $262.9 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms remained relatively low.

New Jersey's total employed population aged 16 and above remained relatively stable, with a slight increase from 3.88 million in 2012 to 3.85 million in 2020, despite a dip in

2020 likely due to the COVID-19 pandemic. The state's per capita income consistently increased from $54,247 in 2012 to $70,957 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, New Jersey's entrepreneurial ecosystem has shown a strong presence of employer firms in the manufacturing, professional, scientific, and technical services, and health care sectors. The state has also witnessed a growing number of nonemployer firms, particularly in the Professional, Scientific, and Technical Services sector, the Ambulatory Health Care Services sector and the Data Processing, Hosting, and Related Services sector. The high number of women patentees highlights New Jersey's focus on fostering innovation among women entrepreneurs. Despite the challenges posed by the COVID-19 pandemic, New Jersey's per capita income has consistently increased, reflecting overall economic growth.

5-32-1 New Jersey Model Interpretations

A 1% increase in the number of women patentees in New Jersey produces about a 0.01% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in New Jersey has been relatively high compared to other states, with a maximum of 2,194 in 2014. The negative sign of the coefficient suggests that other factors beyond the number of women patentees may be more influential in determining women's STEM entrepreneurship in New Jersey. There could be several reasons for these results. The high number of women patentees may not necessarily translate into a higher number of women STEM entrepreneurs if there are barriers to commercializing these patents. Factors such as access to funding, mentorship, or networks may hinder the transition from patent holder to entrepreneur. Secondly, the patents held by women in New Jersey may be concentrated in specific industries that do not align with the sectors typically associated with STEM entrepreneurship. If the patents are in fields with limited entrepreneurial opportunities or high barriers to entry, the negative relationship may occur.

A 1% increase in venture capital funding in New Jersey produces about a 0.01% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in New Jersey has been relatively higher when compared to other states, with a maximum of $262.9 million in 2020. The negative sign of the coefficient suggest that venture capital funding alone may not be sufficient to drive women's STEM entrepreneurship in New Jersey, and other factors such as the overall entrepreneurial ecosystem, access to other forms of financing, and support networks may play a more crucial role. While New Jersey has consistently seen high levels of venture capital funding, which are generally expected to support entrepreneurship, these high levels of funding may also lead to increased competition for funding and market share, particularly in sectors with a high concentration of firms. The combination of market saturation in key sectors and high levels of venture capital funding may create a competitive environment that makes it challenging for women STEM entrepreneurs to establish and grow their businesses in New Jersey, potentially explaining the surprising negative relationship between venture capital funding and women STEM entrepreneurs in the state.

The data shows that the number of employer firms in the Professional, Scientific, and Technical Services sector has been fluctuating over the years, with a decrease from 5,705 in 2016 to 5132 in 2018 and 5342 in 2020. These trends suggest that the concentration of venture capital funding in certain sectors may not be benefiting all types of STEM ventures equally, and the dilution effect, which occurs when venture capital firms receive a significant portion of a company's equity in return for their investment, can lead to a reduction in the founder's ownership stake and control over the company's strategic direction.

The estimated effect of the labor force in New Jersey is positive. The estimate indicates a 1% increase in the labor force would produce a 0.02% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as a larger labor force is generally expected to provide a broader pool of networks and child care options and support the growth of businesses across sectors, including STEM fields. The data shows that the number of employed individuals in New Jersey has been relatively stable, with a maximum of 4,187,000 in 2019.

A 1% increase in the number of women STEM graduates nationally produces about a 0.04% decrease in the number of women STEM entrepreneurs in New Jersey. The negative sign of this coefficient does not align with expectations, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level.

A one percentage point in the national interest rate produces about a 0.02% increase in the number of women STEM entrepreneurs in New Jersey. The positive sign of this coefficient does not align with expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. However, they can also create positive wealth effects that can encourage entrepreneurship. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in New Jersey produces about a 1.12% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as higher per-capita real income is generally expected to support entrepreneurial activity, including in STEM fields. The data shows that per-capita income in New Jersey has been consistently increasing over the years, with a maximum of $70,957 in 2020. Increasing incomes provide financial flexibility to women for starting STEM businesses.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in New Jersey compared to the pre-pandemic period. The negative sign of this coefficient aligns with expectations.

5-32-2 New Jersey Policy Implications

Based on the New Jersey CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-31: New Jersey Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA can train and educate investors on investing in female STEM businesses. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Federal agencies could tie grant funding to promotion of female faculty. 5. The federal government could invest in infrastructure projects in New Jersey to foster economic growth. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs.	1. Facilitates the commercialization of patents and the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses. 3. Supports female STEM professionals and entrepreneurs through availability of childcare and a skilled workforce. 4. Increases the pool of potential female STEM entrepreneurs and fosters a supportive educational environment. 5. Creates a more conducive environment for women STEM entrepreneurs. 6. Helps women STEM entrepreneurs navigate challenging times and maintain business continuity.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in New Jersey, driving innovation, economic growth, and social progress for the state and beyond.

5-33 New Mexico Model Results and Policy Implications

New Mexico's entrepreneurial landscape has shown varying trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a moderate increase in the number of women patentees, indicating a growing focus on innovation among women entrepreneurs.

In New Mexico from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 867 to 1,172 over the years, while nonemployer firms show significantly higher numbers, ranging from 7,174 to 7,800. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 595 to 912 (with some missing data in later years) and nonemployer firms from 4,887 to 5,500, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, the concentration is generally low across all categories. Fabricated Metal Product Manufacturing and Miscellaneous Manufacturing show the highest concentration of employer firms, though the numbers are relatively low. For nonemployer firms, Miscellaneous Manufacturing shows the highest numbers among manufacturing sectors, ranging from 349 to 410 firms. Chemical Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing, show zero or very low numbers throughout most of the period. This distribution suggests that New Mexico's STEM economy is heavily focused on professional services and healthcare, with a minimal presence in manufacturing sectors. The Data Processing, Hosting, and Related Services sector also shows a consistent but low presence in both the nonemployer category.

New Mexico witnessed a moderate increase in the number of women patentees during this period, rising from 110 in 2012 to 148 in 2020, with a peak of 157 in 2018. This trend highlights the growing participation and success of women in innovation and intellectual property creation.

Venture capital funding in New Mexico remained relatively low throughout the period, with total funding reaching a peak of $179.275 million in 2019. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms was minimal.

New Mexico's total employed population aged 16 and above remained relatively stable, with a slight increase from 802,900 in 2012 to 855,100 in 2019 and a slight decline to 799,600 in 2020. The state's per capita income consistently increased from $35,695 in 2012 to $46,631 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, New Mexico's entrepreneurial ecosystem has shown a mix of trends in the manufacturing, professional, scientific, and technical services, and health care sectors. While the number of employer firms has been relatively low in some sectors, nonemployer firms have shown more stability, particularly in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The moderate increase in women patentees highlights New Mexico's growing focus on fostering innovation among women entrepreneurs. Despite the challenges posed by the COVID-19 pandemic, New Mexico's per capita income has consistently increased, reflecting overall economic growth.

5-33-1 New Mexico Model Interpretations

The coefficient for women patentees is –58.15, indicating that a 1% increase in the number of women patentees in New Mexico is associated with a 58.15% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is unexpected and quite large in magnitude. Looking at the raw data, the number of women patents in New Mexico has been relatively stable, with a maximum of 157 in 2018. Despite the moderate number of women patentees in the state, the large negative coefficient suggests that increasing the number of women inventors and supporting their patenting activities may not directly translate into more women-owned STEM ventures in New Mexico. There could be several reasons for these results. A higher number of women patentees may not necessarily translate into more women STEM entrepreneurs if there are barriers to commercializing these patents. Factors such as access to funding, mentorship, or networks may hinder the transition from patent holder to entrepreneur. Secondly, the patents held by women in New Mexico may be concentrated in specific industries that do not align with the sectors typically associated with STEM entrepreneurship. If the patents are in fields with limited entrepreneurial opportunities or high barriers to entry, the negative relationship may occur.

The coefficient for venture capital funding is 0.81, suggesting that a 1% increase in venture capital funding in New Mexico is associated with a 0.81% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as increased venture capital funding is generally thought to support entrepreneurial activities. The raw data reveals that venture capital funding in New Mexico has been higher than most states, with a maximum of $179.275 million in 2019. The positive coefficient suggests that increasing the availability and accessibility of venture capital funding in New Mexico could potentially benefit women STEM entrepreneurs and leading to an increase in the overall number of female STEM entrepreneurs.

The coefficient for the labor force is -139.04, indicating that a 1% increase in New Mexico's labor force is associated with a 139.04% decrease in the number of women STEM entrepreneurs in the state. This large negative relationship is counterintuitive, as a larger labor force is generally expected to provide more networking and child care options. The raw data shows that the number of employed individuals in New Mexico has been relatively stable, with a maximum of 855,100 in 2019. While overall growth in the labor force is generally seen as a positive economic indicator, it may not necessarily translate into increased opportunities for new female STEM entrepreneurs. The growth in New Mexico's labor force might have been concentrated in industries or positions that do not provide the necessary STEM skills and experience to workers. Additionally, the increased competition for resources and market share resulting from labor force growth could make it more challenging for new female-owned businesses to establish themselves and succeed, particularly in sectors where there is already a high concentration of female STEM entrepreneurs. Furthermore, other factors such as the education and skill level of the workforce, the availability of entrepreneurial opportunities, and the overall entrepreneurial ecosystem in the state may play a more significant role in influencing women's STEM entrepreneurship.

The coefficient for national women STEM graduates is 95.32, suggesting that a 1% increase in the number of women STEM graduates nationally is associated with a 95.32% increase in the number of women STEM entrepreneurs in New Mexico. This large positive relationship aligns with expectations, as a larger pool of women STEM graduates is generally expected to contribute positively to women's STEM entrepreneurship. While the raw data does not provide information on the number of women STEM graduates specific to New Mexico, the large positive coefficient suggests that the national trend may impact women's STEM entrepreneurship in the state.

The coefficient for the national interest rate is 2.47, indicating that a one percentage point increase in the mortgage rate is associated with a 2.47% increase in the number of women STEM entrepreneurs in New Mexico. This positive relationship is unexpected, as higher interest rates are generally thought to make it more difficult for entrepreneurs to access financing for their ventures. The raw data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The positive coefficient suggests that increases in mortgage rates may have a positive impact on women's STEM entrepreneurship in New Mexico, which is counterintuitive. The overall favorable financing environment may have supported women STEM entrepreneurship in New Mexico. This may also be explained by the prevalence of nonemployer firms in the state. Women STEM entrepreneurs operating nonemployer firms may be less sensitive to changes in interest rates due to lower capital requirements and less reliance on external financing.

The coefficient for real income is -126.26, indicating that a 1% increase in New Mexico's real income is associated with a 126.26% decrease in the number of women STEM entrepreneurs in the state. This large negative relationship is surprising, as higher income levels are generally expected to support entrepreneurial activity and provide more opportunities for individuals to start and grow their businesses. The raw data shows that per-capita income in New Mexico has been consistently increasing over the years, with a maximum of $46,631 in 2020. The large negative coefficient suggests that rising income levels in New Mexico may not necessarily translate into increased women's STEM entrepreneurship in the state. It could also be that women are pushed into starting businesses because of income disparity and business ceilings, and higher incomes could mean a decline in the number of women starting businesses. Another reason could be higher incomes leading to the abandonment of entrepreneurship by women to raise families.

The presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in New Mexico compared to the pre-pandemic period. This negative relationship aligns with expectations, as the pandemic has disrupted economic activities and posed challenges for entrepreneurs across various sectors.

It is important to note that the lack of statistical significance measures in the regression output limit the interpretability of the results. The missing values in the female STEM entrepreneur numbers and potential data limitations may affect the reliability of the coefficients and their associated economic interpretations. The large magnitudes of some coefficients, particularly for women patentees, labor force, and real income, warrant further investigation and caution in interpretation.

5-33-2 New Mexico Policy Implications

Based on the New Mexico CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-32: New Mexico Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors and educate them in investing in female STEM businesses in New Mexico. 3. The federal government could provide funding to New Mexico for investment in training for a skilled STEM workforce. 4. Congress could work with the state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide grants to the state government to provide childcare and other care options to female STEM entrepreneurs. 6. The federal government could help the state establish a dedicated fund to aid women STEM entrepreneurs during emergencies.	1. Facilitates the commercialization of patents and the growth of women-owned STEM businesses. 2. Supports the growth and development of women-owned STEM ventures in the state. 3. Supports female STEM entrepreneurs through a skilled workforce. 4. Increases the pool of potential female STEM entrepreneurs. 5. Creates a more conducive environment for women STEM entrepreneurs by providing targeted support and resources. 6. Helps women STEM entrepreneurs adapt to challenges and maintain business continuity during difficult times.

A more supportive and inclusive environment for women STEM entrepreneurs in New Mexico can be created through these policy measures, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and emergency assistance provision can help unlock the full potential of women STEM entrepreneurs in New Mexico, driving innovation, economic growth, and social progress for the state and beyond.

5-34 New York Model Results and Policy Implications

New York's entrepreneurial landscape has shown diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a significant increase in the number of women patentees, indicating a strong focus on innovation and intellectual property creation among women entrepreneurs.

In New York from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms among STEM fields. The number of employer firms in this sector ranges from 9,882 to 14,000 over the years, while nonemployer firms show significantly higher numbers, ranging from 98,703 to 114,000. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 7,961 to 10,530 and nonemployer firms from 53,128 to 57,000, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing and Miscellaneous Manufacturing show the highest concentration of employer firms, with numbers ranging from 158 to 271 for Fabricated Metal Product Manufacturing and up to 450 for Miscellaneous Manufacturing (though data is missing for latter years). For nonemployer firms, Miscellaneous Manufacturing shows the highest numbers among manufacturing sectors, ranging from 1,200 to 1,382 firms. The least concentrated sectors for employer firms is Electrical Equipment, Appliance, and Component Manufacturing, and for nonemployer firms it is Transportation Equipment Manufacturing. Chemical Manufacturing shows a moderate presence in both employer and nonemployer categories. This distribution suggests that New York's STEM economy is heavily focused on professional services and healthcare, with a notable but smaller presence in certain manufacturing sectors, particularly those related to fabricated metal products and miscellaneous manufacturing. There is a relatively large (over a thousand) number of firms in the Data Processing, Hosting and Related Services sector for all study years, though for each year (except 2018 when they are equal) the numbers are smaller than those for Miscellaneous Manufacturing

New York witnessed a remarkable increase in the number of women patentees during this period, rising from 2,896 in 2012 to 4,077 in 2020. This trend highlights the strong participation and success of women in innovation and intellectual property creation.

Venture capital funding in New York showed substantial growth over the years, with total funding increasing from $510.05 million in 2012 to $3,968.15 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms also increased significantly, reaching $1,034 million in 2019.

New York's total employed population aged 16 and above remained relatively stable, with an increase from 8.82 million in 2012 to 9.78 million in 2019 and a slight decrease to 8.81 million in 2020. However, the state's per capita income consistently increased from $52,628 in 2012 to $69,873 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, New York's entrepreneurial ecosystem has shown a strong presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors and a notable presence of firms in data processing. The state has also witnessed a significant increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. Venture capital funding has grown substantially, with a notable increase in funding for both female-founded firms and firms co-founded by men and women. Despite the challenges posed by the COVID-19 pandemic, New York's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-34-1 New York Model Interpretations

A 1% increase in the number of women patentees in New York produces about a .07% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patentees in New York has been consistently high compared to other states, with a maximum of 4,120 in 2019. It is possible that these patentees are in concentrated STEM areas, leading to greater competition and failure of firms, or they have difficulty transitioning to entrepreneurship.

A 1% increase in venture capital funding in New York produces a .024% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in New York has been consistently high compared to other states, with a maximum of $3,968.15 million in 2020.

The estimated effect of the labor force in New York is negative. The estimate indicates a 1% increase in the labor force would produce a 3.3% decline in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as a larger labor force is generally expected to provide a broader pool of skilled workers. The data shows that the number of employed individuals in New York has been steadily increasing, with a maximum of 9.8 million in 2019. It is possible that the growth in this workforce is not in the skilled STEM areas that are essential for women STEM entrepreneurs.

A 1% increase in the number of women STEM graduates nationally produces about a .98% increase in the number of women STEM entrepreneurs in New York. A larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level.

A one percentage point increase in the national interest rate produces a .035% increase in the number of women STEM entrepreneurs in New York. The positive sign of this coefficient does not align with expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. It is possible that these entrepreneurs do not depend on traditional financing, and interest rates do not impact them, or that they experience wealth effects.

A 1% increase in per-capita real income in New York produces about a .3% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient is interesting, as it suggests that higher per-capita real income may be supporting women's STEM entrepreneurship in New York, possibly by providing more financial resources and opportunities for starting and growing STEM ventures. The data shows that per-capita income in New York has been consistently increasing over the years, with a maximum of $69,873 in 2020. The state's strong economic conditions and high per-capita income may provide a supportive environment for women STEM entrepreneurs.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in New York compared to the pre-pandemic period.

5-34-2 New York Policy Implications

Based on the New York CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-33: New York Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization. 2. SBA could train new female investors and educate them on investing in female STEM businesses in New York. 3. The federal government could provide funding to New York for investment in training for a skilled STEM workforce. 4. Congress could work with New York state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in New York to foster economic growth. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs during emergencies. .	1. Encourages and enables women to patent and commercialize their inventions, particularly in STEM nonconcentrated sectors. 2. Helps women-owned STEM ventures secure the necessary capital to create and scale their businesses. 3. Ensures a strong pipeline of diverse talent to support the growth of women-owned STEM ventures. 4. Fosters a supportive environment for female entrepreneurship in the STEM fields. 5. Creates a vibrant and supportive environment that encourages innovation and risk-taking among women STEM entrepreneurs. 6. Supports the continued growth and success of women STEM entrepreneurs.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in New York, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and emergency assistance provision can help unlock the full potential of women STEM entrepreneurs in New York, driving innovation, economic growth, and social progress for the state and beyond.

5-35 North Carolina Model Results and Policy Implications

North Carolina's entrepreneurial landscape has exhibited diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a steady increase in the number of women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has varied over the years, with Fabricated Metal Product Manufacturing and Miscellaneous Manufacturing having the most presence. The number of nonemployer firms in these sectors has remained relatively stable, with Miscellaneous Manufacturing having the highest number of nonemployer firms.

The Professional, Scientific, and Technical Services sector had a substantial number of employer firms, ranging from 4,766 to 6,566 firms throughout the period. The nonemployer firms in this sector showed consistent growth, increasing from 35,996 firms in 2012 to 45,000 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a significant presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 3,256 to 3,946, while the number of nonemployer firms grew from 18,322 in 2012 to 24,000 in 2020.

The Data Processing, Hosting and Related Services sector had a few employer firms but a few hundred nonemployer firms over the years. The nonemployer firm numbers for this sector were always lower than those for the Miscellaneous Manufacturing sector.

North Carolina witnessed a steady increase in the number of women patentees during this period, rising from 930 in 2012 to 1,269 in 2020, with a peak of 1,342 in 2019. This trend highlights the growing participation and success of women in innovation and intellectual property creation.

Venture capital funding in North Carolina showed growth over the years, with total funding increasing from $74.645 million in 2012 to $245.79 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms also increased, reaching a peak of $252.54 million in 2018.

North Carolina's total employed population aged 16 and above grew from 3.99 million in 2012 to 4.42 million in 2020, despite a slight dip in 2020 likely due to the COVID-19 pandemic. The state's per capita income consistently increased from $38,867 in 2012 to $51,781 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, North Carolina's entrepreneurial ecosystem has shown a strong presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors and a notable presence of firms in data processing. The state has also witnessed a steady increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. Venture capital funding has grown, with a notable increase in funding for both female-founded firms and firms co-founded by men and women. Despite the challenges posed by the COVID-19 pandemic, North Carolina's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-35-1 North Carolina Model Interpretations

A 1% increase in the number of women patentees in North Carolina produces about a .32% decline in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in North Carolina has been consistently high compared to other states, with a maximum of 1,342 in 2019. It is possible that these patentees are concentrated in already crowded sectors, leading to competition and failure of firms or it is hard for them to transition from patents to entrepreneurship.

A 1% increase in venture capital funding in North Carolina produces a .002% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in North Carolina has been relatively low compared to some other states, with a maximum of $419.84 million in 2018. It is possible that this funding has gone to concentrated STEM sectors leading to competition and failure amongst firms.

The estimated effect of the labor force in North Carolina is positive. The estimate indicates a 1% increase in the labor force would produce a 15% increase in the number of women STEM entrepreneurs in the state. A larger labor force is generally expected to provide a broader pool of skilled workers, networking, and child care options, and support the growth of businesses across sectors, including STEM fields. The data shows that the number of employed individuals in North Carolina has been growing, with a maximum of 4,597,800 in 2019.

A 1% increase in the number of women STEM graduates nationally produces about a 4.5% decrease in the number of women STEM entrepreneurs in North Carolina. The negative sign of this coefficient does not align with expectations, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level. It is possible that these graduates are in sectors that already have a large number of these firms, leading to increased competition and firm failures, or that these graduates gravitate towards academia or jobs.

A one percentage point increase in the national interest rate produces about a .017% increase in the number of women STEM entrepreneurs in North Carolina. The positive sign of this coefficient does not align with expectations, as interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures.

However, it seems that interest rates do not impact these entrepreneurs very much, possibly because they are not reliant on traditional financing, or because they experience wealth effects.

A 1% increase in per-capita real income in North Carolina produces about a .12% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient can be explained by the concept of opportunity cost. As per-capita real income increases, the opportunity cost of pursuing entrepreneurship also increases, as individuals may have more attractive employment options or may be less willing to take on the risks associated with starting a business. The data shows that per-capita income in North Carolina has been consistently increasing over the years, with a maximum of $51,781 in 2020. Furthermore, state specific factors, such as concentration of women STEM entrepreneurs in certain sectors in North Carolina, may influence this result. It could also be that women are pushed into starting businesses because of income disparity and business ceilings, and higher incomes could mean a decline in the number of women starting businesses. Another reason could be higher incomes leading to the abandonment of entrepreneurship by women to raise families.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in North Carolina compared to the pre-pandemic period. The positive sign of this coefficient does not align with expectations, as the pandemic has had a significant negative impact on entrepreneurial activity across the United States. The data shows that the number of employer firms in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care sector increased in North Carolina in 2020.

5-35-2 North Carolina Policy Implications

Based on the North Carolina CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-34: North Carolina Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors and educate them on investing in less crowded female STEM businesses in North Carolina. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Federal grant funding could be tied to promotion of female faculty. 5. The federal government could provide childcare and other care options for female STEM entrepreneurs. 6. The federal government could provide funding to the state to study and build upon the resilience and adaptability demonstrated by women STEM entrepreneurs in emergencies.	1. Promotes women's STEM entrepreneurship by fostering a strong pool of women patentees in diverse sectors. 2. Helps women-owned STEM ventures secure the necessary capital to start businesses in varied sectors. 3. Supports and encourages women's engagement in STEM entrepreneurship. 4. Facilitates transition from academia to entrepreneurship 5. Reduces barriers to entrepreneurship for these entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses and adapt to the new economic reality during times of crisis.

A more supportive and inclusive environment for women STEM entrepreneurs in North Carolina can be created by implementing these policy measures, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in North Carolina, driving innovation, economic growth, and social progress for the state and beyond.

5-36 North Dakota Model Results and Policy Implications

North Dakota's entrepreneurial landscape has shown varying trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a modest increase in the number of women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, there is little to no data on employer and nonemployer firm activity throughout the period. The chemical manufacturing sector showed a slight increase from 10 firms in 2014 to 20 firms in 2019 in the nonemployer category. Miscellaneous Manufacturing went from 51 nonemployer firms in 2012 to 70 nonemployer firms in 2019 to 60 in 2020. There were a few nonemployer firms in Data Processing, Hosting, and Related Services sector over the years.

The Professional, Scientific, and Technical Services sector had a moderate number of employer firms, ranging from 237 to 362 firms throughout the period. The nonemployer firms in this sector remained relatively stable, ranging from around 2,000 to 2,300 firms.

In the health care sector, Ambulatory Health Care Services had a small presence of employer firms, with numbers ranging from 136 to 229. The number of nonemployer firms in this sector remained relatively stable, with around 1,200 to 1,400 firms.

North Dakota witnessed a modest increase in the number of women patentees during this period, rising from 14 in 2012 to 20 in 2020, with a peak of 32 in 2014. While this trend indicates a growing participation of women in innovation and intellectual property creation, the overall numbers remain relatively low compared to other states.

Venture capital funding in North Dakota was minimal throughout the period, with only two years showing a small amount of funding for female-founded firms ($0.014 million in 2017 and $.55 million in 2020). There was no reported funding for firms co-founded by men and women.

North Dakota's total employed population aged 16 and above remained relatively stable, with an increase from 429,600 in 2012 to 441,100 in 2019 and a slight decrease to 412,400 in 2020. The state's per capita income fluctuated over the years, with an overall increase from $56,077 in 2012 to $61,091 in 2020.

In conclusion, North Dakota's entrepreneurial ecosystem has shown limited activity in the manufacturing, professional, scientific, and technical services, and health care sectors, with a stronger presence of nonemployer firms compared to employer firms. The state has witnessed a modest increase in women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs. However, venture capital funding has been minimal throughout the period. Despite the challenges posed by the COVID-19 pandemic, North Dakota's per capita income has increased overall, reflecting some economic growth and resilience.

5-36-1 North Dakota Model Interpretations

A 1% increase in the number of women patentees in North Dakota is associated with a 0.32% decrease in the number of women STEM entrepreneurs, which is counterintuitive. Looking at the raw data, the number of women patents in North Dakota has been relatively low, with a maximum of 32 in 2014. The low number of women patentees in the state may not be sufficient to generate a significant positive impact on women's STEM entrepreneurship. However, there could be several reasons for these results. A greater number of women patentees may not necessarily translate into a higher number of women STEM entrepreneurs if there are barriers to commercializing these patents. Factors such as access to funding, mentorship, or networks may hinder the transition from patent holder to entrepreneur. Secondly, the patents held by women in North Dakota may be concentrated in specific industries that are concentrated. If the patents are in fields with limited entrepreneurial opportunities or high barriers to entry, the negative relationship may occur.

The lack of statistical significance measures in the regression output limits the interpretability of this results. In addition, the missing values in the female STEM entrepreneur numbers for North Dakota and potential data limitations leads to most of the coefficients not being computed. The missing values may also affect the reliability of the coefficient that was estimated and the associated economic interpretations.

5-36-2 North Dakota Policy Implications

Based on the North Dakota CVR Model Results, we drew a policy implication. The table below lists this policy and its corresponding benefits.

Table 5-35: North Dakota Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state.	1. Facilitates the commercialization of patents and the growth of women-owned STEM businesses.

By implementing this policy measure, a more supportive and inclusive environment for women STEM entrepreneurs in North Dakkota can be created, addressing the unique challenges and opportunities identified in the state-level analysis.

5-37 Ohio Model Results and Policy Implications

Ohio's entrepreneurial landscape has shown diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a significant increase in the number of women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has varied over the years, with Fabricated Metal Product Manufacturing having the most presence, followed by Machinery Manufacturing and Miscellaneous Manufacturing. However, some sectors, such as Computer and Electronic Product Manufacturing, have had little employer firm activity. The number of nonemployer firms in these sectors has remained relatively stable, with Miscellaneous Manufacturing having the highest number of nonemployer firms. Data Processing, Hosting, and Related Services saw close to 600 nonemployer firms for most years of this study, though the number of these firms dropped to 550 firms in 2020. This sector had the greatest number of nonemployer firms after Miscellaneous Manufacturing for all the study years, outside of the service sectors such as professional services and health care.

The Professional, Scientific, and Technical Services sector had a substantial number of employer firms, ranging from 3,981 to 4,761 firms throughout the period. The nonemployer firms in this sector showed consistent growth, increasing from 36,795 firms in 2012 to 40,000 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a significant presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 2,823 to 3,759, while the number of nonemployer firms grew from 24,385 in 2012 to 25,000 in 2020.

Ohio witnessed a notable increase in the number of women patentees during this period, rising from 1,137 in 2012 to 1,728 in 2020, with a peak of 1,496 in 2019. This trend highlights the growing participation and success of women in innovation and intellectual property creation.

Venture capital funding in Ohio showed fluctuations over the years, with total funding ranging from $28.2 million in 2014 to $226.231 million in 2012. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms remained relatively low, with a peak of $33.03 million in 2017.

Ohio's total employed population aged 16 and above remained relatively stable, with a slight increase from 5.20 million in 2012 to 5.26 million in 2020, despite some fluctuations in between and a decline from 2019 to 2020 possible due to COVID-19. The state's per capita income consistently increased from $40,280 in 2012 to $52,879 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, Ohio's entrepreneurial ecosystem has shown a strong presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors and a notable presence of firms in data processing. The state has also witnessed a significant increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. Venture capital funding has fluctuated over the years, with a notable allocation to firms co-founded by men and women. Despite the challenges posed by the COVID-19 pandemic, Ohio's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-37-1 Ohio Model Interpretations

A 1% increase in the number of women patentees in Ohio produces about a .37% decline in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Ohio has been consistently high compared to other states, with a maximum of 1,728 in 2020. It is possible that these patentees are in STEM sectors that are already concentrated leading to overcrowding and firm failures, or the patentees are not able to translate their patents into entrepreneurial ventures.

Ohio has a high concentration of women patentees in one company, P&G. P&G has dominated inventions in Ohio (Smith 2023) and has the highest number of women credited with inventions (Brunsman 2020). It is possible that this makes it difficult for female STEM patentees to start companies outside of P&G’s dominance.

A 1% increase in venture capital funding in Ohio produces a .009% decline in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as increased venture capital funding is expected to support women STEM entrepreneurship. The dominance of one firm P&G could explain the difficulty that female STEM entrepreneurs face in this state. The data shows that venture capital funding in Ohio has been relatively high compared to other states, with a maximum of $226.231 million in 2012. It is possible that this funding is targeted to the concentrated STEM sectors which leads to increased competition among firms and firm failures.

The estimated effect of the labor force in Ohio is negative. The estimate indicates a 1% increase in the labor force would produce a 2.3% decline in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as a larger labor force is generally expected to provide a broader pool of skilled workers. The data shows that the number of employed individuals in Ohio has been relatively stable, with a maximum of 5.59 million in 2019. A growing labor force provides a supportive environment for women STEM entrepreneurs, both in terms of access to childcare and a skilled workforce contributing to the positive relationship. It is possible that the increase in the labor force in Ohio does not occur in sectors where women STEM entrepreneurs look for skilled workers, or there is increased competition amongst firms to hire from these sectors, leading to firm failures.

A 1% increase in the number of women STEM graduates nationally produces about a .8% increase in the number of women STEM entrepreneurs in Ohio. A larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level.

A one percentage point increase in the national interest rate produces a .061% increase in the number of women STEM entrepreneurs in Ohio. Interest rates don't impact these entrepreneurs very much. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Ohio produces about a .04% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as higher per-capita real income is generally expected to support entrepreneurial activity, including in STEM fields. The data shows that per-capita income in Ohio has been consistently increasing over the years, with a maximum of $52,879 in 2020. State-specific factors, such as concentration of women STEM entrepreneurs in certain sectors in Ohio, may influence this result. It could also be that women are pushed into starting businesses because of income disparity and business ceilings, and higher incomes could mean a decline in the number of women starting businesses. Another reason could be higher incomes leading to the abandonment of entrepreneurship by women to raise families.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Ohio compared to the pre-pandemic period.

5-37-2 Ohio Policy Implications

Based on the Ohio CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-36: Ohio Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train Ohio female lenders to invest in diverse STEM sectors. 3. The federal government could provide funding to Ohio for investment in training programs for a skilled workforce. 4. Congress could work with Ohio state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide grants to the state government to provide childcare and other care options to female STEM entrepreneurs. 6. The federal government could help the state establish a dedicated fund to provide assistance to women STEM entrepreneurs during emergencies.	1. Fosters women's STEM entrepreneurship by supporting and promoting women's patenting activity in diverse sectors. 2. Supports the creation, growth and scaling of women-owned STEM businesses in Ohio. 3. Ensures a strong pipeline of diverse talent to support the growth of women-owned STEM ventures. 4. Supports the attraction and retention of female STEM graduates and promotes entrepreneurship. 5. Creates a more conducive environment for women STEM entrepreneurs by providing targeted support and resources. 6. Supports the continued growth and success of women STEM entrepreneurs by providing financial assistance and access to networks.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Ohio, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in Ohio, driving innovation, economic growth, and social progress for the state and beyond.

5-38 Oklahoma Model Results and Policy Implications

Oklahoma's entrepreneurial landscape has shown varying trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a moderate increase in the number of women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has remained relatively stable, with Fabricated Metal Product Manufacturing having the most significant presence, followed by Machinery Manufacturing and Miscellaneous Manufacturing. The number of nonemployer firms in these sectors has fluctuated over the years, with Chemical Manufacturing and Miscellaneous Manufacturing having the highest number of nonemployer firms. The Data Processing, Hosting, and Related Services sector has seen higher number of nonemployer firms compared to other manufacturing sectors, except Miscellaneous Manufacturing.

The Professional, Scientific, and Technical Services sector had a substantial number of employer firms, ranging from 1,550 to 1,927 firms through the study period. The nonemployer firms in this sector showed growth, increasing from 11,591 firms in 2012 to 13,500 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a significant presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 1,295 to 1,924. The number of nonemployer firms grew from 5,843 in 2012 to 7,200 in 2020.

Oklahoma witnessed a moderate increase in the number of women patentees during this period, rising from 93 in 2012 to 109 in 2020, with a peak of 168 in 2017. This trend highlights the growing participation and success of women in innovation and intellectual property creation.

Venture capital funding in Oklahoma remained relatively low throughout the period, with total funding ranging from $1.075 million in 2012 to $37.3 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms remained minimal.

Oklahoma's total employed population aged 16 and above remained relatively stable, with an increase from 1.61 million in 2012 to 1.71 million in 2019 and a decline to 1.63 million in 2020, probably due to COVID-19. The state's per capita income consistently increased from $41,903 in 2012 to $50,249 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, Oklahoma's entrepreneurial ecosystem has shown stability in the manufacturing sectors, with a notable presence of nonemployer firms in these sectors and in data processing. The Professional, Scientific, and Technical Services sector and the Ambulatory Health Care sector have shown growth in both employer and nonemployer firms. The state has also witnessed a moderate increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. However, venture capital funding has remained relatively low throughout the period. Despite the challenges posed by the COVID-19 pandemic, Oklahoma's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-38-1 Oklahoma Model Interpretations

A 1% increase in the number of women patentees in Oklahoma produces about a .07% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Oklahoma has been relatively lower compared to other states, with a maximum of 168 in 2017. This negative relationship could be caused by women patentees concentrated in overcrowded STEM sectors leading to competition and firm failures.

A 1% increase in venture capital funding in Oklahoma produces about a 0.002% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in Oklahoma has been lower compared to other states, with a maximum of $37.3 million in 2020.

The estimated effect of the labor force in Oklahoma is negative. The estimate indicates a 1% increase in the labor force would produce a 4.42% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is counterintuitive, as a larger labor force is generally expected to provide a broader pool of skilled workers. The data shows that the number of employed individuals in Oklahoma has been relatively stable, with a maximum of 1.7 million in 2019. While overall growth in the labor force is generally seen as a positive economic indicator, it may not necessarily translate into increased opportunities for new female STEM entrepreneurs. The growth in Oklahoma’s labor force might have been concentrated in industries or positions that do not provide workers with the necessary skills, or experience in diverse STEM sectors. Additionally, the increased competition for resources and market share resulting from labor force growth could make it more challenging for new female-owned businesses to establish themselves and succeed, particularly in sectors where there is already a high concentration of female STEM entrepreneurs.

A 1% increase in the number of women STEM graduates nationally produces about a .96% increase in the number of women STEM entrepreneurs in Oklahoma. A larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level.

A one percentage point increase in the national interest rate produces about a .08% decrease in the number of women STEM entrepreneurs in Oklahoma. Higher interest rates are generally expected to make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Oklahoma produces a 1.451% increase in the number of women STEM entrepreneurs in the state. Higher per-capita real income is generally expected to support entrepreneurial activity, including in STEM fields. The data shows that per-capita income in Oklahoma has been consistently increasing over the years, with a maximum of $50,249 in 2020.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Oklahoma compared to the pre-pandemic period.

5-38-2 Oklahoma Policy Implications

Based on the Oklahoma CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-37: Oklahoma Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. Congress could train new female investors and educate them on investing in diverse female STEM businesses in Oklahoma. 3. The federal government could provide funding to the state to invest in training programs for a skilled workforce. 4. Congress could work with Oklahoma state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Oklahoma to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs.	1. Fosters women's STEM entrepreneurship by supporting and promoting women's patenting activity in diverse sectors. 2. Supports the growth and scaling of women-owned STEM businesses in Oklahoma. 3. Supports female STEM entrepreneurs through networking, and availability of a skilled workforce. 4. Supports female STEM entrepreneurship. 5. Creates a more conducive environment for women STEM entrepreneurs by increasing their incomes. 6. Supports the continued growth and success of women STEM entrepreneurs.

By implementing these policy measures a more supportive and inclusive environment for women STEM entrepreneurs in Oklahoma can be created, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in Oklahoma, driving innovation, economic growth, and social progress for the state and beyond.

5-39 Oregon Model Results and Policy Implications

Oregon's entrepreneurial landscape has shown diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a significant increase in the number of women patentees, indicating a strong focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has varied over the years, with Miscellaneous Manufacturing having the most significant presence, followed by Fabricated Metal Product Manufacturing and Machinery Manufacturing. Other sectors, such as Computer and Electronic Product Manufacturing and Chemical Manufacturing have had a lower but consistent presence. The number of nonemployer firms in these sectors has remained relatively stable, with Miscellaneous Manufacturing having the highest number of nonemployer firms. The Data Processing, Hosting, and Related Services sector has seen a few hundred firms over the years. These numbers are lower than the Miscellaneous Manufacturing sector numbers, but higher than the numbers for other manufacturing sectors.

The Professional, Scientific, and Technical Services sector had a substantial number of employer firms, ranging from 2,640 to 3,190 firms through the study period. The nonemployer firms in this sector showed consistent growth, increasing from 19,478 firms in 2012 to 23,500 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a significant presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 1,523 to 2,724. The number of nonemployer firms grew from 8,215 in 2012 to 10,500 in 2020.

Oregon witnessed a remarkable increase in the number of women patentees during this period, rising from 542 in 2012 to 1,250 in 2020, with a peak of 1,227 in 2017. This trend highlights the strong participation and success of women in innovation and intellectual property creation.

Venture capital funding in Oregon showed growth over the years, with total funding increasing from $12.655 million in 2012 to $141.6 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms also increased, reaching a peak of $26.085 million in 2019.

Oregon's total employed population aged 16 and above grew from 1.64 million in 2012 to 1.95 million in 2019, with a slight dip in 2020 to 1.83 million, likely due to the COVID-19 pandemic. The state's per capita income consistently increased from $39,128 in 2012 to $56,507 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, Oregon's entrepreneurial ecosystem has shown a strong presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors and a notable presence of nonemployer firms in data processing. The state has also witnessed a significant increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. Venture capital funding has grown notably, with a substantial allocation to firms co-owned by men and women. Despite the challenges posed by the COVID-19 pandemic, Oregon's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-39-1 Oregon Model Interpretations

A 1% increase in the number of women patentees in Oregon produces a 0.03% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Oregon has been consistently increasing over the years, with a maximum of 1,250 in 2020. There could be several reasons for these results. The high number of women patentees may not necessarily translate into a higher number of women STEM entrepreneurs if there are barriers to commercializing these patents. Factors such as access to funding, mentorship, or networks may hinder the transition from patent holder to entrepreneur. Secondly, the patents held by women in Oregon may be concentrated in crowded STEM industries leading to competition and firm failures.

A 1% increase in venture capital funding in Oregon produces a .003% decline in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in Oregon has been increasing over the years, with a maximum of $141.6 million in 2020. It is possible that increased funding in Oregon is going to sectors where female STEM firms are already concentrated and instead of alleviating a resource crunch it is leading to increased competition and firm failures.

The estimated effect of the labor force in Oregon is negative. The estimate indicates a 1% increase in the labor force would produce a .23% drop in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as a larger labor force is generally expected to provide more networking and child care options. Female STEM entrepreneurs can take advantage of increased networking opportunities and better options for childcare due to the large labor force, per the Saksena et al. (2022) USPTO study. The data shows that the number of employed individuals in Oregon has been consistently increasing, with a maximum of 1.9 million in 2019. However, it is possible that the increases in the labor force are not leading to more workers in specific needed sectors or the increased competition to hire them is leading to firm failures.

A 1% increase in the number of women STEM graduates nationally produces about a 0.5% increase in the number of women STEM entrepreneurs in Oregon. A larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level.

A one percentage point increase in the national interest rate produces about a .024% increase in the number of women STEM entrepreneurs in Oregon. Interest rates do not impact the number of women STEM entrepreneurs much. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Oregon produces about a .2% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient shows that the financial flexibility that comes with rising incomes allows women to open more STEM businesses. The data shows that per-capita income in Oregon has been consistently increasing over the years, with a maximum of $56,507 in 2020.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Oregon compared to the pre-pandemic period. The data shows that the number of nonemployer firms in the Professional, Scientific, and Technical Services sector increased from 3,044 in 2019 to 3,174 in 2020, potentially reflecting some resilience in this category.

5-39-2 Oregon Policy Implications

Based on the Oregon CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-38: Oregon Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state 2. SBA could train Oregon female lenders to invest in female STEM businesses. 3. The federal government could provide funding to Oregon for investment in training programs for a skilled workforce. 4. Congress could work with the state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Oregon to foster economic growth and create a supportive entrepreneurship environment. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs.	1. Facilitates the commercialization of patents and the growth of women-owned STEM businesses. 2. Supports the growth and development of women-owned STEM ventures in the state. 3. Provides female STEM entrepreneurs with access to a skilled and diverse workforce. 4. Supports the attraction and retention of female STEM graduates and the creation of new STEM businesses. 5. Creates a more conducive environment for women STEM entrepreneurs through increasing incomes. 6. Supports the continued growth and success of women STEM entrepreneurs during unprecedented shocks.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Oregon, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in Oregon, driving innovation, economic growth, and social progress for the state and beyond.

5-40 Pennsylvania Model Results and Policy Implications

Pennsylvania's entrepreneurial landscape has shown diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a significant increase in the number of women patentees, indicating a strong focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has varied over the years, with Fabricated Metal Product Manufacturing having the most significant presence, followed by Miscellaneous Manufacturing. Other sectors, such as Chemical Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing and Transportation Equipment Manufacturing, have had a lower but consistent presence. The number of nonemployer firms in these sectors has remained relatively stable, with Miscellaneous Manufacturing having the highest number of nonemployer firms. The Data Processing, Hosting, and Related Services sector has had a higher number of nonemployer firms than all manufacturing sectors except for Miscellaneous manufacturing.

The Professional, Scientific, and Technical Services sector had a substantial number of employer firms, ranging from 4,803 to 5,813 firms through the study period. The nonemployer firms in this sector showed consistent growth, increasing from 44,401 firms in 2012 to 47,500 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a significant presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 2,948 to 4,194. The number of nonemployer firms grew from 23,691 in 2012 to 26,500 in 2020.

Pennsylvania witnessed a notable increase in the number of women patentees during this period, rising from 1,075 in 2012 to 1,470 in 2020, with a peak of 1,481 in 2017. This trend highlights the growing participation and success of women in innovation and intellectual property creation.

Venture capital funding in Pennsylvania showed growth over the years, with total funding increasing from $83.665 million in 2012 to $292.01 million in 2020, with a peak of $606.245 million in 2019. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms also increased, reaching a peak of $277.845 million in 2019.

Pennsylvania's total employed population aged 16 and above remained relatively stable, with an increase from 5.73 million in 2012 to 6.07 million in 2019 and a decline to 5.60 million in 2020, likely due to the COVID-19 pandemic. However, the state's per capita income consistently increased from $45,638 in 2012 to $60,320 in 2020, reflecting an overall improvement in the standard of living.

Overall, Pennsylvania's entrepreneurial ecosystem has shown a strong presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors, and a notable presence of nonemployer firms in the data processing sector. The state has also witnessed a significant increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. Venture capital funding has grown notably, with a substantial allocation to firms co-owned by men and women. Despite the challenges posed by the COVID-19 pandemic, Pennsylvania's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-40-1 Pennsylvania Model Interpretations

A 1% increase in the number of women patentees in Pennsylvania produces about a .52% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient does not align with expectations, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Pennsylvania has been consistently high compared to other states, with a maximum of 1,481 in 2017. The negative relationship could happen if the increase in patentees occurs in STEM sectors where female STEM firms are already concentrated, leading to increased competition and firm failures.

Pennsylvania does not rank very highly in innovation rankings and advanced industries in the state have seen modest employment growth. "With that said, the aggregate advanced industry sector barely grew at all from 2015 to 2021. Medical equipment and supplies manufacturing grew only modestly, by 3%. Aerospace products went sideways. And for that matter numerous manufacturing, machinery, communications, and technology segments actually shed jobs" (Muro et al. 2022). This lack of an innovation climate and modest advanced industry growth could have contributed to female STEM patentees unable to start businesses.

A 1% increase in venture capital funding in Pennsylvania produces about a .05% decrease in the number of women STEM entrepreneurs in the state. Increased venture capital funding is expected to support women STEM entrepreneurship. The negative relationship suggests that venture capital funding may go to concentrated sectors and may lead to ownership dilution effects. The lack of an innovation climate and advanced industry growth could explain this finding.

The estimated effect of the labor force in Pennsylvania is positive. The estimate indicates a 1% increase in the labor force would produce a 15.4% increase in the number of women STEM entrepreneurs in the state. A larger labor force provides increased networking and child care options for women.

A 1% increase in the number of women STEM graduates nationally produces about a .5% increase in the number of women STEM entrepreneurs in Pennsylvania. The positive sign of this coefficient aligns with expectations, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level. The data does not provide information on the number of women STEM graduates specific to Pennsylvania, making it difficult to draw conclusions about the state-level dynamics. However, the positive relationship suggests that the national pool of women STEM graduates may be a strong predictor of women's STEM entrepreneurship in Pennsylvania, and efforts to increase the number of women pursuing STEM education at the national level may have positive spillover effects for the state's entrepreneurial ecosystem.

A one percentage point increase in the national interest rate produces about a .01% increase in the number of women STEM entrepreneurs in Pennsylvania. This suggests that interest rates don't have much of an impact on these entrepreneurs. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Pennsylvania produces about a 7.6% decrease in the number of women STEM entrepreneurs in the state. With higher incomes women in Pennsylvania could leave to raise families. The data shows that per-capita income in Pennsylvania has been consistently increasing over the years, with a maximum of $60,320 in 2020.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Pennsylvania compared to the pre-pandemic period. The positive sign of this coefficient does not align with expectations. It is possible that the pandemic provided early-stage women with new opportunities and the growth in the health care sector helped these firms.

5-40-2 Pennsylvania Policy Implications

Based on the Pennsylvania CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-39: Pennsylvania Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train Pennsylvania female lenders to invest in diverse STEM industries. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to female STEM learning in diverse STEM sectors. 4. Congress could work with the state to tie institutional funding to internships, mentorship, and networking opportunities for female STEM graduates. 5. The federal government could provide grants to the state government to provide child care and other care options to female STEM entrepreneurs. 6. The federal government could provide funding to the state to invest in the continued adaptability and resilience of women STEM entrepreneurs.	1. Promotes women's STEM entrepreneurship by fostering a strong pool of diverse women patentees. 2. Supports the growth and scaling of women-owned STEM businesses in Pennsylvania. 3. Supports female STEM professionals and entrepreneurs through availability of skilled workers. 4. Strengthens the pipeline of women STEM graduates and potential entrepreneurs. 5. Creates a supportive environment for women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses and adapt to the new economic reality during times of crisis.

By implementing these policy measures, a more supportive and inclusive environment for women STEM entrepreneurs can be created in Pennsylvania, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Pennsylvania, driving innovation, economic growth, and social progress for the state and beyond.

5-41 Rhode Island Model Results and Policy Implications

Rhode Island's entrepreneurial landscape has shown varying trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a moderate increase in the number of women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has been relatively low, with Miscellaneous Manufacturing having the most presence, followed by Fabricated Metal Product Manufacturing and Computer and Electronic Product Manufacturing. The data for employer firms in other sectors is missing. The number of nonemployer firms in the Fabricated Metal Product Manufacturing sector and Miscellaneous Manufacturing sector has remained relatively stable, with Miscellaneous Manufacturing having the highest number of nonemployer firms.

The Professional, Scientific, and Technical Services sector had a moderate number of employer firms, ranging from 500 to 677 firms through the study period, although data was not consistently available for all years. The nonemployer firms in this sector showed consistent growth, increasing from 4,764 firms in 2012 to 5,300 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a notable presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 435 to 561, though the year 2016 saw a much smaller number of firms and data was not available for some years. The number of nonemployer firms grew from 2,013 in 2012 to 2,500 in 2020.

Rhode Island witnessed a moderate increase in the number of women patentees during this period, rising from 82 in 2012 to 117 in 2020, with a peak of 151 in 2019. This trend highlights the growing participation and success of women in innovation and intellectual property creation.

Venture capital funding in Rhode Island remained relatively low throughout the period, with total funding ranging from $2.158 million in 2014 to $27.815 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms remained minimal.

Rhode Island's total employed population aged 16 and above remained relatively stable, with a slight decrease from 469,100 in 2012 to 461,600 in 2020. However, the state's per capita income consistently increased from $45,305 in 2012 to $59,066 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, Rhode Island's entrepreneurial ecosystem has shown a moderate presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors. The state has also witnessed a moderate increase in women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs. However, venture capital funding has remained relatively low throughout the period. Despite the challenges posed by the COVID-19 pandemic, Rhode Island's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-41-1 Rhode Island Model Interpretations

A 1% increase in the number of women patentees in Rhode Island produces about a .18% increase in the number of women STEM entrepreneurs in the state. A higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Rhode Island has been relatively low compared to other states, with a maximum of 151 in 2019.

A 1% increase in female venture capital funding in Rhode Island produces about a .003% decrease in the number of women STEM entrepreneurs in the state. Increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in Rhode Island has been low compared to other states, with a maximum of $27.815 million in 2020. The negative relationship between venture capital funding and women STEM entrepreneurship in Rhode Island suggest that there could be potential issues of overcrowding in certain sectors and dilution effects.

The estimated effect of the labor force in Rhode Island is negative. A 1% increase in the labor force would produce a .811% decrease in the number of women STEM entrepreneurs in the state. A larger labor force is generally expected to provide a broader pool of skilled and child care labor that is beneficial to female STEM entrepreneurs. However, it is possible that in this state the additional labor is not skilled in the sectors that female STEM entrepreneurs require, or there is competition amongst entrepreneurs to recruit talented workers leading to firm failures.

A 1% increase in per-capita real income in Rhode Island produces about a 1.42% increase in the number of women STEM entrepreneurs in the state. As per-capita real income increases, it may provide women with the financial flexibility to start more businesses. The data shows that per-capita income in Rhode Island has been consistently increasing over the years, with a maximum of $59,066 in 2020.

A 1% increase in the number of women STEM graduates nationally produces about a .08% decrease in the number of women STEM entrepreneurs in Rhode Island. The negative sign of this coefficient does not align with expectations, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs. This may suggest that the national trend in women STEM graduates may not be a strong predictor of women's STEM entrepreneurship in Rhode Island, and other state-specific factors may be more influential. For example, if these graduates are concentrated in overcrowded sectors, there could be increased competition and failure of firms.

A one percentage point increase in the national interest rate produces about a 0.04% decrease in the number of women STEM entrepreneurs in Rhode Island. The negative sign of this coefficient aligns with expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with decrease in the number of women STEM entrepreneurs in Rhode Island. The pandemic is expected to have negative impacts on entrepreneurship.

5-41-2 Rhode Island Policy Implications

Based on the Rhode Island CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-40: Rhode Island Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Rhode Island state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train Rhode Island female lenders to invest in diverse STEM sectors. 3. The federal government could provide funding to Rhode Island for investment in training programs for a skilled workforce. 4. The federal government could tie grant funding to institutions to the promotion and exposure of female faculty. 5. The federal government could invest in infrastructure projects in Rhode Island to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs.	1. Facilitates the commercialization of patents and the growth of women-owned STEM businesses. 2. Supports the growth and development of women-owned STEM ventures in the state. 3. Provides female STEM entrepreneurs with access to a skilled and diverse workforce. 4. Supports female STEM faculty and facilitates the transition from academia to entrepreneurship. 5. Creates a more conducive environment for women STEM entrepreneurs by providing targeted support. 6. Supports the growth and success of women STEM entrepreneurs during economy-wide shocks.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Rhode Island, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in Rhode Island, driving innovation, economic growth, and social progress for the state and beyond.

5-42 South Carolina Model Results and Policy Implications

South Carolina's entrepreneurial landscape has shown diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a significant increase in the number of women patentees, indicating a strong focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has remained relatively stable, with Miscellaneous Manufacturing having the most presence, followed by Fabricated Metal Product Manufacturing. The number of nonemployer firms in these sectors has remained relatively stable, with Miscellaneous Manufacturing and Chemical Manufacturing having the highest number of nonemployer firms. The Data Processing, Hosting, and Related Services sector has had a higher number of nonemployer firms than manufacturing sectors, except for Miscellaneous Manufacturing, with which it is close to or equal in numbers.

The Professional, Scientific, and Technical Services sector had a substantial number of employer firms, ranging from 1,690 to 2,781 firms through the study period. The nonemployer firms in this sector showed consistent growth, increasing from 14,309 firms in 2012 to 20,500 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a significant presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 1,108 to 1,884. The number of nonemployer firms grew from 7,842 in 2012 to 10,500 in 2020.

South Carolina witnessed a notable increase in the number of women patentees during this period, rising from 163 in 2012 to 354 in 2020, with a peak of 391 in 2018. This trend highlights the growing participation and success of women in innovation and intellectual property creation.

Venture capital funding in South Carolina remained relatively low throughout the period, with total funding ranging from $0.345 million in 2012 to a peak of $47.285 million in 2018. The majority of the funding was allocated to firms co-founded by men and women.

South Carolina's total employed population aged 16 and above grew from 1.86 million in 2012 to 2.08 million in 2020, despite a slight dip in 2020 likely due to the COVID-19 pandemic. The state's per capita income consistently increased from $35,794 in 2012 to $48,772 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, South Carolina's entrepreneurial ecosystem has shown a reasonable presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors and a notable presence of nonemployer firms in the data processing sector. The state has also witnessed a significant increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. However, venture capital funding has remained relatively low throughout the period. Despite the challenges posed by the COVID-19 pandemic, South Carolina's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-42-1 South Carolina Model Interpretations

A 1% increase in the number of women patentees in South Carolina produces a .17% increase in the number of women STEM entrepreneurs in the state. A higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in South Carolina has been relatively low compared to other states, with a maximum of 391 in 2018.

A 1% increase in female venture capital funding in South Carolina produces a 0.033% increase in the number of women STEM entrepreneurs in the state. Increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in South Carolina has been low to moderate compared to other states, with a maximum of $47.285 million in 2018. The state needs to attract more funding, and venture capital funding could be more strategically allocated to support female STEM entrepreneurs in diverse sectors, fostering a more balanced and sustainable entrepreneurial ecosystem in the state.

The estimated effect of the labor force in South Carolina is negative. A 1% increase in the labor force would produce a 5.36% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as a larger labor force is generally expected to provide broader networks and more child care options. The data shows that the number of employed individuals in South Carolina has been consistently increasing, with a maximum of 2.18 million in 2019. While overall growth in the labor force is generally seen as a positive economic indicator, it may not necessarily translate into increased opportunities for new female STEM entrepreneurs. The growth in South Carolina’s labor force might have been concentrated in industries that do not provide workers with the necessary skills required by women STEM entrepreneurs. Additionally, the increased competition for resources and market share resulting from labor force growth could make it more challenging for new female-owned businesses to establish themselves and succeed, particularly in sectors where there is already a high concentration of female STEM entrepreneurs.

A 1% increase in per-capita real income in South Carolina produces about a 1.9% increase in the number of women STEM entrepreneurs in the state. The data shows that per-capita income in South Carolina has been consistently increasing over the years, with a maximum of $48,772 in 2020. The positive relationship suggests that as per-capita real income rises in South Carolina, women in STEM fields may have the financial flexibility to pursue entrepreneurship.

A 1% increase in the number of women STEM graduates nationally produces about a 1.5% increase in the number of women STEM entrepreneurs in South Carolina. The positive sign of this coefficient aligns with expectations, as a higher number of women STEM graduates is expected to lead to more women STEM entrepreneurs.

A one percentage point increase in the national interest rate produces about a 0.08% decline in the number of women STEM entrepreneurs in South Carolina. Higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in South Carolina. The negative sign of this coefficient aligns with expectations, as the pandemic is expected to have negative impacts on entrepreneurship. The data shows that the number of women entrepreneurs in some STEM sectors in South Carolina decreased in 2020, which may be attributed to the economic disruptions caused by the pandemic.

5-42-2 South Carolina Policy Implications

Based on the South Carolina CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-41: South Carolina Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with South Carolian state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train new female investors and educate them on investing in female STEM businesses in South Carolina. 3. The federal government could provide funding to South Carolina for investment in training programs for a skilled workforce. 4. The federal government could invest in infrastructure projects in South Carolina to foster economic growth and create a supportive environment for entrepreneurship. 5. Congress could work with South Carolina state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduate. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance women STEM entrepreneurs.	1. Facilitates the commercialization of inventions and the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses. 3. Supports female STEM professionals and entrepreneurs through mentorship, networking, and skilled workforce availability. 4. Supports women STEM entrepreneurs in their financing needs. 5. Strengthens the pipeline of women STEM graduates and potential entrepreneurs. 6. Helps women STEM entrepreneurs navigate challenging times and maintain business continuity.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in South Carolina, driving innovation, economic growth, and social progress for the state and beyond.

5-43 South Dakota Model Results and Policy Implications

South Dakota's entrepreneurial landscape has shown varying trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a moderate increase in the number of women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has been relatively low, with Fabricated Metal Product Manufacturing and Miscellaneous Manufacturing having the most notable presence. However, the data for the manufacturing sectors is inconsistent, with no data for some years and sectors. The number of nonemployer firms in these sectors has remained low again with inconsistent data, with Miscellaneous Manufacturing having the highest number of nonemployer firms.

The Professional, Scientific, and Technical services sector had a moderate number of employer firms, ranging from 252 to 444 firms throughout the period. The nonemployer firms in this sector remained relatively stable, with around 2,400 to 3,000 firms.

In the health care sector, Ambulatory Health Care Services had a small presence of employer firms, with numbers ranging from 205 to 450. The number of nonemployer firms in this sector remained relatively stable, with around 970 to 1,200 firms.

South Dakota witnessed a small increase in the number of women patentees during this period, rising from 24 in 2012 to 29 in 2020, with a peak of 32 in 2019. While this trend indicates a growing participation of women in innovation and intellectual property creation, the overall numbers remain relatively low compared to other states.

Venture capital funding in South Dakota remained minimal throughout the period, with total funding ranging from $0 in some years, to a peak of $95.225 million in 2014, to 17.25 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms remained low.

South Dakota's total employed population aged 16 and above remained relatively stable, with a slight increase from 413,700 in 2012 to 426,200 in 2020, and a dip in 2020 from 2019 due to the pandemic. The state's per capita income consistently increased from $44,992 in 2012 to $59,465 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, South Dakota's entrepreneurial ecosystem has shown limited activity in the manufacturing, professional, scientific, and technical services, and health care sectors, with a stronger presence of nonemployer firms compared to employer firms. The state has witnessed a small increase in women patentees, indicating a growing focus on innovation and intellectual property creation among women entrepreneurs. However, venture capital funding has remained small. Despite the challenges posed by the COVID-19 pandemic, South Dakota's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-43-1 South Dakota Model Interpretations

A 1% increase in the number of women patentees in South Dakota is associated with a .67% decline in the number of women STEM entrepreneurs in the state. This negative relationship does not align with expectations, as more women obtaining patents should lead to more entrepreneurial activity in STEM fields. The data shows that the number of women patentees in South Dakota remained relatively stable, ranging from 19 to 32 during the period of 2012-2020. It is possible that female patentees in South Dakota face difficulty translating their patents into entrepreneurial ventures.

A 1% increase in female venture capital funding in South Dakota is associated with approximately a .05% decline in the number of women STEM entrepreneurs. This negative relationship is not expected, as increased access to funding can support the growth of women-owned STEM businesses. The raw data shows that venture capital funding for female entrepreneurs reached a maximum of 95. 2 million in 2014, but reduced dramatically in the years following. In 2020, total venture capital funding was 17.25 million. It is possible that the increased funding in South Dakota goes to STEM sectors that are already concentrated, leading to greater competition and firm failures.

A 1% increase in the labor force in South Dakota is associated with a 1.88% decrease in the number of women STEM entrepreneurs. This negative relationship is counterintuitive, as a larger labor force typically indicates more networking and child care options. However, it's important to note that an increase in the overall labor force may not necessarily translate to proportional growth in STEM sectors. South Dakota's labor force composition might include industries outside of STEM, and the lack of availability of a skilled STEM labor force could impact entrepreneurship activity. Despite the relatively stable labor force size in South Dakota during the observed period, the negative relationship suggests that factors beyond sheer labor force size play a role in shaping women's entrepreneurial activities in the STEM fields.

A 1% increase in the number of women STEM graduates nationally is associated with a .65% increase in the number of women STEM entrepreneurs in South Dakota. A larger pool of educated women in the STEM fields is expected to contribute to more entrepreneurial activity. When there is an increase in the number of women graduating in STEM fields nationally, it could bring more of these graduates to South Dakota leading to the creation of more STEM businesses.

A one percentage point increase in the interest rate is associated with a .25% increase in the number of women STEM entrepreneurs in South Dakota. This is a small increase and probably means that interest rates do not impact these entrepreneurs much. It is possible that these entrepreneurs are not dependent on traditional financing to a large extent.

A 1% increase in per-capita real income in South Dakota is associated with a 2.5% increase in the number of women STEM entrepreneurs. Higher incomes are typically associated with increased economic opportunities and entrepreneurial activity. The raw data shows a steady increase in per-capita income in South Dakota during the period, ranging from $44,992 to $59,465.

The lack of statistical significance measures in the regression output limits the interpretability of these results. In addition, the missing values in the female STEM entrepreneur numbers for South Dakota and potential data limitations leads to the COVID-19 coefficient not being computed. The missing values may also affect the reliability of the coefficients that are estimated and their associated economic interpretations.

5-43-2 South Dakota Policy Implications

Based on the South Dakota CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-42: South Dakota Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train South Dakota female lenders to invest in diverse STEM sectors. 3. The federal government could provide funding to South Dakota for investment in training programs for a skilled workforce. 4. Congress could work with South Dakota state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in South Dakota to foster economic growth and create a supportive environment for entrepreneurship.	1. Fosters entrepreneurship by encouraging women to pursue research and commercialization opportunities in STEM fields. 2. Supports the growth and development of women-owned STEM businesses in South Dakota. 3. Supports female STEM professionals and entrepreneurs through mentorship, networking, and diverse skilled workers. 4. Increases the pipeline of potential female STEM entrepreneurs. 5. Increases the demand for female STEM entrepreneur services.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, and support for commercialization can help unlock the full potential of women STEM entrepreneurs in South Dakota, driving innovation, economic growth, and social progress for the state and beyond.

5-44 Tennessee Model Results and Policy Implications

Tennessee's entrepreneurial landscape has shown diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a significant increase in the number of women patentees, indicating a strong focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has varied over the years, with Fabricated Metal Product Manufacturing having the most significant presence, followed by Miscellaneous Manufacturing. Other sectors, such as Machinery Manufacturing, Computer and Electronic Product Manufacturing, and Transportation Equipment Manufacturing, have had a lower presence. The number of nonemployer firms in these sectors has remained relatively stable, with Miscellaneous Manufacturing and Chemical Manufacturing having the highest number of nonemployer firms. The Data Processing, Hosting, and Related Services sector had slightly fewer number of nonemployer firms than the Miscellaneous Manufacturing sector in the earlier years and an equal number in the latter years.

The Professional, Scientific, and Technical Services sector had a substantial number of employer firms, ranging from 2,062 to 2,440 firms through the study period. The nonemployer firms in this sector showed consistent growth, increasing from 21,450 firms in 2012 to 27,500 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a significant presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 1,577 to 2,165, while data was not available for some years. The number of nonemployer firms grew from 11,398 in 2012 to 14,000 in 2020.

Tennessee witnessed a remarkable increase in the number of women patentees during this period, rising from 210 in 2012 to 446 in 2020. This trend highlights the strong participation and success of women in innovation and intellectual property creation.

Venture capital funding in Tennessee showed growth over the years, with total funding ranging from $18.025 million in 2015 to $106.447 million in 2020.

Tennessee's total employed population aged 16 and above grew from 2.72 million in 2012 to 3.01 million in 2020, despite a slight dip in 2020 likely due to the COVID-19 pandemic. The state's per capita income consistently increased from $39,082 in 2012 to $51,928 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, Tennessee's entrepreneurial ecosystem has shown a strong presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors. The state has seen the number of data processing nonemployer firms climb in the recent years. The state has also witnessed a significant increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. Venture capital funding has also grown. Despite the challenges posed by the COVID-19 pandemic, Tennessee's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-44-1 Tennessee Model Interpretations

The coefficient for women patentees is -.064, indicating that a 1% increase in the number of women patentees in Tennessee is associated with a .06% decrease in the number of women STEM entrepreneurs in the state. This negative relationship does not align with expectations, as a higher number of women patentees is generally expected to lead to more women STEM entrepreneurs. Looking at the raw data, the number of women patents in Tennessee has been consistently increasing over the years, with a maximum of 446 in 2020. The negative coefficient suggests that the growing number of women patentees in the state are not able to translate their patents into entrepreneurship. This highlights the importance of fostering women's STEM entrepreneurship in Tennessee by removing the challenges that patentees face.

The coefficient for venture capital funding is 0.018, suggesting that a 1% increase in venture capital funding in Tennessee is associated with a 0.02% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as increased venture capital funding is generally thought to support entrepreneurial activities. The raw data reveals that venture capital funding in Tennessee has been fluctuating over the years, with a maximum of $106.447 million in 2020. While the positive coefficient suggests that venture capital funding may have a positive impact on women's STEM entrepreneurship in the state, the small magnitude of the coefficient indicates that the impact may be limited. Policymakers may need to focus on increasing the availability and accessibility of venture capital funding for women-owned STEM ventures, while also addressing potential challenges such as the concentration of funding in specific sectors or the need for a more diverse and inclusive venture capital ecosystem.

The coefficient for the labor force is -13.021, indicating that a 1% increase in Tennessee's labor force is associated with a 13% decrease in the number of women STEM entrepreneurs in the state. This negative relationship does not align with expectations, as a larger labor force is generally expected to provide a broader pool of skilled workers and support business growth. The raw data shows that the number of employed individuals in Tennessee has been consistently increasing, with a maximum of 3.1 million in 2019. The negative coefficient suggests that the growing labor force in Tennessee is not contributing to an increase in women's STEM entrepreneurship in the state. Policymakers could correct his by investing in workforce development initiatives in underrepresented STEM sectors that lead to skilled workers in those areas.

The coefficient for national women STEM graduates is 5.357, suggesting that a 1% increase in the number of women STEM graduates nationally is associated with a 5.3% increase in the number of women STEM entrepreneurs in Tennessee. This positive relationship conforms to expectations, as a larger pool of women STEM graduates is generally expected to contribute positively to women's STEM entrepreneurship. While the raw data does not provide information on the number of women STEM graduates specific to Tennessee, the positive coefficient suggests that the national trend might translate to increased women's STEM entrepreneurship in the state.

The coefficient for the national interest rate is -0.122, indicating that a one-unit increase in the interest rate is associated with a .1% decrease in the number of women STEM entrepreneurs in Tennessee. This negative relationship aligns with expectations, as higher interest rates may make it more difficult for entrepreneurs to access financing for their ventures.

The raw data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The negative coefficient suggests that increases in interest rates may have a negative impact on women's STEM entrepreneurship in Tennessee, potentially by increasing the cost of capital and reducing the availability of funds for entrepreneurial ventures.

The coefficient for real income is -0.85, indicating that a 1% increase in Tennessee's real income is associated with a .85% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is surprising, as higher income levels are generally expected to support entrepreneurial activity and provide more opportunities for individuals to start and grow their businesses. The raw data shows that per-capita income in Tennessee has been consistently increasing over the years, with a maximum of $51,928 in 2020. The negative coefficient suggests that rising income levels in Tennessee may not necessarily translate into increased women's STEM entrepreneurship in the state. State-specific factors, such as concentration of women STEM entrepreneurs in certain sectors in Tennessee, may influence this result. It could also be that women are pushed into starting businesses because of income disparity and business ceilings, and higher incomes could mean a decline in the number of women starting businesses. Another reason could be higher incomes leading to the abandonment of entrepreneurship by women to raise families.

The coefficient for the COVID-19 dummy variable is negative, indicating that the presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Tennessee compared to the pre-pandemic period. The raw data shows that the number of women STEM entrepreneurs in Tennessee, as indicated by the number of employer firms in the Professional, Scientific, and Technical Services sector, increased from 1941 in 2019 to 2394 in 2020. This increase suggests that women STEM entrepreneurs in Tennessee may have shown some resilience and adaptability during the pandemic, potentially by leveraging digital technologies, exploring new market opportunities, or accessing support programs.

5-44-2 Tennessee Policy Implications

Based on the Tennessee CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-43: Tennessee Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors and educate them on investing in diverse female STEM businesses in Tennessee. 3. The federal government could provide funding to Tennessee for investment in training programs for a skilled workforce 4. Congress could work with Tennessee state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide grants to the state government to provide child care and other care options to female STEM entrepreneurs. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance and develop targeted support measures to help women STEM entrepreneurs.	1. Encourages and enables women to patent and commercialize their inventions, particularly in STEM fields. 2. Supports the growth and scaling of women-owned STEM businesses in Tennessee. 3. Ensures a strong pipeline of diverse talent to support the growth of women-owned STEM ventures. 4. Supports women STEM graduates in launching and growing their businesses by providing tailored resources and experiences. 5. Helps women STEM entrepreneurs use their financing to launch and grow their businesses. 6. Creates a more supportive ecosystem for women STEM entrepreneurs by addressing specific challenges and providing resources during emergencies.

The implementation of these policy measures can foster a more supportive environment for women STEM entrepreneurs in Tennessee, addressing the unique challenges and opportunities identified in the state-level analysis.

5-45 Texas Model Results and Policy Implications

Texas's entrepreneurial landscape has shown diverse trends in the manufacturing, professional, scientific, and technical services, and health care sectors from 2012 to 2020. The state has also witnessed a significant increase in the number of women patentees, indicating a strong focus on innovation and intellectual property creation among women entrepreneurs.

In the manufacturing sectors, the number of employer firms has varied over the years, with Fabricated Metal Product Manufacturing having the most significant presence, followed by Miscellaneous Manufacturing and Machinery Manufacturing. Other sectors, such as Chemical Manufacturing, Computer and Electronic Product Manufacturing, and Transportation Equipment Manufacturing, have had a consistent but smaller presence in the employer firm category. The number of nonemployer firms in these sectors has remained relatively stable, with Miscellaneous Manufacturing and Chemical Manufacturing having the highest number of nonemployer firms. The Data Processing, Hosting, and Related Services sector has had a significant presence in the nonemployer category, though at a slightly smaller level than the Miscellaneous Manufacturing sector.

The Professional, Scientific, and Technical Services sector had a substantial number of employer firms, ranging from 11,589 to 16,527 firms through the period. The nonemployer firms in this sector showed consistent growth, increasing from 104,057 firms in 2012 to 133,000 firms in 2020.

In the health care sector, Ambulatory Health Care Services had a significant presence of both employer and nonemployer firms. The number of employer firms in this sector ranged from 10,350 to 15,694. The number of nonemployer firms grew from 51,206 in 2012 to 68,000 in 2020.

Texas witnessed a remarkable increase in the number of women patentees during this period, rising from 2,052 in 2012 to 3,236 in 2020, with a peak of 3,244 in 2019. This trend highlights the strong participation and success of women in innovation and intellectual property creation.

Venture capital funding in Texas showed substantial growth over the years, with total funding increasing from $160.48 million in 2012 to $915.723 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms also increased significantly, reaching a peak of $274.323 million in 2020.

Texas's total employed population aged 16 and above grew from 10.92 million in 2012 to 12.28 million in 2020, despite a slight dip in 2020 likely due to the COVID-19 pandemic. The state's per capita income consistently increased from $43,863 in 2012 to $55,118 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, Texas's entrepreneurial ecosystem has shown a strong presence of employer and nonemployer firms in the manufacturing, professional, scientific, and technical services, and health care sectors and a notable presence of nonemployer firms in data processing. The state has also witnessed a significant increase in women patentees, highlighting its focus on fostering innovation and intellectual property creation among women entrepreneurs. Venture capital funding has grown substantially, with a notable increase in funding for both female-owned firms and firms co-owned by men and women. Despite the challenges posed by the COVID-19 pandemic, Texas's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-45-1 Texas Model Interpretations

A 1% increase in the number of women patentees in Texas produces about a .33% increase in the number of women STEM entrepreneurs in the state. The data shows that the number of women patentees in Texas has been consistently increasing over the years, with a maximum of 3,244 in 2019. These patentees have probably formed new STEM businesses.

A 1% increase in venture capital funding in Texas produces a .269% increase in the number of women STEM entrepreneurs in the state. This is close to the national result. The data shows that venture capital funding in Texas has been consistently increasing over the years, with a maximum of $915.723 million in 2020. There is an increasing number of venture capital firms that invest in women entrepreneurs in North Texas and elsewhere in the state. This was partly promoted through the increased online connectivity during the pandemic (Brand 2021). TWV Capital Management, L.L.C. (TWV Capital) invests in Texas women-owned and -led companies through the Texas Women Ventures Family of Funds.

Venture capital investment with women STEM entrepreneurs can have a big effect partly because of the relative lack of such investment. The small but expanding entrepreneurial support system that is developing in the state, is probably helping venture funding have a positive impact. The factors that provide this support include easier networking opportunities, mentorship options, friendliness to Latina entrepreneurs and a relatively strong economy, amongst other things (Maddox 2024).

The Institute for Innovation and Entrepreneurship at the University of Texas, Dallas[lxv] facilitates the commercialization of university technologies and has the potential to help female STEM entrepreneurs by validating inventions and innovations proposed by faculty and students. The University of North Texas (UNT) Murphy Center for Entrepreneurship and Innovation[lxvi] has a number of programs and partnerships with entrepreneurs, venture funds and service providers to accelerate innovation in the Dallas Fort Worth (DFW) area. UNT has added new degree programs in data science and advanced data analytics to ensure that its students are ready for the entrepreneurial ecosystem. The university has initiatives like the Innovator Awards[lxvii] to help students and faculty gain recognition for their innovations and creativity. UNT alums leverage the areas many resources such as well-trained students to launch startups[lxviii].

The estimated effect of the labor force in Texas is negative. A 1% increase in the labor force would produce a 7% decrease in the number of women STEM entrepreneurs in the state. A larger labor force is generally expected to provide a broader pool of skilled workers and support the growth of businesses across sectors, including STEM fields. The data shows that the number of employed individuals in Texas has been consistently increasing, with a maximum of 12.8 million in 2019. However, the larger labor force might not be skilled, or concentrated in the STEM sectors where women STEM entrepreneurs are concentrated. This could lead to increased competition amongst firms to hire skilled workers and lead to firm failures.

The coefficient for women STEM graduates indicates that a 1% increase leads to a 2.3% increase in the number of women STEM entrepreneurs in Texas. This positive relationship aligns with expectations, as a larger pool of women with STEM education contributes to more women pursuing entrepreneurship in STEM fields within the state.

The increase in the interest rates has a positive relation, a one percentage point rise in interest rates is projected to cause a .03% increase in the number of women STEM entrepreneurs in Texas. This result is surprising, as higher interest rates typically increase funding/financing difficulties for entrepreneurs. The positive relationship between interest rates and the number of women STEM entrepreneurs in Texas, as shown in the regression results, is surprising but may be explained by the prevalence of nonemployer firms. Women STEM entrepreneurs operating nonemployer firms may be less sensitive to changes in interest rates due to lower capital requirements and less reliance on external financing. Higher interest rates could potentially benefit these self-employed women STEM entrepreneurs by increasing the opportunity cost of starting or maintaining a business, reducing competition, and leading to increased demand for their services and potentially higher profits.

A 1% increase in per-capita real income in Texas produces a 1.07% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient can be explained by the concept of opportunity cost. As per-capita real income increases, the opportunity cost of pursuing entrepreneurship also increases, as individuals may have more attractive employment options or may be less willing to take on the risks associated with starting a business. The data shows that per-capita income in Texas has been consistently increasing over the years, with a maximum of $55,118 in 2020. The negative relationship suggests that as per-capita real income rises in Texas, women in STEM fields may face higher opportunity costs when deciding to pursue entrepreneurship, leading to a decrease in the number of women STEM entrepreneurs. However, it is important to note that other factors, such as the availability of support services for entrepreneurs, may also influence this relationship.

The pandemic had a negative impact on female STEM entrepreneurs in Texas, probably due to child care disruptions and lack of financial resources and assistance.

5-45-2 Texas Policy Implications

Based on the Texas CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-44: Texas Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Texas state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Texas. 3. The federal government could provide funding to Texas for investment in training programs for a skilled workforce. 4. Congress could work with Texas state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide grants to the state government to provide childcare and other care options to female STEM entrepreneurs. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs.	1. Facilitates the commercialization of patents and the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses. 3. Ensures a strong pipeline of diverse talent to support the growth of women-owned STEM ventures. 4. Supports women STEM graduates in launching and growing their businesses in the state by providing tailored resources and experiences. 5. Creates a more supportive ecosystem for women STEM entrepreneurs by addressing specific challenges and providing resources. 6. Supports the continued growth and success of women STEM entrepreneurs by providing financial assistance.

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Texas, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in Texas, driving innovation, economic growth, and social progress for the state and beyond.

5-46 Utah Model Results and Policy Implications

Utah has a small economy that is reasonably balanced, but the data has some missing values. For employer firms there are missing values in the Machinery Manufacturing, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing sectors. There are missing values for nonemployer firms in the Electrical Equipment, Appliance, and Component manufacturing and Transportation Equipment Manufacturing sectors.

The dominant sector for women STEM entrepreneurs in the state is the Professional, Scientific and Technical Services sector, with numbers for employer firms ranging between 1080 and 1763 (with a very low value for 2012), and numbers for nonemployer firms ranging between 10,809 and 15500. The Ambulatory Health Care Services sector is the next largest sector with female entrepreneur numbers ranging from 540 to 701 for employer firms and ranging from 3,221 to 4,500 for nonemployer firms. This sector has missing values for the employer firms in 2018 and 2020.

For nonemployer firms, the next most important sectors were Miscellaneous Manufacturing and Data Processing, Hosting and Related Services. The data processing sector had a few hundred firms over the years with slightly lower numbers than Miscellaneous Manufacturing. The growth patterns for these sectors were also intermittent, with Data Processing, Hosting and Related Services nonemployer firms staying the same in 2018, 2019, and 2020, while Miscellaneous Manufacturing nonemployer firms grew to 450 in 2020.

Other sectors are represented but small. The two most important are Chemical Manufacturing, and Fabricated Metal Parts Manufacturing that maintained a consistent but small presence over the years for both employer and nonemployer firms. The Machinery Manufacturing and Computer and Electronic Product Manufacturing sectors have few nonemployer firms in the study period years.

Overall, the Utah landscape for women STEM entrepreneurs seems to have been dominated by services, with some manufacturing and data processing firms in the nonemployer category.

Total female venture capital funding in Utah climbed from $25 million in 2012 to $98.55 million in 2020, with a peak of $350.15 million in 2018. Most of this funding was for firms co-founded by men and women. The only year in which the funding was equally split between female-founded firms and co-founded firms was 2015, when it was close to $24 million for each firm type.

The number of patentees in Utah grew from 205 in 2012 to 323 in 2019 with a slight decline from 2019 to 302 patentees in 2020. The number of employed people in the state went from 1.25 million in 2012 to 1.55 million in 2019, before dropping to 1.53 million in 2020, possibly due to the pandemic.

Real per capita income in Utah increased steadily form $35,633 in 2012 to $51,751 in 2020, showing the economic resilience of the state.

5-46-1 Utah Model Interpretations

Based on the model results, a 1% increase in women patentees in Utah leads to a 0.092% increase in the number of women STEM entrepreneurs, in line with expectation. The University of Utah and Utah State University both have commercialization support, oriented exclusively toward faculty. This could help academic female STEM entrepreneurs patent their innovations, which could lead to more female STEM entrepreneurs.

The model results show a 1% increase in female venture capital leading to a 0.023% drop in women STEM entrepreneurship in Utah. One fund that does specifically fund women entrepreneurs in Utah is the Artemis Fund. It is led by Diana Murakhovskaya, Stephanie Campbell, and Leslie Goldman Tepper, who come to the fund with years of experience fulfilling both roles as business leaders and family caregivers (Myers 2022)[lxix].

But the venture funding gap for women entrepreneurs remains, and is a deterrent to women STEM entrepreneurs in Utah. An example of this problem is in a Venture Capital Podcast about Founder 100 list for the Utah region that shows fewer women in the list of top 100 CEOs, founders, and executives leading startups [lxx]. In this list, well under 20% of those listed are women. The model result implies that even if the venture funding to female founders increases, the number of female STEM entrepreneurs in Utah might not increase. It is possible that this funding is directed to sectors where these entrepreneurs are already concentrated leading to increased competition, or this funding could cause dilution of ownership.

A 1% in labor force leads to a 3.153% increase in women entrepreneurship in the state. In a 2019 factsheet that analyzes labor supply and demand in Utah, John Downen, and Michael Hogue of the University of Utah state, “We found an expected labor shortage in Utah, with roughly two out of five jobs lacking a suitable supply. However, 90 percent of this unfilled demand is for occupations requiring at most a high school diploma. Skilled occupations, those requiring at least a certificate, account for just 9 percent of the unmet demand.” [lxxi]. The skilled labor supply is probably helpful to women STEM entrepreneurs.

A 1% increase in women STEM graduates nationwide is seen as leading to a drop of 1.46% in women entrepreneurship in Utah. This could be related to the continuing barriers that female STEM entrepreneurs face in the state. Jang (2024) finds that “Salt Lake City is second in the nation for STEM career opportunities, but it ranks 43rd for its “STEM-Friendliness.” This shows significant gender disparity in STEM occupations and degrees within Utah.”

Interest rate increases lead to a small (0.015%) positive effect in increasing women STEM entrepreneurship in the state. This is probably because of the relatively high number of nonemployer firms that are not reliant on traditional financing.

A 1% increase in real income is seen as leading to a 0.954% increase in women STEM entrepreneurship in the state, in line with expectation.

The effect of COVID-19 is positive. Utah is a wide-open Western state, and the effect of the pandemic could be less than in other areas.

5-46-2 Utah Policy Implications

Based on the Utah CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-45: Utah Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Utah state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train Utah female lenders to invest in diverse STEM sectors. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Federal grant funding for Utah institutions could be tied to promoting female faculty. 5. The federal government could invest in infrastructure projects in Utah to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could provide funding to the state to invest in the continued innovation demonstrated by women STEM entrepreneurs in emergencies.	1. Promotes women's STEM entrepreneurship by fostering a strong pool of women patentees. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Provides female STEM entrepreneurs with access to a skilled and diverse workforce and childcare support. 4. Supports female STEM entrepreneurs and facilitates the transition from academia to entrepreneurship. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Supports the continued growth and success of women-owned STEM businesses

The implementation of these policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Utah, addressing the unique challenges and opportunities identified in the state-level analysis.

5-47 Vermont Model Results and Policy Implications

Vermont is a small, highly educated state that has been primarily agricultural for years. Recently, the state has become more oriented toward healthcare, real estate, other services and manufacturing, with agriculture still playing a substantial role.

Overall, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms, with numbers generally increasing over the years. The Ambulatory Health Care Services sector is the second most concentrated, though data is missing for some later years. The number of employer firms in the Professional, Scientific and Technical Services sector ranged from 331 to 522 during the years of the study period. The nonemployer firms in this sector ranged from 3,839 to 4,400 during this time period. The Ambulatory Health Care Services sector, the next most concentrated sector had employer firm numbers ranging from 243 to 298 and nonemployer firm numbers ranging from 1,943 to 2,300.

For the manufacturing sectors, Miscellaneous Manufacturing and Chemical Manufacturing dominated nonemployer firms. There are a few nonemployer firms in the Data Processing, Hosting and Related Services sector.

Venture capital investment in female-founded or co-founded firms shows significant fluctuations year to year, with no clear upward trend. The total investment ranges from a low of $3.866 million in 2020 to a high of $41.3 million in 2019.

The number of women patentees in Vermont shows an overall declining trend, starting at 94 in 2012, peaking at 156 in 2013, and then decreasing to 88 by 2020.

Employment trends in Vermont show modest growth until 2019, with total employment rising from 304,700 in 2012 to 316,300 in 2019, before declining sharply to 287,000 in 2020, likely due to the impact of the COVID-19 pandemic.

Vermont's economic growth is reflected in its per capita income, which rose from $44,861 in 2012 to $57,978 in 2020, showcasing the state's overall economic improvement and increasing standard of living during this period, despite challenges in other areas.

5-47-1 Vermont Model Interpretations

A 1% increase in the number of women patentees in Vermont is associated with a 0.009% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is surprising, as a higher number of women patentees is generally expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Vermont has been relatively low compared to other states, with a maximum of 156 in 2013. Factors such as barriers to commercializing patents, concentration of patents in specific industries, or limited entrepreneurial opportunities in certain fields may contribute to this negative relationship.

A 1% increase in venture capital funding in Vermont is associated with a 0.012% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as increased venture capital funding is generally thought to support entrepreneurial activities. The data shows that venture capital funding in Vermont has been very moderate compared to other states, with a maximum of $41.3 million in 2019. However, the small magnitude of the coefficient indicates that venture capital funding alone may not be a strong driver of women's STEM entrepreneurship in Vermont, and other factors such as the overall entrepreneurial ecosystem, access to other forms of financing, and support networks may also play important roles.

A 1% increase in Vermont's labor force is associated with a 1.784% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is surprising, as a larger labor force is generally expected to provide networking and child care options and support the growth of businesses across sectors, including STEM fields. The data shows that the number of employed individuals in Vermont has been relatively stable, with a maximum of 316,300 in 2019. Factors such as the composition of the labor force, industry-specific dynamics, or the presence of barriers to entrepreneurship may be influencing this negative relationship.

A 1% increase in the number of women STEM graduates nationally is associated with a 0.317% increase in the number of women STEM entrepreneurs in Vermont. This positive relationship aligns with expectations, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level. While the data does not provide information on the number of women STEM graduates specific to Vermont, the positive coefficient suggests that the national trend may have a positive influence on women's STEM entrepreneurship in the state.

A one percentage point increase in the national interest rate is associated with a 0.018% decrease in the number of women STEM entrepreneurs in Vermont. This negative relationship aligns with expectations, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Vermont is associated with a 0.124% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as higher per-capita real income is generally expected to support entrepreneurial activity, including in STEM fields. The data shows that per-capita income in Vermont has been consistently increasing over the years, with a maximum of $57,978 in 2020. The positive coefficient suggests that rising income levels may provide more opportunities and resources for women to pursue STEM entrepreneurship in Vermont.

The presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Vermont compared to the pre-pandemic period. This negative relationship suggests that the COVID-19 pandemic may have posed challenges for women's STEM entrepreneurship in Vermont, potentially due to disruptions in business operations, changes in market demand, or difficulties in accessing resources and support during the crisis.

5-47-2 Vermont Policy Implications

Based on the Vermont CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-46: Vermont Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Vermont state/local jurisdictions to condition institutional funding on increased female commercialization exposure. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Vermont. 3. The federal government could provide funding to Vermont for investment in training programs for a skilled workforce. 4. Congress could work with the state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Vermont to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs.	1. Facilitates the growth of women-owned STEM businesses. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

These policy measures can lead to a more supportive and inclusive environment for women STEM entrepreneurs, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in Vermont, driving innovation, economic growth, and social progress for the state and beyond.

5-48 Virginia Model Results and Policy Implications

Virginia is similar to many other states, in that women STEM entrepreneurs are primarily found in the Professional, Scientific and Technical Services sector, and to a lesser extent in the Ambulatory Health Care Services sector.

For the study years, the number of Professional, Scientific and Technical Services employer firms grew from 6393 to 8102 (a 27% increase), while the counterpart number of nonemployer firms in this sector grew from 36,456 to 43,000 (an 18% increase). The number of Ambulatory Health Care Services employer firms grew from 2871 to 4276 (a 49% increase), while the counterpart number of nonemployer firms in this sector grew from 13370 to 19000 (a 42% increase).

In the manufacturing sectors, the number of employer firms has varied over the years, with Fabricated Metal Product Manufacturing having the most significant presence, followed by Miscellaneous Manufacturing and Machinery Manufacturing. Other sectors, such as, Computer and Electronic Product Manufacturing, Electrical Equipment, Appliance, and Component Manufacturing, and Transportation Equipment Manufacturing, have had a consistent but smaller presence in the employer firm category.

The number of nonemployer firms in the Fabricated Metal and Product Manufacturing, Machinery Manufacturing, Computer and Electronic Product Manufacturing sectors has remained relatively stable over the years. Miscellaneous Manufacturing and Chemical Manufacturing have the highest number of nonemployer firms in the study time period. The Data Processing, Hosting, and Related Services sector has had a significant presence in the nonemployer category, with numbers higher than all manufacturing sectors, except for Miscellaneous Manufacturing.

The number of women patentees in Virginia grew from 418 in 2012 to 815 in 2020, with a peak of 818 in 2019. This trend highlights the strong participation and success of women in innovation and intellectual property creation in Virginia.

Total female venture capital funding in Virginia grew from 60.43 million in 2012 to 323.15 million in 2019 before falling to 158.05 million in 2020. The majority of the funding was allocated to firms co-founded by men and women, while funding for female-founded firms was relatively small over the years.

Virginia's total employed population aged 16 and above grew from 3.73 million in 2012 to 4.06 million in 2019, with a dip to 3.86 million in 2020 likely due to the COVID-19 pandemic. The state's per capita income increased from $49,052 in 2012 to $61,474 in 2020, reflecting an overall improvement in the standard of living.

In conclusion, Virginia’s entrepreneurial ecosystem has shown a reasonable presence of employer and nonemployer firms in the manufacturing sector, a strong presence of these firms in the professional, scientific, and technical services, and health care sectors and a notable presence of nonemployer firms in data processing. The state has witnessed a significant increase in women patentees. Venture capital funding has grown substantially, though most of the funding has gone to firms co-owned by men and women. Despite the challenges posed by the COVID-19 pandemic, Virginia's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-48-1 Virginia Model Interpretations

Based on the model results, a 1% increase in women patentees in Virginia produces about a 0.094% increase in the number of women STEM entrepreneurs in the state. This conforms to expectation. Women patentees in Virginia are able to transform their patents into entrepreneurial ventures.

A 1% increase in venture capital funding in Virginia produces only a 0.001% decrease in women STEM entrepreneurs in the state. This implies that increased venture funding does not have a large impact on female STEM entrepreneurs in Virginia. It is possible that increased funding goes to sectors in which firms are already concentrated leading to increased competition or results in ownership dilution for firms.

A more robust result is a 1% increase in labor force in Virginia leading to over a 5% increase in the number of women STEM entrepreneurs. This result conforms to expectations, because a larger labor force leads to increased networking and child care options for female entrepreneurs.

A 1% increase in women STEM graduates nationally is projected to lead to a 0.71% decrease in women STEM entrepreneurs in Virginia. Here again, the focus of women entrepreneurs in the health care sector, does not correspond to the growth sectors in Virginia in the recent years, and women STEM entrepreneurs may have avoided the state because of it. Obbin et al. (2024) find that "Health spending per capita in Virginia in 2022 was about $1,800 lower than the national average, with all major spending categories lower than their national comparators. This $1,800 per capita health care spending gap between Virginia and the U.S. has increased from 2021, when it was $1,600 per person"[lxxii].

Obbin et al. (2024) also note that "A tight labor market for health care workers continued in 2022 in Virginia, driving up the costs for providers. Average annual wages for healthcare practitioners (e.g., physicians, nurses, and technicians) were up 2.8% year over year in 2022, while annual wages for health care support roles (aides and assistants) were up 6.6%". These factors could have discouraged potential women STEM entrepreneurial entrants in the health care sector.

A 1% increase interest rates produces about a 0.039% increase in women STEM entrepreneurs. The positive sign of the coefficient, may be related to a wealth effect, in that wealthier women who receive higher interest payments on bonds or other interest-earning assets, may be more likely to become entrepreneurs.

A 1% increase in real income is seen as producing a 0.099% increase in women STEM entrepreneurs. This corresponds to expectation, and is possibly due to increased incomes providing women with greater financial flexibility to start businesses.

Finally, the effect of the COVID-19 dummy is positive, in contrast to expectation. This may be directly related to the pandemic, stimulating growth in the health sector for these entrepreneurs. The data shows that the number of female employer and nonemployer firms grew in the Ambulatory Health Care Services sector in 2020.

In addition, a number of women entrepreneurs moved online during the pandemic, with women entrepreneurs in Gainesville, Virginia being an example of those who saw increased demand during the pandemic. Burbank (2024) writes about the rise of online businesses in Gainesville, Virginia. "Despite the challenges, many female entrepreneurs in Gainesville have found ways to adapt and thrive during the pandemic. With the closure of physical stores, many businesses have shifted their operations online. This has allowed them to continue serving their customers and generating revenue. Online businesses have also opened up new opportunities for female entrepreneurs.

With more people staying at home and relying on online shopping, there has been a surge in demand for products and services offered by women-owned businesses."

The pandemic led to an increase in female STEM entrepreneurship in Virginia. Virginia received $4.29 billion as part of the American Rescue Plan Act (ARPA) Coronavirus State and Local Fiscal Recovery Fund (SLFRF), which resulted in 148 projects across 42 agencies, as of June 30, 2023[lxxiii]. The Commonwealth of Virginia Executive Order Number Thirty-Five (2019) establishes a target goal of 42% participation for disadvantaged businesses in state contracting, including for small-, women-, minority- and service-disabled veteran-owned businesses. Many of these projects followed this requirement of utilizing a minimum of 42% of these businesses. This probably helped women-owned businesses recover and grow during the pandemic.

5-48-2 Virginia Policy Implications

Based on the Virginia CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-47: Virginia Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Virginia state/local jurisdictions to condition institutional funding on increased female commercialization exposure 2. SBA could train Virginia female lenders to invest in diverse STEM sectors. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding in Virginia to female STEM learning in diverse STEM sectors. 4. Federal grant funding for Virginia institutions could be tied to promoting female faculty. 5. The federal government could invest in infrastructure projects in Virginia to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could provide funding to the state to invest in the continued innovation and adaptability demonstrated by women STEM entrepreneurs in emergencies.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Facilitates the transition from academia to entrepreneurship. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Supports the continued growth and success of women-owned STEM businesses.

These policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Virginia, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women STEM entrepreneurs in Virginia, driving innovation, economic growth, and social progress for the state and beyond.

5-49 Washington Model Results and Policy Implications

In Washington from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms. The number of employer firms in this sector ranges from 3,958 to 5,549 over the years, while nonemployer firms show significantly higher numbers, ranging from 33,994 to 40,000. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 2,844 to 4,114 and nonemployer firms from 12,733 to 15,000, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing shows the highest concentration of employer firms, with numbers ranging from 72 to 190 firms. Machinery Manufacturing and Chemical Manufacturing also show a consistent presence in both employer and nonemployer categories. The least concentrated sectors for employer firms is Electrical Equipment, Appliance, and Component Manufacturing and for nonemployer firms is Transportation Equipment Manufacturing.

Miscellaneous Manufacturing has the highest number of nonemployer firms in the manufacturing sectors. Data Processing, Hosting and Related Services has few hundred nonemployer firms over the years and the number of firms is higher than other manufacturing sectors, though less than Miscellaneous Manufacturing.

Venture capital investment in female-founded or co-founded firms in Washington shows a generally positive trend, albeit with significant fluctuations. The total investment increased from $268.245 million in 2012 to $984.55 million in 2020, with notable peaks of $727.401 million in 2014 and $692.25 million in 2019. Most of the investment has gone to co-founded firms, but female-founded firms have also seen increases from $49.85 million investment in 2012 to $118.7 million in 2020. This overall growth suggests an increasingly supportive funding environment for female entrepreneurs in Washington, particularly in recent years.

The number of women patentees in Washington shows a strong upward trend, increasing from 1,796 in 2012 to 3,068 in 2020, representing a 71% increase over the period. This significant growth indicates a positive trend in women's participation in innovation and intellectual property creation in the state.

Employment trends in Washington show strong and consistent growth until 2019, with total employment rising from 2,919,200 in 2012 to 3,467,300 in 2019, before declining to 3,282,200 in 2020 due to the impact of the COVID-19 pandemic.

Washington's economic growth is further reflected in its per capita income, which rose significantly from $47,057 in 2012 to $67,674 in 2020, showcasing the state's overall economic prosperity and increasing standard of living during this period.

In conclusion, Washington's entrepreneurial ecosystem has shown a reasonable presence of employer and nonemployer firms in the manufacturing sector, a strong presence of these firms in the professional, scientific, and technical services, and health care sectors and a notable presence of nonemployer firms in data processing. The state has witnessed a significant increase in women patentees. Venture capital funding has grown substantially. Despite the challenges posed by the COVID-19 pandemic, Washington's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-49-1 Washington Model Interpretations

A 1% increase in the number of women patentees in Washington produces about an 0.056% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient is surprising, as a higher number of women patentees is expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Washington has been consistently increasing over the years, with a maximum of 3,068 in 2020. There could be several reasons for these results. The high number of women patentees may not necessarily translate into a higher number of women STEM entrepreneurs if there are barriers to commercializing these patents. Factors such as access to funding, mentorship, or networks may hinder the transition from patent holder to entrepreneur. Secondly, the patents held by women in Washington may be concentrated in specific industries that do not align with the sectors typically associated with STEM entrepreneurship. If the patents are in fields with limited entrepreneurial opportunities or high barriers to entry, the negative relationship may occur.

A 1% increase in venture capital funding in Washington produces about a 0.029% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as increased venture capital funding is expected to support women STEM entrepreneurship. The data shows that venture capital funding in Washington has been consistently increasing over the years, with a maximum of $984.55 million in 2020.

The estimated effect of the labor force in Washington is positive. The estimate indicates a 1% increase in the labor force would produce a 1.066% increase in the number of women STEM entrepreneurs in the state. The positive sign of this coefficient aligns with expectations, as a larger labor force is generally expected to provide broader networking and child care options and support the growth of businesses across sectors, including in the STEM fields.

A 1% increase in the number of women STEM graduates nationally produces a 0.624% increase in the number of women STEM entrepreneurs in Washington. The positive sign of this coefficient aligns with expectations, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level.

A one percentage point increase in the national interest rate produces a 0.067% decrease in the number of women STEM entrepreneurs in Washington. The negative sign of this coefficient aligns with expectations, as higher mortgage rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018.

A 1% increase in per-capita real income in Washington produces about an 1.655% decrease in the number of women STEM entrepreneurs in the state. The negative sign of this coefficient can be explained by the concept of opportunity cost. As per-capita real income increases, the opportunity cost of pursuing entrepreneurship also increases, as individuals may have more attractive employment options or may be less willing to take on the risks associated with starting a business. The data shows that per-capita income in Washington has been consistently increasing over the years, with a maximum of $67,674 in 2020.

The COVID-19 dummy variable indicates that the presence of the pandemic is associated with an increase in the number of women STEM entrepreneurs in Washington compared to the pre-pandemic period. The positive sign of this coefficient does not align with expectations, and suggests that women's STEM entrepreneurship in Washington may have been resilient during an economic downturn.

5-49-2 Washington Policy Implications

Based on the Washington CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-48: Washington Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state. 2. SBA could train new female investors and educate them on investing in female STEM businesses in Washington. 3. Congress could provide childcare stabilization grants and the federal government could tie K-12 funding to the state to female STEM learning in diverse STEM sectors. 4. Congress could work with Washington state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide grants to the state government to provide child care and other care options to female STEM entrepreneurs. 6. The federal government could provide funding to the state to invest in the continued innovation and adaptability demonstrated by women STEM entrepreneurs in emergencies.	1. Facilitates the growth of women-owned STEM businesses. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Provides female STEM entrepreneurs with access to a skilled workforce and childcare support. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

These policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Washington, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and fostering resilience and adaptability can help unlock the full potential of women

STEM entrepreneurs in Washington, driving innovation, economic growth, and social progress for the state and beyond.

5-50 West Virginia Model Results and Policy Implications

West Virginia's entrepreneurial landscape has shown mixed trends from 2012 to 2020, with fluctuations in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state has also witnessed a relatively low number of women patentees throughout the period, indicating a limited focus on innovation and intellectual property creation among women entrepreneurs.

In the Professional, Scientific, and Technical Services sector, the number of employer firms has ranged from 390 to 570, with missing data for 2018 and 2020. The number of nonemployer firms in this sector has shown an increase from 3,707 in 2012 to 3,800 in 2020, suggesting an increase in self-employment and small business ownership in this sector.

The Ambulatory Health Care Services sector has seen a decline in the number of employer firms from 423 in 2012 to 326 in 2017, with missing data for latter years and a peak of 443 in 2015. The number of nonemployer firms in this sector has shown a slight increase from 2,375 in 2012 to 2,400 in 2020, indicating a small increase in self-employment and small business ventures in this sector.

The number of women patentees in West Virginia has been relatively low throughout the period, with a maximum of 33 in 2020 and a minimum of 23 in 2018. The low number of women patentees suggests a limited focus on innovation and intellectual property creation among women entrepreneurs in the state.

Venture capital funding in West Virginia has been minimal or non-existent throughout the period, with the total funding (sum of funding for firms co-founded by men and women and funding for female-founded firms) reaching a maximum of only $1.5 million in 2013. The lack of venture capital funding in the state highlights the need for increased support and access to capital for women entrepreneurs, in West Virginia.

West Virginia's labor force, represented by the total number of employed individuals, has shown a decline from 729,000 in 2012 to 668,300 in 2020, with some fluctuations in between. Despite the challenges posed by the COVID-19 pandemic and the declining labor force, West Virginia's per capita income has consistently increased throughout the period, reaching $45,071 in 2020, indicating an overall improvement in the standard of living for residents.

In conclusion, West Virginia's entrepreneurial ecosystem has shown mixed trends, with fluctuations in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state has witnessed a relatively low number of women patentees and minimal venture capital funding, highlighting the need for increased support and resources for women entrepreneurs. To foster a more vibrant and inclusive entrepreneurial environment, West Virginia should focus on addressing the challenges posed by the declining labor force, promoting innovation and intellectual property creation among women, and improving access to capital for entrepreneurs. By leveraging its increasing per capita income and addressing these key areas, West

Virginia can work towards creating a more resilient and diverse entrepreneurial landscape.

5-50-1 West Virginia Model Interpretations

A 1% increase in the number of women patentees in West Virginia is associated with a 0.325% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as a higher number of women patentees is generally expected to lead to more women STEM entrepreneurs. Looking at the raw data, the number of women patents in West Virginia has been relatively low, with a maximum of 33 in 2020.

A 1% increase in venture capital funding in West Virginia is associated with a 0.001% decrease in the number of women STEM entrepreneurs in the state, which is a marginal impact. This negative relationship does not align with expectations, as increased venture capital funding is generally thought to support entrepreneurial activities. The raw data reveals that venture capital funding in West Virginia has been extremely low, with a maximum of $1.5 million in 2013 and no funding recorded in most years. The lack of substantial venture capital investments in the state may limit the growth opportunities for women STEM entrepreneurs. The marginal negative coefficient suggests that increasing the availability and accessibility of female venture capital funding in West Virginia will not impact women STEM entrepreneurs much. This could be because funding is not targeted to less crowded STEM sectors or because increased funding dilutes ownership.

The lack of statistical significance measures in the regression output limits the interpretability of this results. In addition, the missing values in the female STEM entrepreneur numbers for West Virginia and potential data limitations leads to most of the coefficients not being computed. The missing values may also affect the reliability of the coefficients that were estimated and the associated economic interpretations.

5-50-2 West Virginia Policy Implications

Based on the West Virginia CVR Model Results, we drew the following policy implications. The table below lists these policies and their corresponding benefits.

Table 5-49: West Virginia Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with West Virginia state/local jurisdictions to condition institutional funding on increased female commercialization exposure 2. SBA could train West Virginia female lenders to invest in diverse STEM sectors.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Improves access to funding for women-owned STEM businesses in diverse sectors.

These policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in West Virginia, addressing the unique challenges and opportunities identified in the state-level analysis.

5-51 Wisconsin Model Results and Policy Implications

In Wisconsin from 2012 to 2020, the Professional, Scientific, and Technical Services sector consistently shows the highest concentration of both employer and nonemployer firms. The number of employer firms in this sector ranges from 1,808 to 2,478 over the years, while nonemployer firms show significantly higher numbers, ranging from 17,313 to 19,000. This indicates a strong presence of both established businesses and self-employed professionals in this field. The Ambulatory Health Care Services sector is the second most concentrated, with employer firms ranging from 1,156 to 1,615 (with missing data in 2020) and nonemployer firms from 6,852 to 8,000, highlighting the significant role of healthcare services in the state's economy.

Among manufacturing sectors, Fabricated Metal Product Manufacturing shows the highest concentration of employer firms, with numbers ranging from 91 to 189 firms. Machinery Manufacturing and Miscellaneous Manufacturing also show a consistent presence in both employer and nonemployer categories. The least concentrated sectors for employer firms include Computer and Electronic Product Manufacturing and Transportation Equipment Manufacturing. Miscellaneous Manufacturing has the highest number of nonemployer firms in the manufacturing sectors. Data Processing, Hosting, and Related Services has nonemployer firms ranging from 200 to 250 firms over the years, which is less than Miscellaneous Manufacturing but higher than the numbers for other manufacturing sectors.

Venture capital investment in female-founded or co-founded firms in Wisconsin shows fluctuations year to year, with no clear upward trend. The total investment ranges from a low of $10.4 million in 2013 to a high of $45.457 million in 2020. This volatility suggests an unpredictable environment for female entrepreneurs seeking venture capital in the state, though there are signs of improvement in recent years.

The number of women patentees in Wisconsin remains relatively stable over the period, fluctuating between 620 and 712, with no clear upward or downward trend. This suggests consistent participation of women in innovation and intellectual property creation in the state.

Employment trends in Wisconsin show steady growth until 2019, with total employment rising from 2,780,800 in 2012 to 2,987,600 in 2019, before declining to 2,823,800 in 2020 due to the impact of the COVID-19 pandemic.

Wisconsin's economic growth is reflected in its per capita income, which rose from $42,641 in 2012 to $55,431 in 2020, showcasing the state's overall economic improvement and increasing standard of living during this period, despite challenges in other areas.

Wisconsin's entrepreneurial ecosystem has shown a reasonable presence of employer and nonemployer firms in the manufacturing sector, a strong presence of these firms in the professional, scientific, and technical services, and health care sectors and some presence of nonemployer firms in data processing. The state has witnessed a stable number of women patentees. Venture capital funding has fluctuated year to year. Despite the challenges posed by the COVID-19 pandemic, Wisconsin's per capita income has consistently increased, reflecting overall economic growth and resilience.

5-51-1 Wisconsin Model Interpretations

A 1% increase in the number of women patentees in Wisconsin is associated with a 0.15% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as a higher number of women patentees is generally expected to lead to more women STEM entrepreneurs. The data shows that the number of women patents in Wisconsin has been relatively stable over the years, with a maximum of 712 in 2018. The positive coefficient suggests that the presence of women patentees in Wisconsin may be contributing to the growth of women's STEM entrepreneurship in the state, possibly by providing role models, mentorship, and knowledge spillovers that encourage more women to pursue entrepreneurial ventures in STEM fields.

A 1% increase in venture capital funding in Wisconsin is associated with a 0.02% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as increased venture capital funding is generally thought to support entrepreneurial activities. The data shows that venture capital funding in Wisconsin has been moderate when compared to other states, with a maximum of $45.457 million in 2020. The positive coefficient indicates that the availability of venture capital funding in Wisconsin may be beneficial for women STEM entrepreneurs, potentially providing them with the necessary financial resources to start and grow their businesses.

A 1% increase in Wisconsin's labor force is associated with a 1.05% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is surprising, as a larger labor force is generally expected to provide broader networking and child care options and support the growth of businesses across sectors, including STEM fields. The data shows that the number of employed individuals in Wisconsin has been relatively stable, with a maximum of 2,987,600 in 2019. The negative coefficient suggests that the growth in Wisconsin's labor force may not be directly translating into increased opportunities for women STEM entrepreneurs, and other factors such as the composition of the labor force, industry-specific dynamics, or the presence of barriers to entrepreneurship may be influencing this relationship.

A 1% increase in the number of women STEM graduates nationally is associated with a 0.26% increase in the number of women STEM entrepreneurs in Wisconsin. This positive relationship aligns with expectations, as a larger pool of women STEM graduates nationally is expected to contribute positively to women's STEM entrepreneurship at the state level. While the data does not provide information on the number of women STEM graduates specific to Wisconsin, the positive coefficient suggests that the national trend may have a positive influence on women's STEM entrepreneurship in the state.

A one percentage point increase in the national interest rate is associated with a 0.007% increase in the number of women STEM entrepreneurs in Wisconsin. This positive relationship is unexpected, as higher interest rates may make it more difficult for women STEM entrepreneurs to access financing for their ventures. The data shows that the national mortgage rate has been relatively low during the observed period, with a maximum of 4.54% in 2018. The positive coefficient suggests that other factors may be overshadowing the potential negative impact of mortgage rates on women's STEM entrepreneurship in Wisconsin, such as the wealth effect of higher interest rates.

A 1% increase in per-capita real income in Wisconsin is associated with a 0.42% increase in the number of women STEM entrepreneurs in the state. This positive relationship aligns with expectations, as higher per-capita real income is generally expected to support entrepreneurial activity, including in STEM fields. The data shows that per-capita income in Wisconsin has been consistently increasing over the years, with a maximum of $52,774 in 2020. The positive coefficient suggests that rising income levels may provide more opportunities and resources for women to pursue STEM entrepreneurship in Wisconsin.

The presence of the pandemic is associated with a decrease in the number of women STEM entrepreneurs in Wisconsin compared to the pre-pandemic period. This negative relationship suggests that the COVID-19 pandemic may have posed challenges for women's STEM entrepreneurship in Wisconsin, potentially due to disruptions in business operations, changes in market demand, or difficulties in accessing resources and support during the crisis.

5-51-2 Wisconsin Policy Implications

Based on the Wisconsin CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-50: Wisconsin Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could work with Wisconsin state/local jurisdictions to condition institutional funding on increased female commercialization exposure 2. SBA could train new female investors and educate them on investing in female STEM businesses in Wisconsin. 3. The federal government could provide funding to Wisconsin for investment in training programs for a skilled workforce. 4. Congress could work with Wisconsin state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could invest in infrastructure projects in Wisconsin to foster economic growth and create a supportive environment for entrepreneurship. 6. The federal government could help the state establish a dedicated fund to provide emergency assistance to women STEM entrepreneurs.	1. Encourages women to pursue innovation and entrepreneurship in STEM fields. 2. Supports the growth and scaling of women-owned STEM ventures. 3. Creates a more supportive environment for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Encourages innovation and risk-taking among women STEM entrepreneurs. 6. Helps women STEM entrepreneurs sustain their businesses during difficult times.

These policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Wisconsin, addressing the unique challenges and opportunities identified in the state-level analysis. A comprehensive approach that encompasses access to funding, workforce development, support for commercialization, and providing emergency assistance can help unlock the full potential of women STEM entrepreneurs in Wisconsin, driving innovation, economic growth, and social progress for the state and beyond.

5-52 Wyoming Model Results and Policy Implications

Wyoming's entrepreneurial landscape has shown mixed trends from 2012 to 2020, with fluctuations in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state has also witnessed a relatively low number of women patentees throughout the period, indicating a limited focus on innovation and intellectual property creation among women entrepreneurs.

In the Professional, Scientific, and Technical Services sector, the number of employer firms has fluctuated, with a peak of 1,942 in 2016 and a decline to 619 in 2020. The number of nonemployer firms in this sector has shown an increase from 2,074 in 2012 to 2,700 in 2020, suggesting a growing preference for self-employment and small business ownership in this sector.

The Ambulatory Health Care services sector has seen fluctuations in the number of employer firms, ranging from 215 to 1775, with missing data in later years. The number of nonemployer firms in this sector has shown an increase from 1,052 in 2012 to 1,300 in 2020, indicating a growing trend in self-employment and small business ventures in the ambulatory health care services sector.

The number of women patentees in Wyoming has been relatively low throughout the period, with a maximum of 29 in 2020 and a minimum of 6 in 2016. The low number of women patentees suggests a limited focus on innovation and intellectual property creation among women entrepreneurs in the state.

Venture capital funding in Wyoming has been minimal throughout the period, with the total funding (sum of funding for firms co-founded by men and women and funding for female-founded firms) reaching a maximum of only $14.8 million in 2015. The lack of substantial venture capital funding in the state highlights the need for increased support and access to capital for women entrepreneurs, in Wyoming.

Wyoming's labor force, represented by the total number of employed individuals (both men and women), has shown a decline from 292,800 in 2012 to 290,500 in 2019 to 274,000 in 2020, with the pandemic possibly causing the decline between 2019 and 2020. Despite the challenges posed by the declining labor force, Wyoming's per capita income has consistently increased throughout the period, reaching $65,558 in 2020, indicating an overall improvement in the standard of living for residents.

In conclusion, Wyoming's entrepreneurial ecosystem has shown mixed trends, with fluctuations in the Professional, Scientific, and Technical Services sector and the Ambulatory Health Care Services sector. The state has witnessed a relatively low number of women patentees and minimal venture capital funding, highlighting the need for increased support and resources for women entrepreneurs. To foster a more vibrant and inclusive entrepreneurial environment, Wyoming should focus on addressing the challenges posed by the declining labor force, promoting innovation and intellectual property creation among women, and improving access to capital for entrepreneurs. By leveraging its increasing per capita income and addressing these key areas, Wyoming can work towards creating a more resilient and diverse entrepreneurial landscape.

5-52-1 Wyoming Model Interpretations

A 1% increase in the number of women patentees in Wyoming is associated with a 0.01% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is surprising, as a higher number of women patentees is generally expected to lead to more women STEM entrepreneurs. The low number of women patentees in the state may not be sufficient to generate a significant positive impact on women's STEM entrepreneurship. Barriers to commercializing patents, such as access to funding, mentorship, or networks, and the concentration of patents in specific industries that do not align with STEM entrepreneurship may contribute to this negative relationship.

A 1% increase in venture capital funding in Wyoming is associated with a 0.03% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is unexpected, as increased venture capital funding is generally thought to support entrepreneurial activities. The lack of substantial venture capital investments in the state may limit the growth opportunities for women STEM entrepreneurs. The negative coefficient indicates that increasing venture capital funding in Wyoming may not be sufficient to drive the growth of women's STEM entrepreneurship in the state. The increased funding might not go to targeted sectors or might cause ownership dilution.

A 1% increase in Wyoming's labor force is associated with a 1.13% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is counterintuitive, as a larger labor force is generally expected to provide broader networking and child care options for potential entrepreneurs and support business growth. The growth in Wyoming's labor force might have been concentrated in industries or positions that do not provide the necessary skills and experience to workers. Additionally, increased competition for resources and market share resulting from labor force growth could make it more challenging for new female-owned businesses to establish themselves and succeed, particularly in sectors where there is already a high concentration of female STEM entrepreneurs.

A 1% increase in the number of women STEM graduates nationally is associated with a 0.43% increase in the number of women STEM entrepreneurs in Wyoming. This positive relationship aligns with expectations, as a larger pool of women STEM graduates is generally expected to contribute positively to women's STEM entrepreneurship.

A one percentage point increase in the interest rate is associated with a 0.09% decrease in the number of women STEM entrepreneurs in Wyoming. This negative relationship aligns with expectations, as higher rates are generally thought to make it more difficult for entrepreneurs to access financing for their ventures.

A 1% increase in Wyoming's real income is associated with a 1.46% decrease in the number of women STEM entrepreneurs in the state. This negative relationship is surprising, as higher income levels are generally expected to support entrepreneurial activity and provide more opportunities for individuals to start and grow their businesses. Factors such as the concentration of women STEM entrepreneurs in certain sectors, or the potential for higher incomes to lead to the abandonment of entrepreneurship by women to raise families may contribute to this negative relationship.

The lack of statistical significance measures in the regression output limits the interpretability of these results. In addition, the missing values in the female STEM entrepreneur numbers for Wyoming and potential data limitations leads to the COVID-19 coefficient not being computed. The missing values may also affect the reliability of the coefficients that are estimated and their associated economic interpretations.

5-52-2 Wyoming Policy Implications

Based on the Wyoming CVR Model Results, we drew a number of policy implications. The table below lists these policies and their corresponding benefits.

Table 5-51: Wyoming Policy Solutions and Benefits

Policy Solution/s	Benefits
1. Congress could legislate that federal agencies participating in SBIR/STTR programs support female commercialization and entrepreneurship in the state 2. SBA could train Wyoming female lenders to invest in diverse STEM sectors. 3. The federal government could provide funding to Wyoming for investment in training programs for a skilled workforce. 4. Congress could work with Wyoming state government to tie institutional funding to internships, mentorship, and networking opportunities for female STEM students and graduates. 5. The federal government could provide grants to the state government to provide child care and other care options to female STEM entrepreneurs.	1. Facilitates the growth of women-owned STEM businesses. 2. Improves access to funding for women-owned STEM businesses in diverse sectors. 3. Creates a skilled workforce for women STEM entrepreneurs. 4. Strengthens the pipeline of potential women STEM entrepreneurs. 5. Reduces barriers to entry for women STEM entrepreneurs.

These policy measures can create a more supportive and inclusive environment for women STEM entrepreneurs in Wyoming, addressing the unique challenges and opportunities identified in the state-level analysis.

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6. Conclusion

Our investigation to further understand the entrepreneurship of Women in STEM in Phase II involved analyses at the national and state levels.

6-1 National Level Analyses

We started with collecting data at the national level on female employer and nonemployer STEM firms at the three-digit NAICS level for the years 2012 to 2020 through various Census sources. We used other sources to collect data on female patentees, female venture capital funding, women STEM graduates, labor force, per capita income, and interest rates at the national level. Next, we applied the econometric approach of a log-log model to analyze the impact of these explanatory variables and of a COVID-19 dummy variable on the number of female STEM entrepreneurs. In addition to running this model at the aggregate national level, we applied this approach to female employer and nonemployer firm data at the two-digit NAICS level broken down by racial and ethnic categories, and veteran status at the national level, for the years 2012 to 2020.

The results of running this model at the aggregate national level and by race and ethnic categories, and veteran status nationally are captured in the Table 6-1 below.

Table 6-1: National Level Log-Log Model Results

National	Increase in Female Patentees	Increase in female venture funding	Increase in the national labor force	Increase in women STEM graduates	Increase in interest rates	Increase in per-capita incomes	COVID-19
Whole Nation	↑	↑	↑	↓	↓	↓	↑
American Indian or Alaska Native	↑	↑	↑	↓	↓	↓	↑
Black or African American	↑	↑	↑	↓	↓	↓	↑
White	↑	↑	↑	↓	↓	↓	↑
Asian	↑	↑	↑	↓	↓	↓	↑
Native Hawaiian or Pacific Islander	↑	↑	↑	↓	↓	↓	↑
Hispanic	↑	↑	↑	↓	↓	↓	↑
Non-Hispanic	↑	↑	↑	↓	↓	↓	↑
Veteran	↑	↑	↑	↓	↓	↓	↑
Non-veteran	↑	↑	↑	↓	↓	↓	↑

Based on the table, the results for certain groups show similar relationships, even though the magnitude of these results can be different. We discuss the results and inferences for groups with similar relationships in the section below.

6-1-1 Nation Aggregate and all Races, Ethnicities and Veteran Groups Results and Policy Inferences

The female entrepreneur numbers for all races, Hispanic and non-Hispanic ethnicities, and Veteran and non-veteran groups have similar relationships to female patentees, female venture funding, labor force, women STEM graduates, interest rates and the dummy representing COVID-19 as the aggregate national female STEM numbers. Increases in female patentees bring about increases in female STEM numbers for all of these groups. More female patentees at the national level, provide greater opportunity for women nationally and in these other groups to open STEM businesses. Similarly, larger amounts of venture funding going to women founders' results in greater availability of capital for STEM firms in these groups, possibly for sectors that they are highly concentrated in, alleviating competition and spurring the growth of new STEM businesses. A larger labor force allows for more childcare options and greater access to a skilled workforce for networking for Women in STEM leading to the formation of new businesses.

Some of the other variables for these groups show a negative relationship. Increases in the number of female STEM graduates possibly leads to greater competition in the sectors these businesses are concentrated in, leading to business failures and drops in the number of female STEM firms. An increase in interest rates leads to financing difficulties and decreases in the number of female STEM firms nationally and for these other groups. The COVID-19 variable shows that the number of these firms went up during the pandemic. This could be because nationally early-stage women entrepreneurs found new opportunities during the pandemic and the monthly rate of new entrepreneurs was the highest in 24 years for women. For female STEM entrepreneurs in these groups the pandemic could have opened up new opportunities, due to their concentration in the health care sector.

Policy approaches to help female STEM entrepreneurs in these groups are similar. Congress could work with states so that public funding to institutions is tied to increased training and commercialization exposure for female students, thereby increasing the number of female patentees. Congress could authorize states to use grant funding to establish a commercialization authority to help institutions support female faculty innovations. Congress could legislate additional funding for SBICs and the SSBCI to fund various STEM sectors for these groups. Additional funding would alleviate the funding pressure in crowded sectors and provide capital in the less crowded sectors for new businesses. The SBA could train female venture capitalists, local lenders, and financial institutions in investing in these businesses. The federal government could provide grants to increase childcare options for female STEM entrepreneurs and help states support the wages and benefits of childcare workers. Federal K-12 funding for schools could be tied to female STEM learning creating a pipeline for a skilled STEM workforce to support female STEM businesses. The SBA could provide emergency application assistance to female STEM businesses using its resource networks in these communities. The federal government could provide emergency assistance to female STEM businesses through community organizations and direct cash payments to families during economy-wide shocks. This would stabilize the financial status of female STEM businesses and provide women the flexibility to start new STEM firms.

6-2 State Level Analyses and Results

After analyzing the factors that influence female STEM entrepreneurship at the national level, we focused on understanding their impact at the state level. We collected state data on female employer and nonemployer STEM firms at the three-digit NAICS level for the years 2012 to 2020, through the same Census sources as for the national level analysis. We used other sources to collect data on female patentees and female venture capital funding by state, and labor force and per capita income by state. We used national level values for interest rates and women STEM graduates. Next, we ran a state level log-log model to analyze the impact of these explanatory variables and of a COVID-19 dummy variable on the number of female STEM entrepreneurs in each state.

The results of running this model for each state are summarized in the table below.

Table 6-2: National and State Level Log-Log Model Results

State		1%↑ female patentees	1%↑ female venture funds	1%↑ labor force	1%↑ Women STEM graduates	1% Point ↑ Interest rate	1%↑ per-capita income	COVID-19
National	National	0.56%	0.29%	37.29%	-9.91%	-0.08	-2.97%	↑
AL	Alabama	0.06%	-0.06%	0.59%	0.43%	-0.08	0.27%	
AK	Alaska	-0.04%	-0.03%	-0.45%				
AZ	Arizona	-0.07%	0.02%	3.68%	-1.46%	-0.01	0.94%	↑
AR	Arkansas	0.12%	-0.01%	1.70%	0.34%	0.01	-1.28%	↑
CA	California	-0.03%	0.01%	-0.18%	0.34%	0.03	0.20%	↓
CO	Colorado	0.40%	0.02%	0.59%	-0.37%	-0.10	0.49%	↓
CT	Connecticut	0.12%	-0.01%	1.29%	0.06%	0.00	0.65%	↑
DC	District of Columbia	0.14%	0.04%	1.46%	-0.09%	-0.12	-1.01%	↓
DE	Delaware	0.24%	0.02%	-1.98%	0.85%	-0.14	0.80%	↓
FL	Florida	-0.28%	-0.11%	-27.15%	14.93%	0.02	-0.21%	↓
GA	Georgia	0.84%	-0.04%	-9.79%	0.84%	0.12	7.03%	↓
HI	Hawaii	0.00%	0.00%	-0.39%	0.34%	0.02	0.16%	↓
ID	Idaho	0.42%	-0.05%	14.45%	-3.65%	-0.16	-6.85%	↑
IL	Illinois	-0.03%	-0.02%	-1.54%	0.59%	0.03	-0.36%	↓
IN	Indiana	0.00%	0.00%	-5.77%	1.18%	0.04	1.35%	↓
IA	Iowa	-0.03%	0.00%	-1.70%	0.35%	0.03	0.37%	↓
KS	Kansas	0.06%	0.03%	1.45%	0.21%	-0.03	-0.25%	↑
KY	Kentucky	0.15%	0.03%	0.80%	0.13%	0.00	-0.35%	↑
LA	Louisiana	-0.02%	0.00%	-0.48%	0.34%	0.10	-1.56%	↑
ME	Maine	0.67%	-0.03%	0.46%	-1.82%	0.17	5.36%	
MD	Maryland	-0.19%	-0.01%	-8.81%	2.10%	0.05	0.61%	↓
MA	Massachusetts	0.01%	-0.01%	-7.49%	2.37%	0.00	0.23%	↓
MI	Michigan	-0.02%	-0.01%	-4.74%	1.40%	0.04	-0.03%	↓
MN	Minnesota	-0.23%	-0.09%	13.94%	-3.41%	0.16	0.98%	↑
MS	Mississippi	-0.09%	0.01%	-0.54%	0.52%	0.15		
MO	Missouri	0.18%	0.00%	2.99%	-0.41%	-0.04	-0.34%	↑
MT	Montana	0.04%	-0.01%	-0.81%	0.37%	0.00	0.87%	↓
NE	Nebraska	-0.05%	-0.01%	2.33%	-0.07%	-0.04	-0.23%	↑
NV	Nevada	0.21%	-0.02%	0.10%	0.67%	-0.01	0.00%	
NH	New Hampshire	-0.01%	-0.01%	-0.15%	0.17%	0.01	-0.13%	↑
NJ	New Jersey	-0.01%	0.01%	0.02%	-0.04%	0.02	1.12%	↓
NM	New Mexico	-58.15%	0.81%	-139.04%	95.32%	2.47	-126.26%	↓
NY	New York	-0.07%	0.02%	-3.27%	0.98%	0.04	0.30%	↓
NC	North Carolina	-0.32%	-0.002	15.15%	-4.51%	0.02	-0.12%	↑
ND	North Dakota	-0.32%						
OH	Ohio	-0.37%	-0.01%	-2.29%	0.79%	0.06	-0.04%	↓
OK	Oklahoma	-0.07%	0.00%	-4.42%	0.96%	-0.08	1.45%	↓
OR	Oregon	-0.03%	0.00%	-0.23%	0.54%	0.02	0.20%	↓
PA	Pennsylvania	-0.52%	-0.05%	15.39%	0.50%	0.01	-7.60%	↑
RI	Rhode Island	0.18%	0.00%	-0.81%	-0.08%	-0.04	1.42%	↓
SC	South Carolina	0.17%	0.03%	-5.36%	1.54%	-0.08	1.92%	↓
SD	South Dakota	-0.67	-0.05%	-1.88%	0.65%	0.25	2.49%	
TN	Tennessee	-0.06%	0.02%	-13.02%	5.36%	-0.12	-0.85%	↓
TX	Texas	0.33%	0.27%	-7.12%	2.30%	0.03	-1.07%	↓
UT	Utah	0.09%	-0.02%	3.15%	-1.46%	0.02	0.95%	↑
VT	Vermont	-0.01%	0.01%	-1.78%	0.32%	-0.02	0.12%	↓
VA	Virginia	0.09%	0.00%	5.03%	-0.71%	0.04	0.10%	↑
WA	Washington	-0.06%	0.03%	1.07%	0.62%	-0.07	-1.66%	↑
WV	West Virginia	0.33%	0.00%					
WI	Wisconsin	0.15%	0.02%	-1.05%	0.26%	0.01	0.42%	↓
WY	Wyoming	-0.01%	-0.03%	-1.13%	0.43%	-0.09	-1.46%	

Note: For Nevada, the labor force change leads to a -.10% change and not the .10% change shown above.

The table shows the positive and negative relationships between each explanatory variable and the number of female STEM entrepreneurs in a state, and how they compare to the national level results. Here we summarize the policy implications of those positive and negative relationships.

If there is a positive relationship between women patentees and female STEM entrepreneurs, Congress could work with states to encourage their institutions to enroll and expose female students to STEM, perform outreach to female faculty, and establish a dedicated authority to support STEM innovation. With a positive relationship between female venture funding and female STEM entrepreneurs, public funding should target both concentrated and nonconcentrated STEM sectors and SBA should train investors and lenders on female STEM investment. In states with a positive relationship of female STEM entrepreneurs to the labor force, Congress could provide grants to help the states support childcare wages and benefits. The federal government could tie K-12 funding to female STEM learning, contributing to a larger female STEM workforce and networking opportunities for female STEM entrepreneurs. For states with a positive relationship between female STEM graduates and female STEM entrepreneurship, Congress could work with the state governments to condition funding to institutions on expansion of STEM programs and outreach to female students. For a state where per-capita incomes are positively related to entrepreneurship, the federal government could invest in infrastructure projects to stimulate demand and growth. Higher interest rates leading to a positive impact on entrepreneurship, implies the state's entrepreneurs do not use traditional financing. The federal government could investigate policies to support more nonemployer STEM businesses in the state and the SBA could work with lenders to provide alternative financing options. A positive impact of COVID-19 implies resiliency of female STEM entrepreneurs and the federal government could support the state government in encouraging female STEM entrepreneurs to build on that resiliency for future economy-wide shocks.

If states see a negative relationship between female patentees and female STEM entrepreneurs, federal agencies need to support states, so they can provide the resources and networks to help women patentees transition from patent holder to entrepreneur. A negative female venture capital funding relationship indicates the need to invest in nonconcentrated STEM sectors and SBA could train lenders to invest in these sectors. A negative relationship with the labor force implies a lack of workers skilled in STEM disciplines, and the federal government should help states invest in applicable education and training programs. If an increase in women STEM graduates causes a decline in female STEM entrepreneurship, the federal government could help the state address the challenges of transitioning from education to entrepreneurship for female graduates. If rising per-capita incomes bring about declines in entrepreneurship, there are possible other factors such as lack of childcare and other care options for women and the federal government could provide grants to help the state resolve those issues. A negative relationship with interest rates means the SBA could provide, financial education and counseling services to female STEM entrepreneurs, and work with financial institutions to provide affordable financing to these entrepreneurs. If COVID-19 led to a negative impact, the federal government could help the state government provide emergency financial assistance and technical support to women STEM entrepreneurs.

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Appendices

Appendix A
National Level Results

National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.034	7	0.005	F Statistic	=	205.311	
Residual	0.000	1	0.000	Prob > F	=	0.054	
Total	0.034	8	0.004	R-squared	=	0.999	
				Adj. R-squared	=	0.994	
				Root MS	=	0.005	
LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
LWPAT 162.2249	0.556	0.125	4.461	0.140		-1.028	2.141
LVCF 784.7314	0.288	0.092	3.143	0.196		-0.876	1.453
LLF 43960.048	37.294	10.420	3.579	0.173		-95.104	169.693
LWSG 60979.1369	-9.906	2.745	-3.608	0.172		-44.790	24.979
X30YR_MORT_RT 68.7228	-0.080	0.036	-2.204	0.271		-0.540	0.381
LRI 1560.6102	-2.967	1.149	-2.583	0.235		-17.562	11.628
COVID19_D 26526.6486	2.990	0.842	3.553	0.175		-7.703	13.682
(Intercept)	-298.415	85.280	-3.499	0.177		-1381.994	785.164

Model Fit

The Total Sum of Squares (Total SS) is a measure of the total variability in the data. The Model Sum of Squares (Model SS) is the variability captured by the model. The Residual Sum of Squares (Residual SS) is the remaining variability that the model does not capture. The model captures a high percentage of the variation in the data, since the Model SS is high and the Residual SS is low. MS is "Mean Sum of Squares" and provides another measure of the relative fit of the model given the Residual MS is low.

R-squared describes the percent of variation the model captures, and is quite high, at 99.9%. Adjusted R-Squared (Adj. R-squared) adjusts the R-squared statistic for number of variables included in the regression, to attempt a more accurate measure, and is still high, at over 99% of the variation explained. "Root MS" is taken as the square root of the mean squared error (MSE), and is a measure of the accuracy of the model, with low values indicating that the model is highly descriptive. In this case, the model appears to describe the data well.

Statistical Significance

The F statistic is a measure of whether the coefficients arose by chance. An F statistic close to zero would indicate that this was the case. Since the F-statistic is 205.311, it is evident that these coefficients did not arise by chance. "Prob" is probability, and there is still some possibility that the coefficients did arise by chance since "Prob > F" is 0.054, although the probability is quite small. This is based on using the criterion that "Prob > F" should be less than 0.05 or 5%, that the coefficients did arise by chance.

Coef. is the coefficient estimated by Ordinary Least Squares (OLS) and Std. Err. describes the OLS standard error, which is a measure of variability. The t statistic (Coef/Std. Err.) is represented by t and describes the likelihood the coefficient arose by chance, whereas Pr > |t| is the probability that the coefficient arose by chance or the probability that the absolute value of the coefficient is zero. All the coefficients appear statistically strong, in that all the t statistics are significantly different than zero. Given the small number of observations, the t statistics are good, though there are none for which Pr > |t| < 0.05, or 5%, which is the usual criterion.

The 95% Confidence Interval predicts the range in which the true coefficient lies. Given the regression results, in 19 out of 20 cases, the true coefficient will lie in this interval if the model is true. Many of the ranges of the 95% confidence intervals have the same sign as the coefficients, but are quite wide, relative to the value of the coefficients.

Model Choice

The log-log national regression is a good model choice for the following reasons:

- The national level Census data that the model uses is researched and verified well.
- The R-squared and Adjusted R-Squared values for the model are high. This implies that the model captures a high percent of variation in the dependent variable.
- The Root Mean Square Error value for the model is low, which indicates that the model fits the data well.
- Multicollinearity is present, but it is to be expected given that some of the independent variables, such as income, education, patents increase is correlated.
- Running the model using percentages, or correcting for multicollinearity by centering independent variables, or removing correlated variables leads to strange coefficient results.
- The model is able to explain the effects of changes in independent variables such as women patentees, venture capital funding etc. reasonably well.
- We tested other models, such as we used a logistic regression to model the data by sector (for states with missing values in the female STEM employer and nonemployer numbers), and the standard errors in the results were very high, showing the low accuracy of the statistics. So, we did not use this approach.

COVID-19 Coefficient interpretation

We are interpreting the COVID-19 dummy variable according to the approximate interpretation of Duquette (1999).

Duquette Christopher M., "Is Charitable Giving by Nonitemizers Responsive to Tax Incentives? New evidence." *National Tax Journal*, 52(2), 195-206.

This is to have the coefficient on the dummy variable, times 100, to indicate approximately how much percentage effect the dummy variable being 1 instead of 0 has on the predicted dependent variable. However, given that some states had missing values for employer and nonemployer female STEM numbers for certain sectors for some years, the COVID-19 dummy variable coefficient interpretations at the national level should be treated with caution. These states include Alabama, Alaska, Hawaii, Maine, Mississippi, Nevada, New Mexico, North Dakota, South Dakota, West Virginia, and Wyoming.

The missing values in these data are such that the COVID-19 dummy variable coefficient interpretations should be treated with caution. This is because in the case of missing dependent values in earlier years the COVID-19 dummy coefficient could show large positive percentage changes in the pandemic year, or in the case where there are missing dependent values in the pandemic year it could show large negative percentage changes due to the pandemic. We believe that the direction rather than the magnitude of these results is more reliable.

Keeping this in mind, below are the approximate interpretations of the dummy variable coefficients at the national level:

- The COVID-19 dummy variable coefficient for the overall national-level model indicates a 299% increase in women STEM entrepreneurs due to the pandemic.

Black or African American National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.023	7	0.003	F Statistic	=	48541.543	
Residual	0.000	1	0.000	Prob > F	=	0.003	
Total	0.023	8	0.003	R-squared	=	1.000	
				Adj. R-squared	=	1.000	
				Root MS	=	0.000	
B_AA_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence**	**Interval]**
LWPAT 162.2249	1.574	0.007	234.896	0.003		1.489	1.659
LVCF 784.7314	0.922	0.005	187.165	0.003		0.859	0.984
LLF 43960.048	114.476	0.560	204.455	0.003		107.361	121.590
LWSG 60979.1369	-30.908	0.148	-209.512	0.003		-32.782	-29.033
X30YR_MORT_RT 68.7228	-0.319	0.002	-163.782	0.004		-0.344	-0.294
LRI 1560.6102	-10.518	0.062	-170.411	0.004		-11.302	-9.734
COVID19_D 26526.6486	9.223	0.045	203.964	0.003		8.648	9.797
(Intercept)	-931.615	4.582	-203.303	0.003		-989.840	-873.390

Note:

- The COVID-19 dummy variable coefficient for the Black or African-American group indicates a 922% increase in these women STEM entrepreneurs due to the pandemic.

American Indian and Alaska Native National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	2.486	7	0.355	F Statistic	=	110.061	
Residual	0.003	1	0.003	Prob > F	=	0.073	
Total	2.490	8	0.311	R-squared	=	0.999	
				Adj. R-squared	=	0.990	
				Root MS	=	0.057	
AI_AN_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
LWPAT 162.2249	17.662	1.455	12.142	0.052		-0.820	36.143
LVCF 784.7314	6.550	1.069	6.129	0.103		-7.030	20.131
LLF 43960.048	864.629	121.521	7.115	0.089		-679.440	2408.697
LWSG 60979.1369	-240.996	32.018	-7.527	0.084		-647.826	165.834
X30YR_MORT_RT 68.7228	-2.810	0.423	-6.647	0.095		-8.181	2.562
LRI 1560.6102	-70.948	13.396	-5.296	0.119		-241.161	99.265
COVID19_D 26526.6486	69.174	9.814	7.049	0.090		-55.524	193.872
(Intercept)	-7148.124	994.553	-7.187	0.088		-19785.117	5488.868

Note:

- The COVID-19 dummy variable coefficient for the American Indian or Alaska Native group indicates a 6917% increase in these women STEM entrepreneurs due to the pandemic.

White National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.012	7	0.002	F Statistic	=	121.286	
Residual	0.000	1	0.000	Prob > F	=	0.070	
Total	0.012	8	0.002	R-squared	=	0.999	
				Adj. R-squared	=	0.991	
				Root MS	=	0.004	
W_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**		
LWPAT 162.2249	0.682	0.097	7.049	0.090		-0.547	1.911
LVCF 784.7314	0.465	0.071	6.538	0.097		-0.438	1.368
LLF 43960.048	56.863	8.082	7.036	0.090		-45.826	159.553
LWSG 60979.1369	-15.109	2.129	-7.095	0.089		-42.166	11.948
X30YR_MORT_RT 68.7228	-0.142	0.028	-5.058	0.124		-0.499	0.215
LRI 1560.6102	-5.399	0.891	-6.060	0.104		-16.719	5.921
COVID19_D 26526.6486	4.580	0.653	7.018	0.090		-3.713	12.873
(Intercept)	-455.392	66.144	-6.885	0.092		-1295.826	385.042

Note:

- The COVID-19 dummy variable coefficient for the White group indicates a 458% increase in these women STEM entrepreneurs due to the pandemic.

Asian National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.067	7	0.010	F Statistic	=	2818.686	
Residual	0.000	1	0.000	Prob > F	=	0.015	
Total	0.067	8	0.008	R-squared	=	1.000	
				Adj. R-squared	=	1.000	
				Root MS	=	0.002	
A_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
LWPAT 162.2249	2.417	0.047	51.045	0.012		1.815	3.019
LVCF 784.7314	1.359	0.035	39.064	0.016		0.917	1.801
LLF 43960.048	168.135	3.956	42.503	0.015		117.871	218.398
LWSG 60979.1369	-45.440	1.042	-43.597	0.015		-58.683	-32.196
X30YR_MORT_RT 68.7228	-0.498	0.014	-36.155	0.018		-0.672	-0.323
LRI 1560.6102	-15.477	0.436	-35.491	0.018		-21.017	-9.936
COVID19_D 26526.6486	13.541	0.319	42.385	0.015		9.481	17.600
(Intercept)	-1375.592	32.375	-42.489	0.015		-1786.956	-964.228

Note:

- The COVID-19 dummy variable coefficient for the Asian group indicates a 1,354% increase in these women STEM entrepreneurs due to the pandemic.

Native Hawaiian and Other Pacific Islander National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.634	7	0.091	F Statistic	=	33.458	
Residual	0.003	1	0.003	Prob > F	=	0.132	
Total	0.637	8	0.080	R-squared	=	0.996	
				Adj. R-squared	=	0.966	
				Root MS	=	0.052	
NH_OP_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
LWPAT 162.2249	8.775	1.332	6.586	0.096		-8.153	25.703
LVCF 784.7314	3.318	0.979	3.389	0.183		-9.121	15.757
LLF 43960.048	437.194	111.306	3.928	0.159		-977.079	1851.467
LWSG 60979.1369	-121.400	29.327	-4.140	0.151		-494.032	251.232
X30YR_MORT_RT 68.7228	-1.393	0.387	-3.598	0.173		-6.313	3.527
LRI 1560.6102	-36.639	12.270	-2.986	0.206		-192.543	119.266
COVID19_D 26526.6486	35.023	8.989	3.896	0.160		-79.193	149.240
(Intercept)	-3609.739	910.950	-3.963	0.157		-15184.455	7964.977

Note:

- The COVID-19 dummy variable coefficient for the Native Hawaiian or Other Pacific Islander group indicates a 3,502% increase in these women STEM entrepreneurs due to the pandemic.

Hispanic National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.048	7	0.007	F Statistic	=	111.467
Residual	0.000	1	0.000	Prob > F	=	0.073
Total	0.048	8	0.006	R-squared	=	0.999
				Adj. R-squared	=	0.990
				Root MS	=	0.008
H_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
LWPAT 162.2249	1.494	0.202	7.413	0.085	-1.067	4.055
LVCF 784.7314	0.989	0.148	6.682	0.095	-0.892	2.871
LLF 43960.048	121.744	16.837	7.231	0.087	-92.193	335.681
LWSG 60979.1369	-32.622	4.436	-7.354	0.086	-88.990	23.746
X30YR_MORT_RT 68.7228	-0.335	0.059	-5.716	0.110	-1.079	0.409
LRI 1560.6102	-11.337	1.856	-6.108	0.103	-34.921	12.247
COVID19_D 26526.6486	9.896	1.360	7.278	0.087	-7.382	27.173
(Intercept)	-991.936	137.799	-7.198	0.088	-2742.842	758.970

Note:

- The COVID-19 dummy variable coefficient for the Hispanic group indicates a 990% increase in these women STEM entrepreneurs due to the pandemic.

Non-Hispanic National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.037	7	0.005	F Statistic	=	201.536	
Residual	0.000	1	0.000	Prob > F	=	0.054	
Total	0.037	8	0.005	R-squared	=	0.999	
				Adj. R-squared	=	0.994	
				Root MS	=	0.005	
N_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
LWPAT 162.2249	0.602	0.131	4.602	0.136		-1.060	2.263
LVCF 784.7314	0.433	0.096	4.505	0.139		-0.788	1.654
LLF 43960.048	51.757	10.923	4.738	0.132		-87.035	190.548
LWSG 60979.1369	-13.801	2.878	-4.795	0.131		-50.370	22.768
X30YR_MORT_RT 68.7228	-0.134	0.038	-3.532	0.176		-0.617	0.349
LRI 1560.6102	-4.701	1.204	-3.904	0.160		-20.001	10.599
COVID19_D 26526.6486	4.282	0.882	4.855	0.129		-6.926	15.491
(Intercept)	-413.608	89.397	-4.627	0.136		-1549.505	722.290

Note:

- The COVID-19 dummy variable coefficient for the non-Hispanic group indicates a 428% increase in these women STEM entrepreneurs due to the pandemic.

Veteran National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.009	7	0.001	F Statistic	=	30.686	
Residual	0.000	1	0.000	Prob > F	=	0.138	
Total	0.009	8	0.001	R-squared	=	0.995	
				Adj. R-squared	=	0.963	
				Root MS	=	0.006	
V_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
LWPAT 162.2249	0.620	0.163	3.802	0.164		-1.451	2.690
LVCF 784.7314	0.374	0.120	3.123	0.197		-1.147	1.895
LLF 43960.048	40.921	13.613	3.006	0.204		-132.049	213.890
LWSG 60979.1369	-11.086	3.587	-3.091	0.199		-56.660	34.488
X30YR_MORT_RT 68.7228	-0.150	0.047	-3.177	0.194		-0.752	0.451
LRI 1560.6102	-3.846	1.501	-2.563	0.237		-22.913	15.222
COVID19_D 26526.6486	3.227	1.099	2.935	0.209		-10.742	17.196
(Intercept)	-326.869	111.412	-2.934	0.209		-1742.487	1088.748

Note:

- The COVID-19 dummy variable coefficient for the Veteran group indicates a 323% increase in these women STEM entrepreneurs due to the pandemic.

Non-Veteran National Level CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.014	7	0.002	F Statistic	=	69.908	
Residual	0.000	1	0.000	Prob > F	=	0.092	
Total	0.014	8	0.002	R-squared	=	0.998	
				Adj. R-squared	=	0.984	
				Root MS	=	0.005	
NV_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
LWPAT 162.2249	0.710	0.139	5.111	0.123		-1.055	2.476
LVCF 784.7314	0.501	0.102	4.909	0.128		-0.796	1.798
LLF 43960.048	60.355	11.608	5.199	0.121		-87.141	207.852
LWSG 60979.1369	-16.112	3.059	-5.268	0.119		-54.975	22.750
X30YR_MORT_RT 68.7228	-0.159	0.040	-3.925	0.159		-0.672	0.355
LRI 1560.6102	-5.515	1.280	-4.310	0.145		-21.774	10.745
COVID19_D 26526.6486	4.854	0.937	5.178	0.121		-7.058	16.766
(Intercept)	-484.310	95.005	-5.098	0.123		-1691.457	722.837

Note:

- The COVID-19 dummy variable coefficient for the non-veteran group indicates a 485% increase in these women STEM entrepreneurs due to the pandemic.

Appendix B
State Level Results

Alabama CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.020	7	0.003	F Statistic	=	#NUM!	
Residual	0.058	1	0.058	Prob > F	=	#NUM!	
Total	0.022	8	0.003	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.240	
AL_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
AL_LWPAT	0.060	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
AL_LVCF	-0.061	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
AL_LLF	0.589	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_LWSG	0.430	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_MORT_RT	-0.081	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
AL_LRI	0.268	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
(Intercept)	-1.026	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!

Notes:
- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.

Alaska CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.013	7	0.002	F Statistic	=	#NUM!	
Residual	0.041	1	0.041	Prob > F	=	#NUM!	
Total	0.018	8	0.002	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.203	
AK_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
AK_LWPAT	-0.038	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
AK_LVCF	-0.029	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
AK_LLF	-0.454	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
(Intercept)	11.270	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.

Arizona CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.086	7	0.012	F Statistic	=	221.828	
Residual	0.000	1	0.000	Prob > F	=	0.052	
Total	0.086	8	0.011	R-squared	=	0.999	
				Adj. R-squared	=	0.995	
				Root MS	=	0.007	
AZ_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
AZ_LWPAT 32.1804	-0.065	0.069	-0.937	0.521		-0.941	0.812
AZ_LVCF 6.9028	0.018	0.006	3.270	0.189		-0.053	0.090
AZ_LLF 425.1842151	3.675	0.875	4.201	0.149		-7.441	14.791
NAT_LWSG 276.6052	-1.455	0.283	-5.152	0.122		-5.045	2.134
NAT_MORT_RT 5.3649	-0.009	0.015	-0.600	0.656		-0.206	0.187
AZ_LRI 200.9419	0.941	0.461	2.043	0.290		-4.912	6.794
COVID19_D 67.4363	0.127	0.065	1.955	0.301		-0.697	0.950
(Intercept)	-5.642	2.120	-2.662	0.229		-32.574	21.290

Note:

- The COVID-19 dummy variable coefficient for Arizona suggests that the pandemic led to a 12.7% increase in the number of women STEM entrepreneurs in the state. Using 2019 as an example of a non-pandemic year, the actual numbers indicated a 1.4% increase between 2019 and 2020.

Arkansas CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.080	7	0.011	F Statistic	=	72.134	
Residual	0.000	1	0.000	Prob > F	=	0.090	
Total	0.080	8	0.010	R-squared	=	0.998	
				Adj. R-squared	=	0.984	
				Root MS	=	0.013	
AR_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
AR_LWPAT 59.1834	0.119	0.112	1.067	0.479		-1.303	1.542
AR_LVCF 3.4693	-0.007	0.007	-0.996	0.501		-0.090	0.077
AR_LLF 894.1451105	1.698	4.184	0.406	0.755		-51.461	54.857
NAT_LWSG 534.2631	0.337	0.664	0.508	0.701		-8.102	8.777
NAT_MORT_RT 8.8975	0.007	0.034	0.195	0.878		-0.422	0.435
AR_LRI 99.3727	-1.275	0.943	-1.352	0.405		-13.252	10.703
COVID19_D 322.4504	0.147	0.240	0.611	0.651		-2.901	3.194
(Intercept)	0.656	17.018	0.039	0.975		-215.584	216.896

Note:

- The COVID-19 dummy variable coefficient for Arkansas suggests that the pandemic increased the number of women STEM entrepreneurs in the state by 14.7%. Using 2019 as an example of a non-pandemic year, the actual numbers show a 3.5% increase between 2019 and 2020.

California CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.022	7	0.003	F Statistic	=	47.374
Residual	0.000	1	0.000	Prob > F	=	0.111
Total	0.022	8	0.003	R-squared	=	0.997
				Adj. R-squared	=	0.976
				Root MS	=	0.008

CA_LNWSTEM VIF	Coef.	Std. Err	t	Pr > |t|	[95% Confidence	Interval]
CA_LWPAT 161.4731	-0.034	0.209	-0.163	0.897	-2.683	2.615
CA_LVCF 65.1442	0.007	0.042	0.178	0.888	-0.521	0.536
CA_LLF 659.622427	-0.182	1.317	-0.138	0.913	-16.917	16.554
NAT_LWSG 2775.2611	0.343	0.978	0.351	0.785	-12.088	12.774
NAT_MORT_RT 15.1227	0.034	0.028	1.189	0.445	-0.327	0.395
CA_LRI 433.0583	0.199	0.666	0.299	0.815	-8.258	8.656
COVID19_D 198.6856	-0.053	0.122	-0.437	0.738	-1.599	1.493
(Intercept)	9.243	5.618	1.645	0.348	-62.139	80.625

Note:

- The COVID-19 dummy variable coefficient for California suggests a 5.3% drop in women STEM entrepreneurs in the state because of the pandemic.

Colorado CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.045	7	0.006	F Statistic	=	10.401
Residual	0.001	1	0.001	Prob > F	=	0.234
Total	0.046	8	0.006	R-squared	=	0.986
				Adj. R-squared	=	0.892
				Root MS	=	0.025
CO_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
CO_LWPAT 12.1122	0.403	0.287	1.405	0.394	-3.243	4.050
CO_LVCF 15.6148	0.022	0.041	0.537	0.686	-0.498	0.542
CO_LLF 1123.123073	0.586	4.709	0.124	0.921	-59.252	60.424
NAT_LWSG 1514.8541	-0.371	2.219	-0.167	0.894	-28.567	27.825
NAT_MORT_RT 3.2114	-0.103	0.040	-2.568	0.236	-0.614	0.408
CO_LRI 40.3968	0.492	0.735	0.670	0.624	-8.842	9.826
COVID19_D 202.5285	-0.042	0.377	-0.112	0.929	-4.833	4.749
(Intercept)	5.519	8.548	0.646	0.635	-103.091	114.130

Note:

- The coefficient for the COVID-19 dummy variable for Colorado suggests a 4.2% drop in women STEM entrepreneurship in the state because of the pandemic.

Connecticut CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.010	7	0.001	F Statistic	=	1198.404
Residual	0.000	1	0.000	Prob > F	=	0.022
Total	0.010	8	0.001	R-squared	=	1.000
				Adj. R-squared	=	0.999
				Root MS	=	0.001
CT_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
CT_LWPAT 14.5618	0.124	0.011	11.389	0.056	-0.014	0.262
CT_LVCF 5.1553	-0.013	0.001	-12.461	0.051	-0.026	0.000
CT_LLF 444.0749039	1.288	0.331	3.887	0.160	-2.923	5.500
NAT_LWSG 203.7465	0.062	0.036	1.696	0.339	-0.400	0.524
NAT_MORT_RT 3.5910	0.000	0.002	0.219	0.863	-0.024	0.025
CT_LRI 24.6026	0.648	0.056	11.475	0.055	-0.070	1.365
COVID19_D 457.4382	0.035	0.025	1.371	0.401	-0.287	0.356
(Intercept)	-4.925	2.400	-2.052	0.289	-35.425	25.575

Note:

- The COVID-19 dummy variable coefficient for Connecticut suggests a 3.5% increase in women STEM entrepreneurs in the state due to the pandemic.

Delaware CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.051	7	0.007	F Statistic	=	3.861
Residual	0.002	1	0.002	Prob > F	=	0.374
Total	0.053	8	0.007	R-squared	=	0.964
				Adj. R-squared	=	0.715
				Root MS	=	0.043
DE_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
DE_LWPAT 27.4173	0.240	0.382	0.627	0.644	-4.620	5.099
DE_LVCF 11.6466	0.023	0.062	0.376	0.771	-0.763	0.809
DE_LLF 75.38126192	-1.975	3.785	-0.522	0.694	-50.064	46.115
NAT_LWSG 227.2241	0.854	1.494	0.572	0.669	-18.123	19.832
NAT_MORT_RT 16.6213	-0.142	0.159	-0.894	0.536	-2.161	1.877
DE_LRI 123.0849	0.795	3.600	0.221	0.862	-44.951	46.542
COVID19_D 67.5351	-0.187	0.378	-0.494	0.708	-4.995	4.621
(Intercept)	4.452	18.754	0.237	0.852	-233.839	242.742

Note:

- A decrease of 18.7% in women STEM entrepreneurs in the state because of the pandemic is suggested by the COVID-19 dummy variable coefficient for Delaware. Using 2019 as an example of a non-pandemic year the actual numbers show a 14.8% increase between 2019 and 2020.

The District of Columbia CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.029	7	0.004	F Statistic	=	111.878
Residual	0.000	1	0.000	Prob > F	=	0.073
Total	0.029	8	0.004	R-squared	=	0.999
				Adj. R-squared	=	0.990
				Root MS	=	0.006
DC_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
DC_LWPAT 39.1703	0.139	0.039	3.536	0.175	-0.361	0.639
DC_LVCF 10.6590	0.040	0.005	8.315	0.076	-0.021	0.101
DC_LLF 289.2676166	1.458	1.170	1.246	0.431	-13.407	16.322
NAT_LWSG 662.9614	-0.093	0.358	-0.261	0.837	-4.642	4.455
NAT_MORT_RT 5.5599	-0.117	0.013	-9.108	0.070	-0.281	0.046
DC_LRI 39.0109	-1.006	0.223	-4.504	0.139	-3.845	1.832
COVID19_D 189.5829	-0.006	0.089	-0.070	0.955	-1.137	1.124
(Intercept)	7.157	4.043	1.770	0.327	-44.220	58.534

Note:

- The COVID-19 dummy variable coefficient for the District of Columbia suggests there was virtually no effect of the pandemic, that there was a slight decline in female STEM entrepreneur numbers of 0.6% in the District.

Florida CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.132	7	0.019	F Statistic	=	3762.691	
Residual	0.000	1	0.000	Prob > F	=	0.013	
Total	0.132	8	0.017	R-squared	=	1.000	
				Adj. R-squared	=	1.000	
				Root MS	=	0.002	
FL_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
FL_LWPAT 40.5030	-0.278	0.029	-9.618	0.066		-0.646	0.089
FL_LVCF 164.7629	-0.110	0.015	-7.367	0.086		-0.300	0.080
FL_LLF 51976.60399	-27.151	2.704	-10.042	0.063		-61.507	7.204
NAT_LWSG 81164.1797	14.929	1.457	10.246	0.062		-3.584	33.442
NAT_MORT_RT 4.1349	0.022	0.004	5.407	0.116		-0.030	0.074
FL_LRI 104.5314	-0.208	0.108	-1.927	0.305		-1.578	1.162
COVID19_D 7806.8290	-2.056	0.210	-9.791	0.065		-4.724	0.612
(Intercept)	77.179	7.300	10.573	0.060		-15.573	169.931

Notes:

- The COVID-19 dummy variable coefficient for Florida suggests a 206% drop in female STEM entrepreneurship in the state because of the pandemic.
- There are missing values for Florida in 2020, so the magnitude of this percentage drop should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers show a 5.5% increase between 2019 and 2020.

Georgia CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.052	7	0.007	F Statistic	=	26.366
Residual	0.000	1	0.000	Prob > F	=	0.149
Total	0.052	8	0.007	R-squared	=	0.995
				Adj. R-squared	=	0.957
				Root MS	=	0.017
GA_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
GA_LWPAT 65.2154	0.843	0.479	1.759	0.329	-5.247	6.934
GA_LVCF 7.0461	-0.035	0.019	-1.899	0.309	-0.272	0.201
GA_LLF 2412.991629	-9.786	5.356	-1.827	0.319	-77.838	58.267
NAT_LWSG 7378.7633	0.842	3.286	0.256	0.840	-40.912	42.596
NAT_MORT_RT 15.9209	0.121	0.060	2.019	0.293	-0.642	0.884
GA_LRI 1785.0741	7.027	3.478	2.020	0.293	-37.165	51.219
COVID19_D 410.1950	-0.700	0.360	-1.944	0.303	-5.275	3.875
(Intercept)	34.389	19.181	1.793	0.324	-209.331	278.108

Notes:

- The COVID-19 dummy variable coefficient for Georgia indicates a 70% drop in women STEM entrepreneurs in the state in that year.
- There are missing values for Georgia in 2020, so the magnitude of this percentage drop should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual values show a 1.3% increase between 2019 and 2020.

Hawaii CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.012	7	0.002	F Statistic	=	#NUM!	
Residual	0.011	1	0.011	Prob > F	=	#NUM!	
Total	0.013	8	0.002	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.106	
HI_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
HI_LWPAT #NUM!	-0.001	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
HI_LVCF #NUM!	0.001	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
HI_LLF #NUM!	-0.392	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_LWSG #NUM!	0.340	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_MORT_RT #NUM!	0.019	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
HI_LRI #NUM!	0.161	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
COVID19_D #NUM!	-0.123	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
(Intercept)	6.646	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The COVID-19 dummy variable coefficient indicates the pandemic caused a 12.3% drop in women STEM entrepreneurs in the state.
- There are missing values for Hawaii in 2020, so the magnitude of this percentage drop should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers show a 5% decrease between 2019 and 2020.

Idaho CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.078	7	0.011	F Statistic	=	88.068	
Residual	0.000	1	0.000	Prob > F	=	0.082	
Total	0.078	8	0.010	R-squared	=	0.998	
				Adj. R-squared	=	0.987	
				Root MS	=	0.011	
ID_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
ID_LWPAT 77.1993	0.420	0.209	2.007	0.294		-2.239	3.078
ID_LVCF 70.7714	-0.051	0.029	-1.786	0.325		-0.417	0.314
ID_LLF 13579.59115	14.449	6.241	2.315	0.260		-64.848	93.746
NAT_LWSG 2697.9914	-3.653	1.332	-2.743	0.223		-20.575	13.269
NAT_MORT_RT 51.4027	-0.157	0.072	-2.165	0.276		-1.075	0.762
ID_LRI 6500.3761	-6.851	4.199	-1.631	0.350		-60.207	46.505
COVID19_D 371.6863	0.449	0.230	1.954	0.301		-2.470	3.368
(Intercept)	-0.425	0.818	-0.519	0.695		-10.812	9.963

Notes:

- The COVID-19 dummy variable coefficient indicates a 45% increase in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values in Idaho in many years, so the magnitude of this percentage increase should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers indicate a 2.45% increase between 2019 and 2020.

Illinois CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.003	7	0.000	F Statistic	=	4.779
Residual	0.000	1	0.000	Prob > F	=	0.339
Total	0.003	8	0.000	R-squared	=	0.971
				Adj. R-squared	=	0.768
				Root MS	=	0.010
IL_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
IL_LWPAT 11.9364	-0.027	0.092	-0.291	0.820	-1.191	1.137
IL_LVCF 10.7040	-0.023	0.018	-1.294	0.419	-0.250	0.204
IL_LLF 131.689772	-1.535	1.543	-0.995	0.502	-21.147	18.077
NAT_LWSG 404.1022	0.586	0.461	1.270	0.425	-5.274	6.446
NAT_MORT_RT 2.6074	0.028	0.015	1.928	0.305	-0.157	0.213
IL_LRI 126.8976	-0.360	0.700	-0.515	0.697	-9.250	8.529
COVID19_D 145.0205	-0.106	0.128	-0.826	0.560	-1.738	1.525
(Intercept)	20.070	10.530	1.906	0.308	-113.725	153.865

Note:

- The COVID-19 dummy variable coefficient indicates a 10.6% decrease in the number of women STEM entrepreneurs in the state because of the pandemic. Using 2019 as an example of a non-pandemic year, the actual numbers indicate a 1.4% decrease between 2019 and 2020.

Indiana CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.015	7	0.002	F Statistic	=	172.908	
Residual	0.000	1	0.000	Prob > F	=	0.058	
Total	0.015	8	0.002	R-squared	=	0.999	
				Adj. R-squared	=	0.993	
				Root MS	=	0.004	
IN_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
IN_LWPAT 28.4392	-0.003	0.039	-0.078	0.951		-0.494	0.488
IN_LVCF 3.2109	-0.004	0.002	-2.161	0.276		-0.026	0.018
IN_LLF 305.4976797	-5.771	0.731	-7.893	0.080		-15.061	3.520
NAT_LWSG 645.9253	1.181	0.203	5.812	0.108		-1.401	3.763
NAT_MORT_RT 3.9809	0.035	0.006	5.594	0.113		-0.045	0.115
IN_LRI 136.6218	1.350	0.270	5.004	0.126		-2.079	4.780
COVID19_D 181.8555	-0.469	0.050	-9.363	0.068		-1.106	0.168
(Intercept)	33.834	4.003	8.452	0.075		-17.027	84.696

Notes:

- The COVID-19 dummy variable coefficient indicates a 46.9% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Indiana in 2020, so the magnitude of this percentage drop should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers indicate a 4.7% decrease between 2019 and 2020.

Iowa CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.008	7	0.001	F Statistic	=	1.324
Residual	0.001	1	0.001	Prob > F	=	0.586
Total	0.009	8	0.001	R-squared	=	0.903
				Adj. R-squared	=	0.221
				Root MS	=	0.030
IA_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
IA_LWPAT 8.8408	-0.029	0.221	-0.129	0.918	-2.839	2.782
IA_LVCF 2.9346	-0.004	0.020	-0.196	0.877	-0.258	0.250
IA_LLF 41.47048324	-1.698	3.449	-0.493	0.709	-45.516	42.120
NAT_LWSG 104.7589	0.346	0.698	0.496	0.707	-8.522	9.214
NAT_MORT_RT 14.8229	0.032	0.103	0.313	0.807	-1.280	1.345
IA_LRI 41.9121	0.371	2.317	0.160	0.899	-29.076	29.818
COVID19_D 30.8903	-0.076	0.176	-0.432	0.740	-2.314	2.162
(Intercept)	15.648	26.808	0.584	0.664	-324.984	356.280

Note:

- The COVID-19 dummy variable coefficient indicates a 7.6% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.

Kansas CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.018	7	0.003	F Statistic	=	290.992	
Residual	0.000	1	0.000	Prob > F	=	0.045	
Total	0.018	8	0.002	R-squared	=	1.000	
				Adj. R-squared	=	0.996	
				Root MS	=	0.003	
KS_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
KS_LWPAT 5.8071	0.062	0.014	4.554	0.138		-0.110	0.233
KS_LVCF 2.2511	0.028	0.003	8.379	0.076		-0.014	0.070
KS_LLF 28.94401358	1.446	0.327	4.422	0.142		-2.710	5.602
NAT_LWSG 42.2843	0.214	0.044	4.868	0.129		-0.345	0.773
NAT_MORT_RT 7.0497	-0.031	0.007	-4.377	0.143		-0.121	0.059
KS_LRI 8.8161	-0.251	0.104	-2.408	0.251		-1.577	1.074
COVID19_D 35.8846	0.032	0.019	1.704	0.338		-0.207	0.271
(Intercept)	-2.083	2.288	-0.910	0.530		-31.158	26.992

Note:

- The COVID-19 dummy variable coefficient indicates a 3.2% increase in the number of women STEM entrepreneurs in the state because of the pandemic.

Kentucky CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.022	7	0.003	F Statistic	=	11253.334
Residual	0.000	1	0.000	Prob > F	=	0.007
Total	0.022	8	0.003	R-squared	=	1.000
				Adj. R-squared	=	1.000
				Root MS	=	0.001

KY_LNWSTEM VIF	Coef.	Std. Err	t	Pr > |t|	[95% Confidence Interval]	
KY_LWPAT 5.6470	0.149	0.005	30.076	0.021	0.086	0.211
KY_LVCF 19.3168	0.025	0.001	38.363	0.017	0.017	0.033
KY_LLF 516.6391251	0.796	0.166	4.793	0.131	-1.314	2.907
NAT_LWSG 781.4163	0.131	0.034	3.850	0.162	-0.301	0.562
NAT_MORT_RT 5.4012	-0.001	0.001	-0.827	0.560	-0.015	0.013
KY_LRI 63.5898	-0.353	0.029	-12.022	0.053	-0.727	0.020
COVID19_D 414.5327	0.035	0.011	3.048	0.202	-0.111	0.181
(Intercept)	3.675	0.855	4.298	0.146	-7.190	14.540

Note:

- The COVID-19 dummy variable coefficient indicates a 3.5% increase in the number of women STEM entrepreneurs in the state because of the pandemic.

Louisiana CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.020	7	0.003	F Statistic	=	3.589	
Residual	0.001	1	0.001	Prob > F	=	0.386	
Total	0.021	8	0.003	R-squared	=	0.962	
				Adj. R-squared	=	0.694	
				Root MS	=	0.029	
LA_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
LA_LWPAT 1.4520	-0.018	0.074	-0.242	0.849		-0.959	0.923
LA_LVCF 6.1583	0.004	0.019	0.193	0.879		-0.235	0.242
LA_LLF 17.10391215	-0.476	1.640	-0.290	0.820		-21.312	20.360
NAT_LWSG 10.4414	0.342	0.210	1.627	0.351		-2.332	3.016
NAT_MORT_RT 4.1161	0.101	0.052	1.946	0.302		-0.559	0.762
LA_LRI 8.5688	-1.564	0.921	-1.699	0.339		-13.262	10.133
COVID19_D 33.1855	0.059	0.174	0.336	0.794		-2.157	2.274
(Intercept)	19.041	11.144	1.709	0.337		-122.560	160.643

Notes:

- The COVID-19 dummy variable coefficient indicates a 5.9 % increase in the number of women STEM entrepreneurs in the state because of the pandemic.

Maine CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.006	7	0.001	F Statistic	=	#NUM!	
Residual	0.014	1	0.014	Prob > F	=	#NUM!	
Total	0.008	8	0.001	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.119	
ME_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**		
ME_LWPAT	0.669	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	
ME_LVCF	-0.034	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	
ME_LLF	0.459	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	
NAT_LWSG	-1.818	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	
NAT_MORT_RT	0.170	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	
ME_LRI	5.361	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	
(Intercept)	-7.619	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.

Maryland CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.017	7	0.002	F Statistic	=	110.792
Residual	0.000	1	0.000	Prob > F	=	0.073
Total	0.017	8	0.002	R-squared	=	0.999
				Adj. R-squared	=	0.990
				Root MS	=	0.005

MD_LNWSTEM VIF	Coef.	Std. Err	t	Pr > |t|	[95% Confidence Interval]	
MD_LWPAT 68.8781	-0.190	0.071	-2.660	0.229	-1.096	0.717
MD_LVCF 2.5116	-0.014	0.005	-3.198	0.193	-0.072	0.043
MD_LLF 1129.503195	-8.814	1.989	-4.432	0.141	-34.084	16.455
NAT_LWSG 1629.2606	2.098	0.433	4.846	0.130	-3.404	7.601
NAT_MORT_RT 3.9535	0.048	0.008	5.730	0.110	-0.059	0.155
MD_LRI 18.7991	0.614	0.194	3.168	0.195	-1.848	3.076
COVID19_D 1017.2657	-0.690	0.159	-4.337	0.144	-2.710	1.331
(Intercept)	52.070	10.233	5.088	0.124	-77.954	182.094

Notes:

- The COVID-19 dummy variable coefficient indicates a 69% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Maryland in 2019 and 2020, so the magnitude of this percentage drop should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers indicate a 1% decrease between 2019 and 2020.

Massachusetts CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.013	7	0.002	F Statistic	=	57.117	
Residual	0.000	1	0.000	Prob > F	=	0.102	
Total	0.013	8	0.002	R-squared	=	0.998	
				Adj. R-squared	=	0.980	
				Root MS	=	0.006	
MA_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
MA_LWPAT 28.9914	0.014	0.064	0.214	0.866		-0.800	0.827
MA_LVCF 20.5665	-0.014	0.013	-1.049	0.485		-0.181	0.153
MA_LLF 1706.25556	-7.491	2.100	-3.567	0.174		-34.179	19.197
NAT_LWSG 3117.6681	2.369	0.726	3.265	0.189		-6.851	11.589
NAT_MORT_RT 8.8160	0.004	0.015	0.260	0.838		-0.189	0.197
MA_LRI 116.4000	0.234	0.300	0.778	0.579		-3.583	4.051
COVID19_D 1303.1814	-0.808	0.218	-3.705	0.168		-3.578	1.962
(Intercept)	41.622	10.086	4.127	0.151		-86.534	169.777

Notes:

- The COVID-19 dummy variable coefficient indicates an 80.8% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Massachusetts in 2019 and 2020, so the magnitude of this percentage drop should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers indicate a 3.2% decrease between 2019 and 2020.

Michigan CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.009	7	0.001	F Statistic	=	449.014
Residual	0.000	1	0.000	Prob > F	=	0.036
Total	0.009	8	0.001	R-squared	=	1.000
				Adj. R-squared	=	0.997
				Root MS	=	0.002

MI_LNWSTEM VIF	Coef.	Std. Err	t	Pr > |t|	[95% Confidence Interval]	
MI_LWPAT 73.2907	-0.018	0.025	-0.711	0.606	-0.337	0.301
MI_LVCF 2.9105	-0.007	0.001	-7.352	0.086	-0.020	0.005
MI_LLF 252.9135025	-4.738	0.255	-18.606	0.034	-7.974	-1.503
NAT_LWSG 690.5248	1.398	0.102	13.727	0.046	0.104	2.691
NAT_MORT_RT 4.9534	0.044	0.003	12.935	0.049	0.001	0.087
MI_LRI 99.4461	-0.032	0.100	-0.322	0.802	-1.299	1.234
COVID19_D 242.0118	-0.510	0.028	-18.200	0.035	-0.866	-0.154
(Intercept)	33.765	1.279	26.393	0.024	17.510	50.020

Notes:

- The COVID-19 dummy variable coefficient indicates a 51% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Michigan in 2020, so the magnitude of this percentage drop should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers indicate a 2.4% decrease between 2019 and 2020.

Minnesota CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.024	7	0.003	F Statistic	=	11.688
Residual	0.000	1	0.000	Prob > F	=	0.222
Total	0.025	8	0.003	R-squared	=	0.988
				Adj. R-squared	=	0.903
				Root MS	=	0.017
MN_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
MN_LWPAT 3.7763	-0.233	0.138	-1.693	0.340	-1.982	1.516
MN_LVCF 26.0058	-0.088	0.059	-1.488	0.377	-0.843	0.666
MN_LLF 296.1118449	13.940	3.289	4.238	0.148	-27.854	55.735
NAT_LWSG 645.6940	-3.409	1.002	-3.403	0.182	-16.138	9.321
NAT_MORT_RT 18.2568	0.158	0.066	2.389	0.252	-0.684	1.000
MN_LRI 87.3591	0.983	1.190	0.827	0.560	-14.136	16.103
COVID19_D 297.9198	1.251	0.316	3.957	0.158	-2.767	5.270
(Intercept)	-63.206	19.795	-3.193	0.193	-314.722	188.309

Notes:

- The COVID-19 dummy variable coefficient indicates a 125% increase in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Minnesota in 2018, 2019 and 2020, so the magnitude of this percentage should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers indicate a 4.14% decrease between 2019 and 2020.

Mississippi CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.030	7	0.004	F Statistic	=	#NUM!
Residual	0.075	1	0.075	Prob > F	=	#NUM!
Total	0.035	8	0.004	R-squared	=	1.000
				Adj. R-squared	=	#NUM!
				Root MS	=	0.274

MS_LNWSTEM VIF	Coef.	Std. Err	t	Pr > |t|	[95% Confidence Interval]	
MS_LWPAT	-0.086	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
MS_LVCF	0.012	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
MS_LLF	-0.539	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
NAT_LWSG	0.521	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
NAT_MORT_RT	0.153	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
(Intercept)	6.839	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.

Missouri CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.010	7	0.001	F Statistic	=	785.538
Residual	0.000	1	0.000	Prob > F	=	0.027
Total	0.010	8	0.001	R-squared	=	1.000
				Adj. R-squared	=	0.999
				Root MS	=	0.001

MO_LNWSTEM VIF	Coef.	Std. Err	t	Pr > |t|	[95% Confidence Interval]	
MO_LWPAT 378.9608	0.177	0.060	2.944	0.208	-0.589	0.943
MO_LVCF 11.3055	-0.004	0.001	-3.415	0.181	-0.020	0.012
MO_LLF 3755.097046	2.992	1.052	2.843	0.215	-10.380	16.364
NAT_LWSG 11835.8327	-0.414	0.336	-1.232	0.434	-4.681	3.853
NAT_MORT_RT 22.3069	-0.041	0.006	-7.129	0.089	-0.114	0.032
MO_LRI 607.4827	-0.344	0.243	-1.416	0.391	-3.428	2.740
COVID19_D 1653.5235	0.149	0.058	2.563	0.237	-0.592	0.891
(Intercept)	-7.060	6.052	-1.166	0.451	-83.962	69.842

Notes:

- The COVID-19 dummy variable coefficient indicates a 14.9% increase in the number of women STEM entrepreneurs because of the pandemic.
- There are missing values for Missouri in 2018, 2019, and 2020 for some sectors, so the magnitude of this percentage increase should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual numbers indicate a 0.35% decrease between 2019 and 2020.

Montana CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.035	7	0.005	F Statistic	=	5.221	
Residual	0.001	1	0.001	Prob > F	=	0.325	
Total	0.036	8	0.005	R-squared	=	0.973	
				Adj. R-squared	=	0.787	
				Root MS	=	0.031	
MT_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
MT_LWPAT 1.6697	0.040	0.058	0.683	0.618		-0.697	0.776
MT_LVCF 4.6764	-0.008	0.013	-0.592	0.660		-0.173	0.158
MT_LLF 119.283088	-0.805	3.705	-0.217	0.864		-47.887	46.277
NAT_LWSG 150.4191	0.374	0.872	0.429	0.742		-10.703	11.451
NAT_MORT_RT 3.2232	0.002	0.050	0.035	0.978		-0.636	0.640
MT_LRI 21.0261	0.870	0.883	0.986	0.505		-10.349	12.090
COVID19_D 15.1599	-0.042	0.129	-0.324	0.801		-1.676	1.593
(Intercept)	3.956	12.229	0.324	0.801		-151.433	159.345

Note:

- The COVID-19 dummy variable coefficient indicates a 4.2% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.

Nebraska CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.008	7	0.001	F Statistic	=	10.972
Residual	0.000	1	0.000	Prob > F	=	0.228
Total	0.008	8	0.001	R-squared	=	0.987
				Adj. R-squared	=	0.897
				Root MS	=	0.010
NE_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
NE_LWPAT 19.3629	-0.046	0.119	-0.389	0.764	-1.553	1.461
NE_LVCF 13.3527	-0.008	0.010	-0.768	0.583	-0.139	0.123
NE_LLF 58.07555279	2.333	1.326	1.760	0.329	-14.513	19.180
NAT_LWSG 91.1154	-0.073	0.222	-0.327	0.799	-2.892	2.747
NAT_MORT_RT 6.4427	-0.035	0.023	-1.522	0.370	-0.330	0.260
NE_LRI 16.8013	-0.226	0.489	-0.462	0.724	-6.442	5.990
COVID19_D 82.5887	0.056	0.098	0.575	0.668	-1.191	1.304
(Intercept)	-4.230	6.006	-0.704	0.609	-80.539	72.079

Note:

- The COVID-19 dummy variable coefficient indicates a 5.6% increase in the number of women STEM entrepreneurs in the state because of the pandemic.

Nevada CVR Model Results

Source	**SS**	**Df**	**MS**	**Number of Obs.**	=	**9**	
Model	0.070	7	0.010	F Statistic	=	#NUM!	
Residual	0.166	1	0.166	Prob > F	=	#NUM!	
Total	0.113	8	0.014	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.407	
NV_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
NV_LWPAT	0.214	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NV_LVCF	-0.018	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NV_LLF	-0.095	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_LWSG	0.667	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_MORT_RT	-0.011	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NV_LRI	0.000	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
(Intercept)	1.470	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.

New Hampshire CVR Model Results

Source	SS	Df	MS	Number of Obs.	=	9
Model	0.002	7	0.000	F Statistic	=	1.050
Residual	0.000	1	0.000	Prob > F	=	0.638
Total	0.003	8	0.000	R-squared	=	0.880
				Adj. R-squared	=	0.042
				Root MS	=	0.018

NH_LNWSTEM VIF	Coef.	Std. Err	t	Pr > |t|	[95% Confidence Interval]	
NH_LWPAT 3.3086	-0.006	0.085	-0.069	0.956	-1.092	1.080
NH_LVCF 5.4962	-0.012	0.020	-0.595	0.658	-0.260	0.237
NH_LLF 341.6022202	-0.153	3.995	-0.038	0.976	-50.915	50.609
NAT_LWSG 425.6886	0.171	0.858	0.200	0.875	-10.736	11.079
NAT_MORT_RT 6.4926	0.011	0.042	0.253	0.842	-0.519	0.540
NH_LRI 20.8935	-0.133	0.463	-0.288	0.822	-6.017	5.750
COVID19_D 252.8879	0.019	0.307	0.061	0.961	-3.888	3.926
(Intercept)	9.069	15.714	0.577	0.667	-190.600	208.739

Note:

- The COVID-19 dummy variable coefficient indicates a 1.9% increase in the number of women STEM entrepreneurs in the state because of the pandemic.

New Jersey CVR Model Results

Source	SS	Df	MS	Number of Obs.	=	9	
Model	0.020	7	0.003	F Statistic	=	7.999	
Residual	0.000	1	0.000	Prob > F	=	0.266	
Total	0.021	8	0.003	R-squared	=	0.982	
				Adj. R-squared	=	0.860	
				Root MS	=	0.019	
NJ_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
NJ_LWPAT 2.0028	-0.011	0.140	-0.077	0.951		-1.788	1.767
NJ_LVCF 83.7986	0.008	0.082	0.092	0.942		-1.031	1.046
NJ_LLF 473.4024186	0.023	4.852	0.005	0.997		-61.623	61.669
NAT_LWSG 1915.1710	-0.043	1.900	-0.023	0.986		-24.190	24.104
NAT_MORT_RT 3.7526	0.021	0.033	0.644	0.636		-0.399	0.442
NJ_LRI 418.0608	1.123	2.600	0.432	0.740		-31.908	34.155
COVID19_D 395.5625	-0.028	0.401	-0.071	0.955		-5.128	5.071
(Intercept)	4.337	31.298	0.139	0.912		-393.343	402.018

Note:

- The COVID-19 dummy variable coefficient indicates a 2.8% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.

New Mexico CVR Model Results

Source	SS	Df	MS	Number of Obs.	=	9	
Model	0.002	7	0.000	F Statistic	=	#NUM!	
Residual	0.005	1	0.005	Prob > F	=	#NUM!	
Total	0.002	8	0.000	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.070	
NM_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
NM_LWPAT #NUM!	-58.145	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NM_LVCF #NUM!	0.809	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NM_LLF #NUM!	-139.040	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_LWSG #NUM!	95.316	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_MORT_RT #NUM!	2.471	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NM_LRI #NUM!	-126.258	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
COVID19_D #NUM!	-2.761	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
(Intercept)	797.698	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The COVID-19 coefficient suggests that the pandemic caused the number of female STEM entrepreneurs in the state to drop by 276%.
- There are a large number of missing values for New Mexico for many years, so the magnitude of this estimated percentage drop should be treated with caution.

New York CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.014	7	0.002	F Statistic	=	63.895
Residual	0.000	1	0.000	Prob > F	=	0.096
Total	0.014	8	0.002	R-squared	=	0.998
				Adj. R-squared	=	0.982
				Root MS	=	0.006

NY_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
NY_LWPAT 12.8029	-0.069	0.058	-1.181	0.447	-0.812	0.674
NY_LVCF 55.2465	0.024	0.024	1.018	0.494	-0.277	0.326
NY_LLF 1148.404039	-3.268	1.716	-1.904	0.308	-25.073	18.538
NAT_LWSG 1892.1084	0.984	0.564	1.744	0.331	-6.182	8.149
NAT_MORT_RT 3.2479	0.035	0.009	3.781	0.165	-0.082	0.152
NY_LRI 123.4331	0.302	0.360	0.840	0.555	-4.268	4.872
COVID19_D 1115.8929	-0.404	0.201	-2.009	0.294	-2.962	2.153
(Intercept)	28.231	10.256	2.753	0.222	-102.080	158.542

Notes:

- The COVID-19 dummy variable coefficient indicates a 40.4% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values in certain sectors for New York in 2020, so the magnitude of this percentage drop should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual decrease between 2019 and 2020 was 2.72%.

North Carolina CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.059	7	0.008	F Statistic	=	2591.957
Residual	0.000	1	0.000	Prob > F	=	0.015
Total	0.059	8	0.007	R-squared	=	1.000
				Adj. R-squared	=	1.000
				Root MS	=	0.002
NC_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
NC_LWPAT 37.5823	-0.319	0.027	-11.778	0.054	-0.664	0.025
NC_LVCF 1.7274	-0.002	0.001	-2.497	0.242	-0.014	0.010
NC_LLF 4516.819235	15.153	0.883	17.152	0.037	3.928	26.379
NAT_LWSG 5104.4805	-4.514	0.293	-15.385	0.041	-8.242	-0.786
NAT_MORT_RT 4.6364	0.017	0.003	4.885	0.129	-0.027	0.061
NC_LRI 30.9469	-0.124	0.056	-2.199	0.272	-0.840	0.592
COVID19_D 675.1726	0.823	0.050	16.601	0.038	0.193	1.453
(Intercept)	-57.150	3.519	-16.239	0.039	-101.868	-12.433

Notes:

- The COVID-19 dummy variable coefficient indicates an 82.3% increase in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for some sectors in North Carolina in 2018, 2019 and 2020, so the magnitude of this percentage increase should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual increase between 2019 and 2020 was 0.9%.

North Dakota CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.001	7	0.000	F Statistic	=	#NUM!	
Residual	0.013	1	0.013	Prob > F	=	#NUM!	
Total	0.006	8	0.001	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.114	
ND_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
ND_LWPAT	-0.323	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
(Intercept)	9.244	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.

Ohio CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.005	7	0.001	F Statistic	=	16.431	
Residual	0.000	1	0.000	Prob > F	=	0.188	
Total	0.005	8	0.001	R-squared	=	0.991	
				Adj. R-squared	=	0.931	
				Root MS	=	0.007	
OH_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
OH_LWPAT 50.0686	-0.367	0.134	-2.740	0.223		-2.070	1.335
OH_LVCF 2.7015	-0.009	0.006	-1.431	0.388		-0.087	0.069
OH_LLF 158.7281825	-2.294	1.125	-2.039	0.290		-16.591	12.003
NAT_LWSG 693.6770	0.793	0.405	1.958	0.301		-4.354	5.941
NAT_MORT_RT 6.3285	0.061	0.015	4.008	0.156		-0.132	0.254
OH_LRI 267.7422	-0.042	0.787	-0.053	0.966		-10.046	9.963
COVID19_D 83.4351	-0.096	0.065	-1.470	0.380		-0.926	0.734
(Intercept)	23.884	8.539	2.797	0.219		-84.619	132.387

Note:

- The COVID-19 dummy variable coefficient indicates a 9.6% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.

Oklahoma CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.029	7	0.004	F Statistic	=	20.159
Residual	0.000	1	0.000	Prob > F	=	0.170
Total	0.029	8	0.004	R-squared	=	0.993
				Adj. R-squared	=	0.944
				Root MS	=	0.014
OK_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
OK_LWPAT 2.7288	-0.073	0.043	-1.685	0.341	-0.626	0.479
OK_LVCF 4.3069	0.002	0.010	0.225	0.859	-0.125	0.130
OK_LLF 42.00449826	-4.418	1.887	-2.341	0.257	-28.396	19.560
NAT_LWSG 52.6119	0.963	0.238	4.049	0.154	-2.058	3.984
NAT_MORT_RT 3.4496	-0.081	0.024	-3.375	0.183	-0.385	0.224
OK_LRI 8.0661	1.451	0.408	3.553	0.175	-3.738	6.641
COVID19_D 70.1456	-0.370	0.128	-2.903	0.211	-1.992	1.251
(Intercept)	22.741	9.112	2.496	0.243	-93.039	138.521

Notes:

- The COVID-19 dummy variable coefficient indicates a 37% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Oklahoma in 2019 and 2020, so the magnitude of this percentage decrease should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual decrease between 2019 and 2020 was 0.5%.

Oregon CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.043	7	0.006	F Statistic	=	65.411	
Residual	0.000	1	0.000	Prob > F	=	0.095	
Total	0.043	8	0.005	R-squared	=	0.998	
				Adj. R-squared	=	0.983	
				Root MS	=	0.010	
OR_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
OR_LWPAT 18.2213	-0.030	0.043	-0.683	0.619		-0.582	0.523
OR_LVCF 12.2763	-0.003	0.013	-0.201	0.873		-0.172	0.167
OR_LLF 638.6488324	-0.226	1.440	-0.157	0.901		-18.519	18.067
NAT_LWSG 753.3427	0.543	0.606	0.895	0.535		-7.161	8.247
NAT_MORT_RT 2.9728	0.024	0.015	1.609	0.354		-0.166	0.215
OR_LRI 92.1499	0.197	0.385	0.510	0.700		-4.700	5.094
COVID19_D 187.6567	-0.013	0.141	-0.092	0.942		-1.800	1.774
(Intercept)	4.449	2.871	1.550	0.365		-32.032	40.930

Note:

- The COVID-19 dummy variable coefficient indicates a 1.3% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.

Pennsylvania CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.012	7	0.002	F Statistic	=	12.425
Residual	0.000	1	0.000	Prob > F	=	0.215
Total	0.012	8	0.001	R-squared	=	0.989
				Adj. R-squared	=	0.909
				Root MS	=	0.012

PA_LNWSTEM VIF	Coef.	Std. Err	t	Pr > |t|	[95% Confidence Interval]	
PA_LWPAT 42.7918	-0.518	0.267	-1.939	0.303	-3.913	2.877
PA_LVCF 113.2144	-0.053	0.070	-0.762	0.585	-0.945	0.838
PA_LLF 7822.039803	15.389	14.442	1.066	0.480	-168.116	198.895
NAT_LWSG 244.1527	0.502	0.414	1.211	0.439	-4.763	5.766
NAT_MORT_RT 5.3660	0.011	0.024	0.459	0.726	-0.296	0.318
PA_LRI 6548.1566	-7.595	6.187	-1.228	0.435	-86.214	71.023
COVID19_D 14002.1609	1.603	1.458	1.099	0.470	-16.924	20.130
(Intercept)	-77.082	84.161	-0.916	0.528	-1146.452	992.287

Notes:

- The COVID-19 dummy variable coefficient indicates a 160.3% increase in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for some sectors in Pennsylvania in 2018, 2019 and 2020, so the magnitude of this percentage increase should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual decrease between 2019 and 2020 was 3.79%.

Rhode Island CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.015	7	0.002	F Statistic	=	0.296
Residual	0.007	1	0.007	Prob > F	=	0.892
Total	0.023	8	0.003	R-squared	=	0.674
				Adj. R-squared	=	-1.607
				Root MS	=	0.086
RI_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
RI_LWPAT 3.4532	0.183	0.352	0.520	0.695	-4.295	4.662
RI_LVCF 2.7058	-0.003	0.064	-0.052	0.967	-0.811	0.805
RI_LLF 339.0756782	-0.811	18.259	-0.044	0.972	-232.817	231.195
NAT_LWSG 394.9376	-0.080	3.884	-0.021	0.987	-49.433	49.272
NAT_MORT_RT 3.3097	-0.043	0.140	-0.306	0.811	-1.820	1.735
RI_LRI 38.7697	1.423	3.679	0.387	0.765	-45.329	48.176
COVID19_D 338.2948	-0.285	1.671	-0.171	0.892	-21.512	20.942
(Intercept)	5.520	82.865	0.067	0.958	-1047.385	1058.425

Notes:

- The COVID-19 dummy variable coefficient indicates a 28.5% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- Using 2019 as an example of a non-pandemic year, the actual decrease between 2019 and 2020 was 15%.

South Carolina CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.109	7	0.016	F Statistic	=	28.908	
Residual	0.001	1	0.001	Prob > F	=	0.142	
Total	0.109	8	0.014	R-squared	=	0.995	
				Adj. R-squared	=	0.961	
				Root MS	=	0.023	
SC_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
SC_LWPAT 15.7440	0.170	0.098	1.736	0.333		-1.072	1.411
SC_LVCF 14.2636	0.033	0.021	1.598	0.356		-0.231	0.297
SC_LLF 1784.265707	-5.359	6.274	-0.854	0.550		-85.075	74.356
NAT_LWSG 1636.4419	1.539	2.141	0.719	0.603		-25.662	28.740
NAT_MORT_RT 11.3477	-0.079	0.070	-1.121	0.464		-0.970	0.812
SC_LRI 147.2990	1.921	1.486	1.293	0.419		-16.956	20.797
COVID19_D 317.5628	-0.419	0.438	-0.956	0.514		-5.987	5.150
(Intercept)	19.974	16.880	1.183	0.447		-194.507	234.455

Notes:

- The COVID-19 dummy variable coefficient indicates a 41.9% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for South Carolina in 2018 and 2019 for some sectors, so the magnitude of this percentage decrease should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual increase between 2019 and 2020 was 3%.

South Dakota CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.026	7	0.004	F Statistic	=	#NUM!
Residual	0.062	1	0.062	Prob > F	=	#NUM!
Total	0.035	8	0.004	R-squared	=	1.000
				Adj. R-squared	=	#NUM!
				Root MS	=	0.249
SD_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
SD_LWPAT	-0.665	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
SD_LVCF	-0.046	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
SD_LLF	-1.883	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
NAT_LWSG	0.653	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
NAT_MORT_RT	0.252	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
SD_LRI	2.485	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
(Intercept)	-2.464	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.

Tennessee CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.039	7	0.006	F Statistic	=	140.214
Residual	0.000	1	0.000	Prob > F	=	0.065
Total	0.039	8	0.005	R-squared	=	0.999
				Adj. R-squared	=	0.992
				Root MS	=	0.006
TN_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
TN_LWPAT 62.5541	-0.064	0.073	-0.886	0.538	-0.988	0.859
TN_LVCF 2.5814	0.018	0.005	3.527	0.176	-0.046	0.082
TN_LLF 3810.756713	-13.021	2.873	-4.532	0.138	-49.529	23.488
NAT_LWSG 6331.0834	5.357	1.145	4.677	0.134	-9.196	19.910
NAT_MORT_RT 5.7879	-0.122	0.014	-8.953	0.071	-0.295	0.051
TN_LRI 59.7981	-0.850	0.292	-2.914	0.210	-4.558	2.857
COVID19_D 596.8904	-0.750	0.163	-4.591	0.137	-2.827	1.326
(Intercept)	54.647	10.190	5.363	0.117	-74.832	184.125

Notes:

- The COVID-19 dummy variable coefficient indicates a 75% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Tennessee in 2018 and 2019 for some sectors, so the magnitude of this percentage decrease should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual increase between 2019 and 2020 was 6.9%.

Texas CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.077	7	0.011	F Statistic	=	99.421
Residual	0.000	1	0.000	Prob > F	=	0.077
Total	0.077	8	0.010	R-squared	=	0.999
				Adj. R-squared	=	0.989
				Root MS	=	0.010
TX_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
TX_LWPAT 38.6530	0.325	0.144	2.262	0.265	-1.501	2.151
TX_LVCF 386.6709	0.269	0.127	2.118	0.281	-1.346	1.884
TX_LLF 1599.878581	-7.118	2.888	-2.465	0.245	-43.814	29.577
NAT_LWSG 1035.3523	2.296	0.771	2.978	0.206	-7.500	12.091
NAT_MORT_RT 9.5002	0.031	0.029	1.054	0.483	-0.339	0.400
TX_LRI 145.1863	-1.070	1.102	-0.971	0.509	-15.079	12.938
COVID19_D 182.1111	-0.416	0.150	-2.768	0.221	-2.325	1.493
(Intercept)	53.208	22.452	2.370	0.254	-232.077	338.493

Notes:

- The COVID-19 dummy variable coefficient indicates a 41.6% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Texas in 2019 and 2020, so the magnitude of this percentage decrease should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual increase between 2019 and 2020 was 0.78%.

Utah CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.107	7	0.015	F Statistic	=	52.466	
Residual	0.000	1	0.000	Prob > F	=	0.106	
Total	0.108	8	0.013	R-squared	=	0.997	
				Adj. R-squared	=	0.978	
				Root MS	=	0.017	
UT_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
UT_LWPAT 11.1563	0.092	0.124	0.739	0.595		-1.484	1.667
UT_LVCF 5.4038	-0.023	0.013	-1.722	0.335		-0.195	0.148
UT_LLF 2033.882254	3.153	3.426	0.920	0.526		-40.384	46.691
NAT_LWSG 2013.2433	-1.461	1.752	-0.834	0.557		-23.719	20.797
NAT_MORT_RT 7.6349	0.015	0.042	0.360	0.780		-0.524	0.554
UT_LRI 137.0924	0.954	0.806	1.184	0.447		-9.287	11.195
COVID19_D 65.6309	0.103	0.147	0.701	0.611		-1.765	1.971
(Intercept)	-1.276	1.838	-0.694	0.614		-24.625	22.074

Notes:

- The COVID-19 dummy variable coefficient indicates a 10.3% increase in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Utah in 2019 and 2020, so the magnitude of this percentage increase should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual increase between 2019 and 2020 was 1.74%.

Vermont CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.008	7	0.001	F Statistic	=	2.722
Residual	0.000	1	0.000	Prob > F	=	0.436
Total	0.008	8	0.001	R-squared	=	0.950
				Adj. R-squared	=	0.601
				Root MS	=	0.020
VT_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence**	**Interval]**
VT_LWPAT 37.2836	-0.009	0.189	-0.047	0.970	-2.412	2.394
VT_LVCF 10.2808	0.012	0.028	0.436	0.738	-0.339	0.363
VT_LLF 930.8547399	-1.784	7.190	-0.248	0.845	-93.140	89.572
NAT_LWSG 129.6642	0.317	0.528	0.601	0.656	-6.398	7.032
NAT_MORT_RT 8.8144	-0.018	0.054	-0.324	0.801	-0.706	0.671
VT_LRI 517.1223	0.124	3.725	0.033	0.979	-47.209	47.456
COVID19_D 1708.5440	-0.195	0.892	-0.219	0.863	-11.523	11.133
(Intercept)	14.498	23.087	0.628	0.643	-278.852	307.848

Notes:

- The COVID-19 dummy variable coefficient indicates a 19.5% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Vermont in 2019 and 2020 in certain sectors, so the magnitude of this percentage decrease should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual decrease between 2019 and 2020 was 1.3%.

Virginia CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.058	7	0.008	F Statistic	=	366.052	
Residual	0.000	1	0.000	Prob > F	=	0.040	
Total	0.058	8	0.007	R-squared	=	1.000	
				Adj. R-squared	=	0.997	
				Root MS	=	0.005	
VA_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
VA_LWPAT 42.7169	0.094	0.053	1.791	0.324		-0.574	0.762
VA_LVCF 63.2045	-0.001	0.021	-0.056	0.964		-0.264	0.261
VA_LLF 255.802952	5.030	0.933	5.388	0.117		-6.831	16.891
NAT_LWSG 739.2074	-0.708	0.296	-2.392	0.252		-4.467	3.052
NAT_MORT_RT 11.3475	0.039	0.014	2.690	0.227		-0.144	0.222
VA_LRI 29.9650	0.099	0.217	0.453	0.729		-2.665	2.862
COVID19_D 195.4162	0.333	0.071	4.708	0.133		-0.565	1.231
(Intercept)	-23.133	4.731	-4.889	0.128		-83.252	36.986

Notes:

- The COVID-19 dummy variable coefficient indicates a 33.3% increase in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Virginia in 2018, 2019 and 2020 for some sectors, so the magnitude of this percentage increase should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual increase between 2019 and 2020 was 1.5%.

Washington CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.017	7	0.002	F Statistic	=	3.895	
Residual	0.001	1	0.001	Prob > F	=	0.372	
Total	0.018	8	0.002	R-squared	=	0.965	
				Adj. R-squared	=	0.717	
				Root MS	=	0.025	
WA_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence**	**Interval]**
WA_LWPAT 44.4881	-0.056	0.354	-0.157	0.901		-4.558	4.447
WA_LVCF 7.2595	0.029	0.044	0.666	0.626		-0.532	0.590
WA_LLF 1963.015955	1.066	6.672	0.160	0.899		-83.715	85.847
NAT_LWSG 2755.7864	0.624	3.022	0.206	0.870		-37.778	39.025
NAT_MORT_RT 7.2862	-0.067	0.061	-1.091	0.472		-0.844	0.710
WA_LRI 147.3938	-1.655	1.275	-1.298	0.418		-17.853	14.543
COVID19_D 376.8589	0.109	0.519	0.209	0.869		-6.491	6.708
(Intercept)	5.677	16.712	0.340	0.792		-206.674	218.027

Notes:

- The COVID-19 dummy variable coefficient indicates a 10.9% increase in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Washington in 2018 and 2019 for some sectors, so the magnitude of this percentage increase should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual increase between 2019 and 2020 was 6.8%.

West Virginia CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.002	7	0.000	F Statistic	=	#NUM!	
Residual	0.023	1	0.023	Prob > F	=	#NUM!	
Total	0.017	8	0.002	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.152	
WV_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence**	**Interval]**
WV_LWPAT	0.325	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
WV_LVCF	-0.001	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
(Intercept)	7.784	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.

Wisconsin CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9
Model	0.008	7	0.001	F Statistic	=	7.673
Residual	0.000	1	0.000	Prob > F	=	0.271
Total	0.009	8	0.001	R-squared	=	0.982
				Adj. R-squared	=	0.854
				Root MS	=	0.013
WI_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**	**[95% Confidence Interval]**	
WI_LWPAT 5.4681	0.147	0.237	0.621	0.646	-2.866	3.160
WI_LVCF 3.2991	0.020	0.017	1.185	0.446	-0.194	0.234
WI_LLF 150.1578961	-1.046	2.037	-0.513	0.698	-26.927	24.836
NAT_LWSG 287.1825	0.264	0.484	0.545	0.682	-5.883	6.410
NAT_MORT_RT 7.1412	0.007	0.030	0.248	0.845	-0.374	0.389
WI_LRI 88.7085	0.424	0.823	0.515	0.697	-10.038	10.886
COVID19_D 112.0927	-0.130	0.140	-0.924	0.525	-1.914	1.655
(Intercept)	11.747	12.531	0.937	0.521	-147.480	170.974

Notes:

- The COVID-19 dummy variable coefficient indicates a 13% decrease in the number of women STEM entrepreneurs in the state because of the pandemic.
- There are missing values for Wisconsin in 2019 and 2020 for certain sectors, so the magnitude of this percentage decrease should be treated with caution.
- Using 2019 as an example of a non-pandemic year, the actual decrease between 2019 and 2020 was 4.4%.

Wyoming CVR Model Results

Source	SS	df	MS	Number of Obs.	=	9	
Model	0.068	7	0.010	F Statistic	=	#NUM!	
Residual	0.344	1	0.344	Prob > F	=	#NUM!	
Total	0.331	8	0.041	R-squared	=	1.000	
				Adj. R-squared	=	#NUM!	
				Root MS	=	0.587	
WY_LNWSTEM VIF	**Coef.**	**Std. Err**	**t**	**Pr > |t|**		**[95% Confidence Interval]**	
WY_LWPAT	-0.009	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
WY_LVCF	-0.028	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
WY_LLF	-1.133	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_LWSG	0.430	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
NAT_MORT_RT	-0.086	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
WY_LRI	-1.462	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!
(Intercept)	19.202	#NUM!	#NUM!	#NUM!		#NUM!	#NUM!

Notes:

- The #NUM! values represent that the model did not compute these estimates due to limited data.
- The model also did not compute the coefficient for the COVID-19 dummy variable.