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# The National-Level Economic Impact of the Manufacturing Extension Partnership (MEP) : Estimates for Fiscal Year 2017

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MEP • MANUFACTURING EXTENSION PARTNERSHIP

MEP Economic Impact Analysis: Estimates of Fiscal Year 2017

# EXECUTIVE SUMMARY

# Study Overview

The Manufacturing Extension Partnership (MEP), which is part of the National Institute of Standards and Technology (NIST), contracted with the Upjohn Institute to conduct an analysis of the overall effect of MEP projects on the U.S. economy. MEP centers provide assistance to primarily small and medium-size manufacturing businesses to help them improve their productivity and competitiveness. The centers provide services such as assistance with product development, tools and resources for business expansion, and business continuity planning, which contribute to cost savings, new investments, and improved products and processes. These improvements increase the profitability and competitiveness of the client firms, which in turn improves the economy by creating jobs, increasing earnings, and expanding the tax base.

Each year, NIST MEP surveys their clients using an independent third-party vendor, Fors Marsh, to obtain a reading of the impact of the services provided. The survey asks clients to report the effects of MEP services on the following possible outcomes:

- Jobs created and retained
- Sales created and retained
- Cost savings
- Investments

The study's purpose is to use the client-reported outcomes to estimate the overall effect of MEP projects on the U.S. economy. Using a model developed by Regional Economic Models, Inc. (REMI) of Amherst, MA, the study estimates the indirect and induced effects of the reported increase in jobs, sales, cost savings, and investments by MEP clients.

# Study Overview (continued)

This study updates the March 2017 Upjohn Institute report that estimated the economic impact analysis of MEP using survey results from FY16 with survey results from FY17. The Upjohn Institute used the same methodology for the FY17 impact estimates as it used for the FY16 estimates. Studies for each fiscal year used the REMI model to estimate the induced and indirect effects of the impacts reported by MEP clients on the surveys administered each of the two years.

Three scenarios are presented when estimating the impact of MEP program. The first is the unconstrained approach in which it is assumed that an increase in sales of one firm does not effect or reduce the sales of another firm. This scenario does not consider the displacement effects of competition among businesses on sales and employment, and is included to serve as an upper bound on the estimates. The second more realistic, yet conservative, scenario assumes that competition among firms mitigates the overall effects of the estimated increase in sales and employment since firms that do not benefit from the services rendered by MEP may lose market share to those that do, and thus grow less quickly than they would have otherwise and perhaps even lose sales and jobs. Recognizing that one use of this study is to determine whether the cost of the MEP program is justified by the benefits it generates, the third scenario estimates the fraction of reported outcomes required for the program to break even, as measured by the projected tax increases covering the annual cost of the program for FY17 ($128 million). The study takes the self-reported outcomes of MEP clients at face value, without attempting to validate the reported outcomes.

# Study Overview (continued)

As discussed later in this report, as much as we tried to replicate the methodology and procedures in the FY16 study to estimate the impact of MEP in FY17, there were unavoidable differences. The major concern was the higher response rate to the survey in FY17 compared to FY16. Although the number of clients selected for the survey remained relatively the same between the two years, there was an 11 percent increase in the number of responses from FY16 to FY17 – from 6,507 to 7,228. The actual response rate went from 72.9 percent in FY16 to 80.9 percent in FY17. We explored whether the response rate affected the difference in outcomes (e.g., number of jobs created) between the two years and tried to adjust the responses so that the difference in response rates was neutralized between the two years.

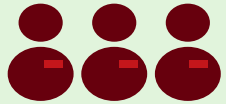
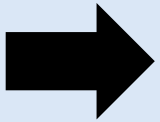
Differences in reported outcomes and estimated net impacts could also be affected by the difference in industry mix of the MEP clients, since REMI estimates separate multipliers for each industry group. Another issue that could affect the estimates was that the REMI model was updated for 2018, the year we conducted the analysis for FY17, and includes somewhat different macroeconomic trends than were embedded in the 2017 model, which was used to analyze the FY16 survey data. To help control for this change, we estimated FY16 survey data and FY17 survey data using the same 2018 model and compared the difference in estimates. The values in Table 1 below are from the surveys and show the differences between FY16 and FY17.

# Study Overview (continued)

Table 1: Differences in Survey Impacts, FY16 VS FY17.

| | FY16 | FY17 | | |
|---|---|---|---|---|
| Category | | | % Increase | % Decrease |
| Total Jobs | 86,541 | 100,721 | 16.4 | |
| Created | 19,653 | 24,210 | 23.2 | |
| Retained | 66,888 | 76,511 | 14.4 | |
| | | | | |
| Total Sales | $9.33 b | $12.6 b | 35.0 | |
| Increased sales | $2.33 b | $3.5 b | 50.2 | |
| Retained sales | $7.0 b | $9.1 b | 30.0 | |
| | | | | |
| Cost Savings | $857m | $1.04 b | 21.4 | |
| | | | | |
| Investment Savings | $514 m | $703 m | 32.8 | |
| | | | | |
| Total Investment | $3.5 b | $3.5 b | 0 | |
| Products & Process | $1.07 b | $1.07 b | 0 | |
| Plant & Equipment | $1.83b | $1.86 b | 1.64 | |
| Systems & Software | $134m | $178 m | 32.8 | |
| Workforce Practices | $210 | $199 m | | 5.2 |
| Other | $227 | $233 m | 2.6 | |

# Study Overview: Estimates of Impacts

| Forecast |  Jobs |  GDP |  Output |  Personal Income |  Returns to Treasury | ROI Return on Investment |
|---|---|---|---|---|---|---|
| Unconstrained Model Using Industry Variables | 711,908 | $83.64* | $162.70* | $45.63* | $6.16* | 48.2:1 |
| Constrained Model Using Firm Variables | 219,148 | $22.01* | $40.34* | $13.76* | $1.86* | 14.5:1 |
| 6.9% of Reported Impact | 15,115 | $1.52* | $2.78* | $.949* | $0.128* | 1:1 |

Dollars in billions

MEP Economic Impact Analysis: Estimates of Fiscal Year 2017

# MODELING THE NET IMPACT OF MEP ACTIVITIES

# Modeling the Net Impact

The Manufacturing Extension Partnership (MEP), which is part of the National Institute of Standards and Technology (NIST), contracted with the Upjohn Institute to estimate the economic impacts of the collective activities of its MEP centers on the U.S. economy. The estimates are based on a survey that NIST MEP administers to their clients. The survey asks clients to provide their estimates of the effect of MEP services and activities on their businesses with respect to jobs, sales, investments, and cost savings. The results used in this analysis covered surveys done between Q4 2016 through Q3 2017. The Upjohn Institute made no attempt to validate the outcomes reported by the MEP clients in the survey.

The values are taken at face value and entered into an econometric model to forecast the overall effect of the MEP Centers. The approach is similar to the standard approach of estimating the impact of an establishment on a local economy.

To estimate the net impact of the aggregate outcomes attributed to MEP activities, two forecasts are run using the REMI model. The baseline forecast is run without the additional outcomes associated with MEP activities, and the alternative forecast is run with the additional outcomes reported by MEP clients. In this approach, as in the business-specific net impact analysis, the activity of the business, or in this case the reported aggregate outcomes of client businesses of MEP Centers across the country, is

# Modeling the Net Impact (continued)

taken as known factors and entered into the REMI model.

The difference between the baseline forecast and the alternative forecast (which includes the client-reported outcomes) is considered the net impact of MEP Center activities on the U.S. economy.

The core of the analysis is the outcomes of MEP Center clients. The survey asks clients to quantify in dollars or numbers the following outcomes:

- Sales created or retained
- Jobs created or retained
- Investments in products or processes
- Investments in plants and equipment
- Investment in information systems and software, workforce practices, and employee skills
- Investments in other areas of business
- Production cost reduction through cost savings

Approximately 7,228 clients from across the country completed the survey. MEP Centers are located in every state, except Alaska, for the period covered, and in the District of Columbia and Puerto Rico. Each jurisdiction with an MEP presence obtained survey responses from their respective clients.

The survey observations not identified with a North American Classification Industry System (NAICS) code are not included in this analysis, resulting in 39 observations included in the summary data but not in the economic impact estimates.

There is no control group of randomly selected companies available that could provide comparable data on the performance of creating new and retained jobs and sales or on cost savings and investments. This factor limits the

# Modeling the Net Impact (continued)

causality that can be assigned to MEP efforts in aiding firms. Because of a self-selection bias, firms opting to use MEP services may also be more inclined to invest in workforce training, plants, equipment, and other technology on their own. Similarly, MEP center clients may be growing and better able to leverage MEP-based services in adding jobs and sales. Because Upjohn did not attempt to validate the accuracy of the outcomes reported in the survey, we present these caveats when interpreting the results. These caveats are similar to estimating the net impact on the local economy of a company that reports that it plans to expand its employment by so many workers. In estimating the net impact of such an exogenous shock to a local economy, we typically take the company's plans at face value.

To be consistent with the methodology of prior net impact analyses, Upjohn followed a guide created by Mark Ehlen and M. Hayden Brown (2000), "A Guide for Estimating and Reporting Macroeconomic Impacts of MEP Centers." The guide offered a process to estimate economic impacts on a state, based on the collective outcomes of the surveys administered by centers within the study state. The guide also recommended the use of an economic impact model from Regional Economic Models, Inc. (REMI-www.remi.com) for creating the estimates.

Informed by the guide, Upjohn made several decisions regarding the use of the survey data and assumptions in the REMI model about the dynamics of the U.S. economy.

# Modeling the Net Impact (continued)

**Decisions Regarding Data Elements**

Although the survey includes both employment and sales, both cannot be used in the REMI model at the same time without double counting the effects of the outcomes associated with MEP activities. Either employment or sales should be used consistently when aggregating the 7,228 responses. Contrary to the guide's suggestion, we chose to use the reported estimates of the number of jobs created or retained, when available, instead of sales. Our decision was based on our observation and assumption that businesses are better able to estimate the impact of MEP activities on employment than on sales. The reasoning is that firms typically keep close tabs on head count and are more likely to be able to attribute a change in the number of personnel to MEP activities. Sales, on the other hand, are more volatile and depend on outside market factors, which are beyond a firm's control. However, when employment is not available from the surveys, sales is used instead and the model then calculates the number of additional workers required to generate the observed increase in sales.

Another issue is the decision when to use investment data from the survey in the model. The REMI model allows either the model to determine the amount of investment that would be commensurate with employment (or sales) increase, or that feature of the model can be turned off and the amount reported from the survey can be input in the model instead.

# Modeling the Net Impact (continued)

There are pros and cons to using one approach or the other. Using the investment estimated by the REMI model may overestimate the amount of capital expenditure induced by MEP activities, and the model would generate additional indirect and induced effects on employment and other outcomes based on the overestimate of the investment expenditures. Using the investment expenditures from the survey assumes that the firms have accurately attributed additional investment expenditures to MEP activities and that these are consistent with what is needed to accommodate increased sales and additional personnel. Neither approach is completely satisfactory. We view the results from entering reported investment expenditures as a more conservative approach, since it is possible that firms that do not report investment expenditures (investment expenditures that are less than needed to accommodate sales or employment increases) may have excess capacity due to prior investments or slack demand.

In Upjohn's version of the REMI model, it is possible to "nullify" capital investment caused by changes in sales and employment, assuming that new jobs and sales use existing capital stocks. Within the MEP survey and as noted above, data on a number of types of production-related investments were collected and were used in place of the assumed changes in capital stock. This change in methodology provides a more realistic view of impacts on the national economy.

# Modeling the Net Impact (continued)

As shown in Figure 1, employment is the preferred input for impacts, with sales used when employment isn't available. In the case of investment, it is included whether employment, sales, or neither are available.

**Assumptions Regarding Market Dynamics**

Since Ehlen and Brown's development of the guide, REMI has added some policy variables that are helpful in estimating impacts at the macro level. Part of the dilemma with this research is in attempting to estimate the effect that helping one company has on others who don't receive help from an MEP Center. Ehlen and Brown refer to this as "beggar thy neighbor" and define it as "in the course of improving ones' own condition,

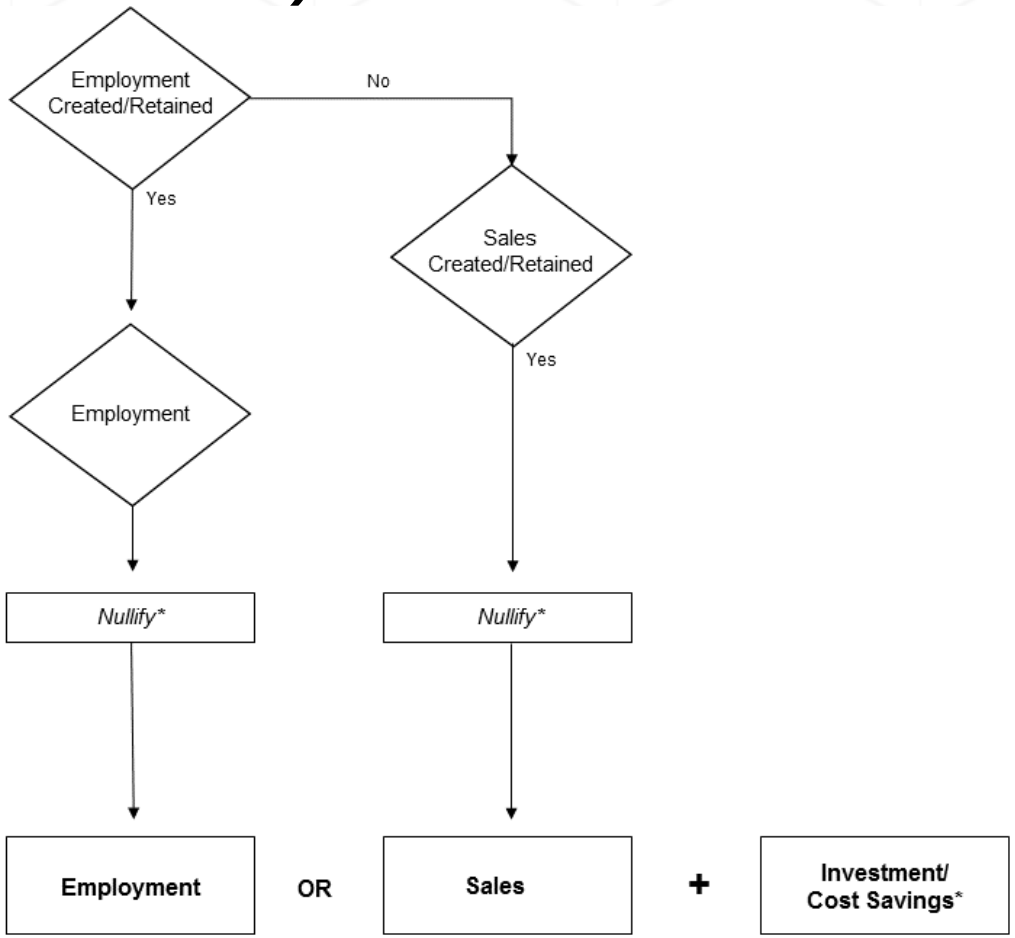



**Figure 1: Upjohn's Decision Tree for Using Survey Data**

# Modeling the Net Impact (continued)

making a neighbor worse off" (2000, p. 39). They continue with "(R)elevant to state impacts, the sales increases that MEP clients report may only being displacing the sales of other in-state firms…" (p. 39). While this is true at the state level, it is exacerbated at the national level when the only mitigating factors that don't affect other companies are when there is either import substitution and/or increases in exports for that firm. REMI does offer a solution to that by allowing sales and employment to be placed in a number of policy variables, including ones that assume all new output is exported and ones that assume more productive firms will "crowd out" their less productive competitors.

The "crowding out" or competitive scenario is more realistic and will yield a more conservative estimate of the outcomes than the unconstrained or non-competitive" approach.

MEP Economic Impact Analysis: Estimates of Fiscal Year 2017

# SURVEY RESPONSES FROM MEP CLIENTS

# Survey Responses

This section provides insights into the survey responses of MEP client firms that were collected by Fors Marsh. Summaries are provided for each question, and for both employment and sales, as well as the values for both new and retained values. A later section, *Geography of Impacts: Comparing FY16 to FY17*, compares the responses by question between the two fiscal years for the Census regions. MEP clients were surveyed and asked to indicate whether they believed that MEP activities affected each element of possible business outcomes. If they responded yes, then the respondent was asked to provide a quantitative estimate of the impact of MEP on that specific outcome, such as the number of jobs created or the dollar amount of cost savings. As shown in Table 2, the percentage of "yes" responses ranged from 19.1 percent (other investments) to 52.7 percent (investment in workforce training). Only roughly 323 responded "yes" to all 11 elements and provided a quantitative estimate of the impact. When responses to the two employment questions (created and retained) were combined, 58 percent of the respondents indicated a positive employment effect**.** Forty-eight percent indicated a positive combined sales effect. About 42 percent of those surveyed responded "yes" to both the employment and the sales questions, and only 36 percent responded no to both. Although most surveys did not indicate positive effects on all variables, we sum the responses at the state and national levels and treat the aggregate numbers as an overall direct effect (to MEP clients) of MEP activities. The national and state totals are reported in the following slides in this section.

# Survey Responses

Table 2: Survey Responses for FY17.

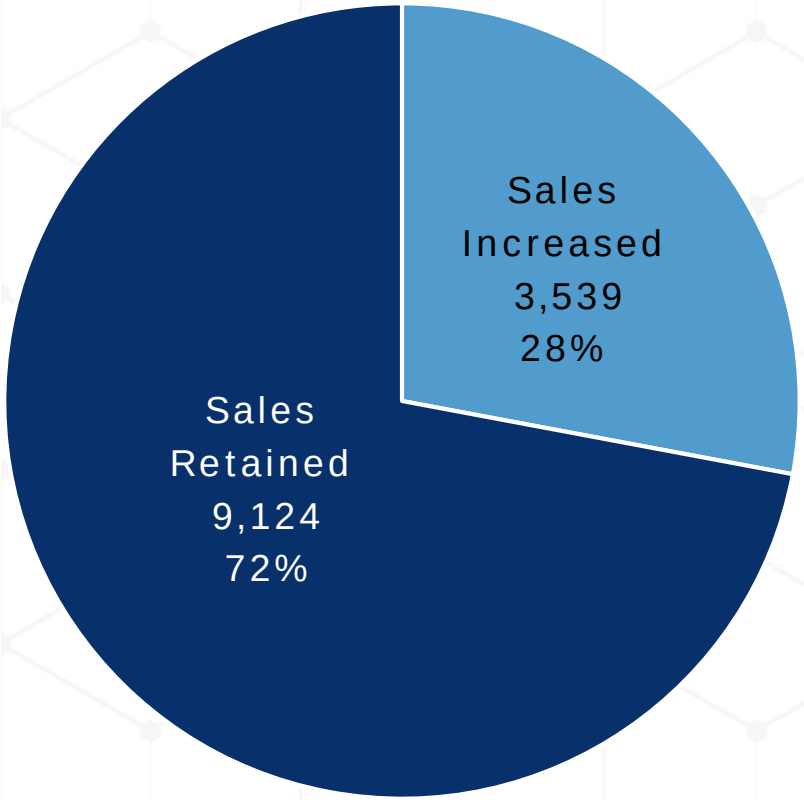
| Data Element (variable) | Number that Indicated MEP Affected a Positive Response (2017) |
|---|---|
| Number of jobs created | 2,789 |
| Number of jobs retained | 3,339 |
| Increase in sales | 2,421 |
| Retained sales | 2,739 |
| Cost savings | 3,600 |
| Investment in plant and equipment | 3,096 |
| Invest in products and processes | 2,900 |
| Investment in information system | 2,174 |
| Investment in workforce training | 3,812 |
| Other investments | 1,378 |
| Unnecessary investments | 2,472 |
| Total Responses | 7,228 |

# A Summary of Center Activities: Q4 2016 to Q3 2017

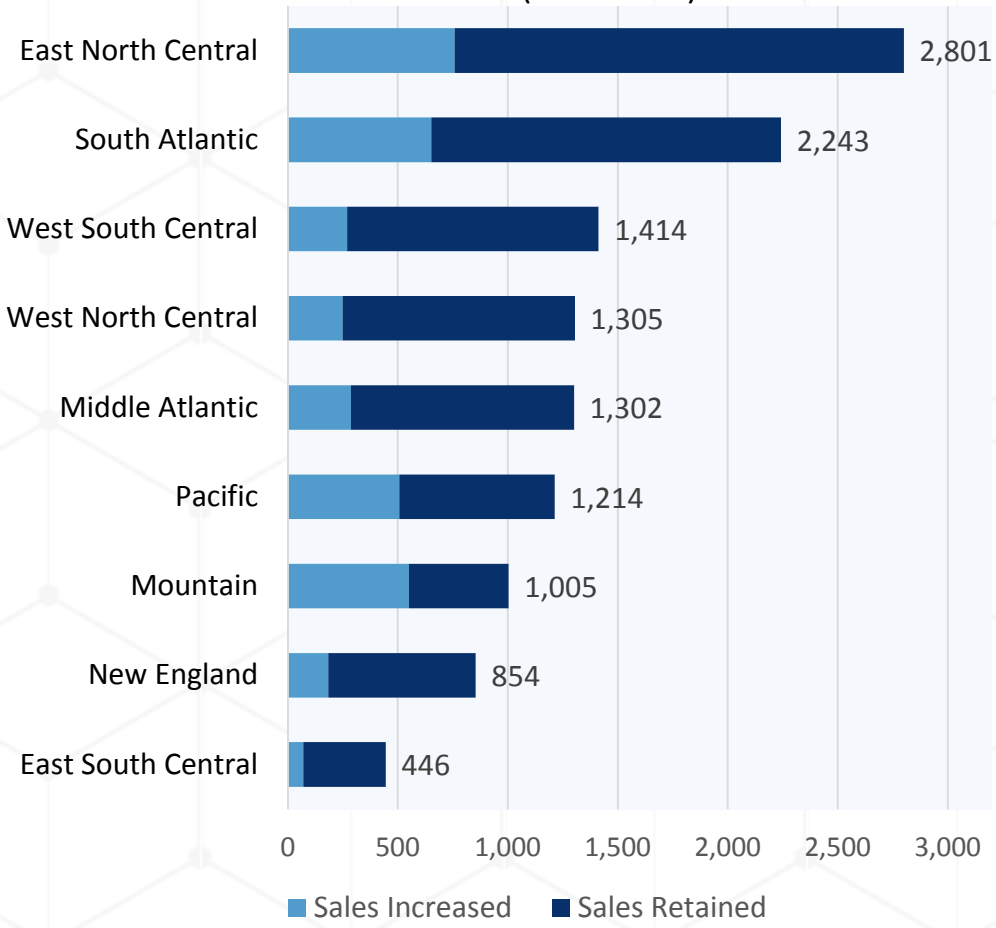
| | | | |
|---|---|---|---|
| **Sales:** | **+$12.6b** | **Total investment:** | **+$3.5b** |
| o Increased: | $3.5b | o Products & Process: | $1.07b |
| o Retained: | $ 9.1b | | |
| **Jobs:** | **+100,721** | o Plant & Equipment: | $1.86b |
| o Created: | 24,210 | o Systems & Software: | $178m |
| o Retained: | 76,511 | | |
| | | o Workforce Practices & Employee Skills | $199m |
| **Cost Savings:** | **+$1.04b** | | |
| **Investment Savings:** | **+$703m** | o Other Areas of Business: | $233m |

# Overview of Total Sales

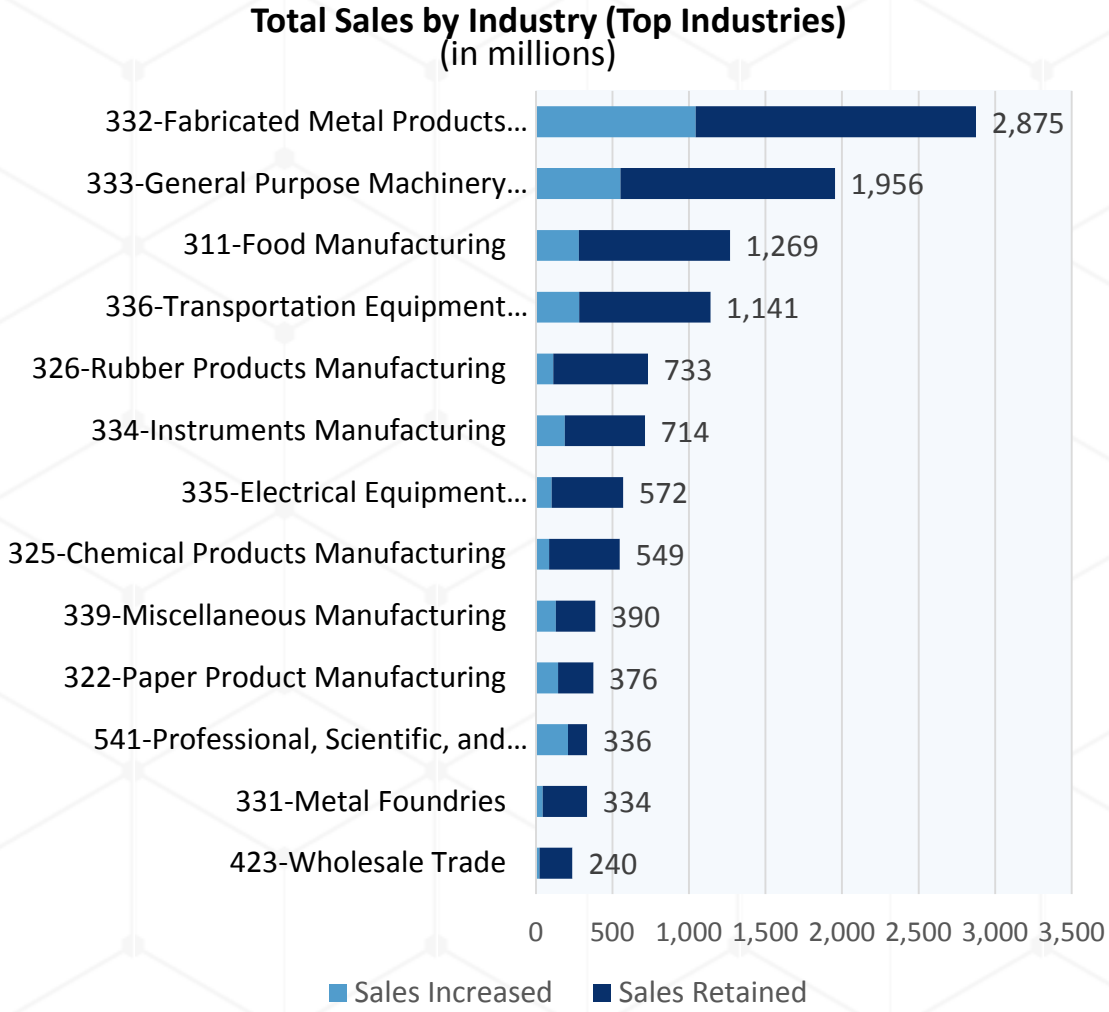
**Total Sales Increased vs. Total Sales Retained**
(in millions)

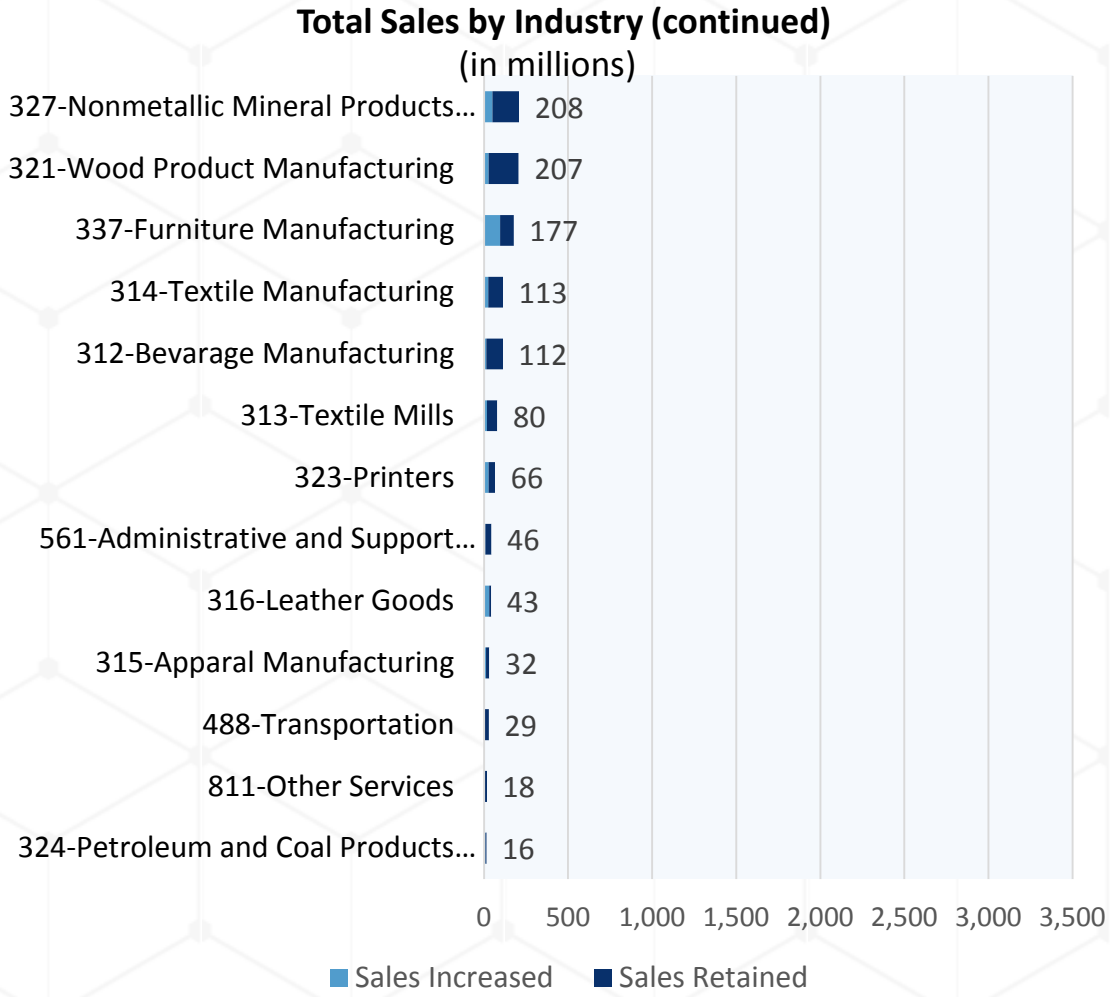



**Total Sales by Region**
(in millions)

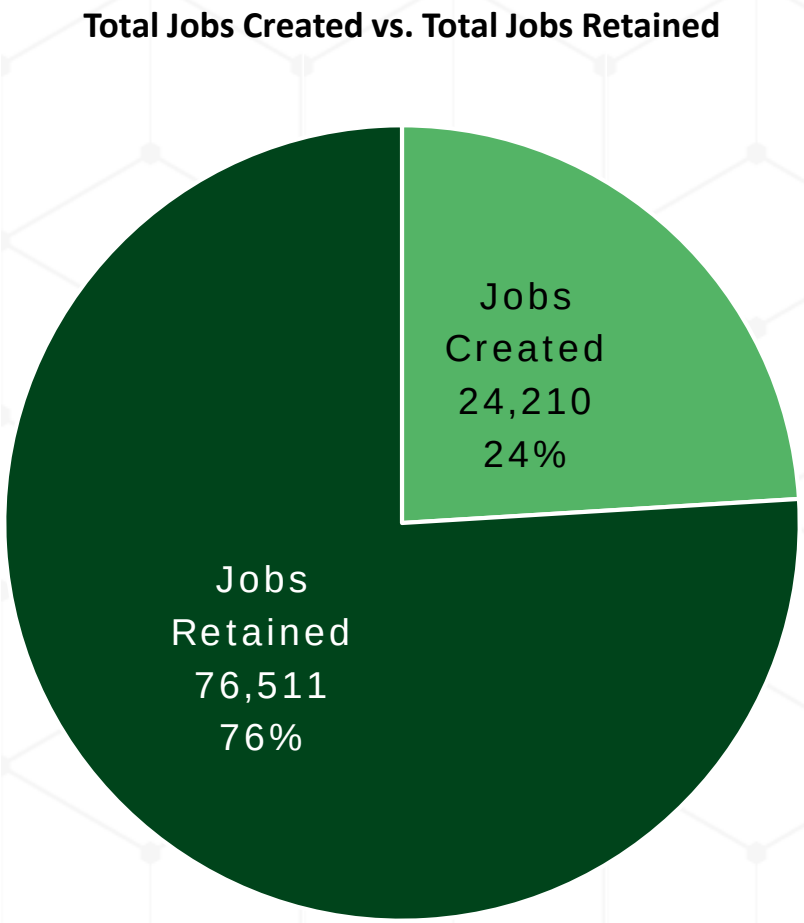


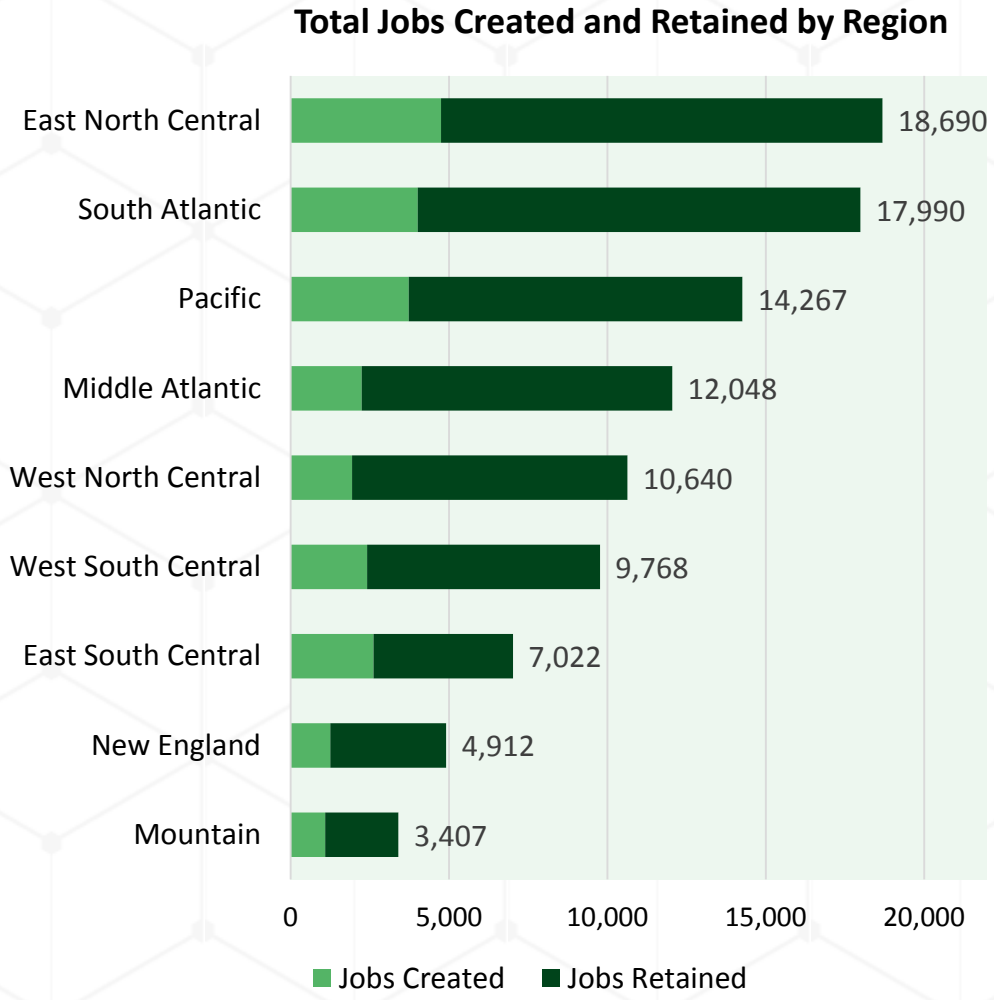
# Total Sales by Industry



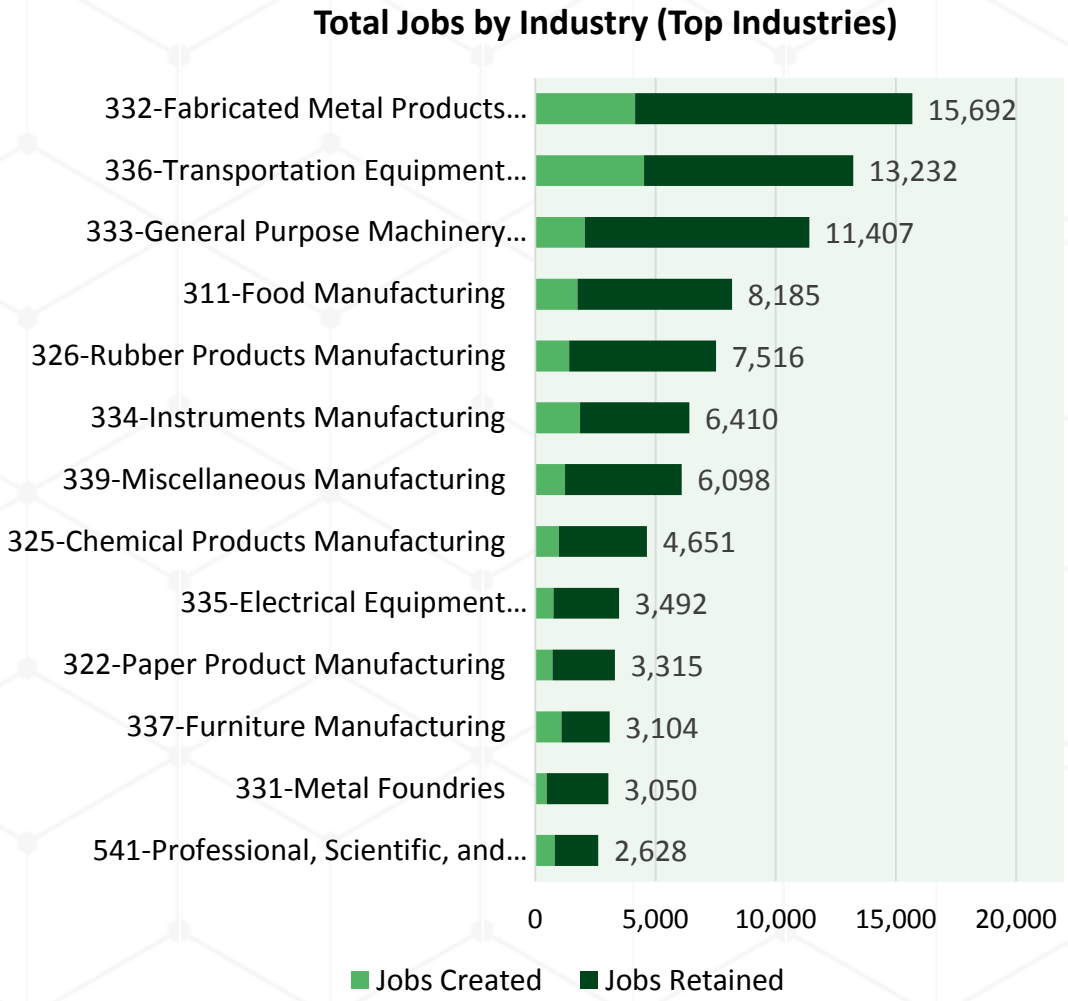



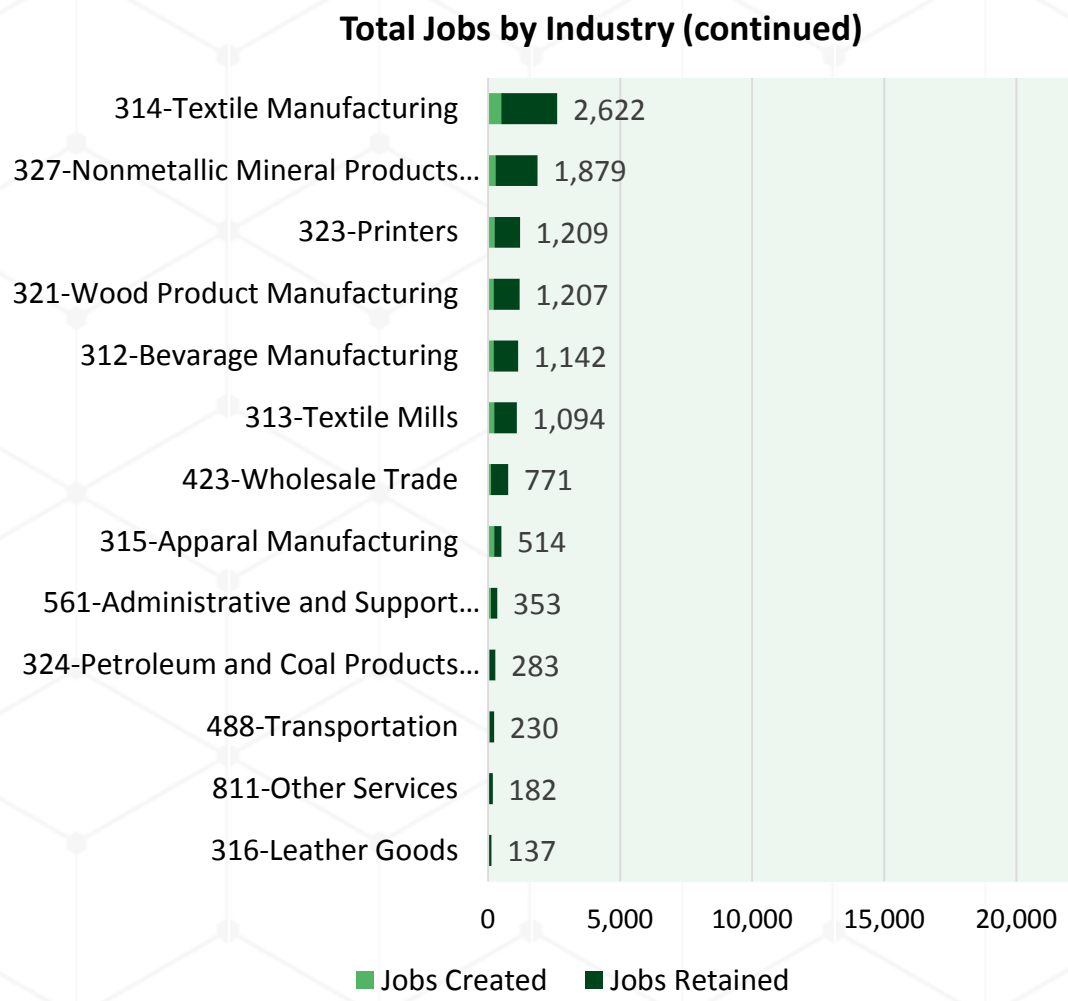
# Overview of Total Jobs



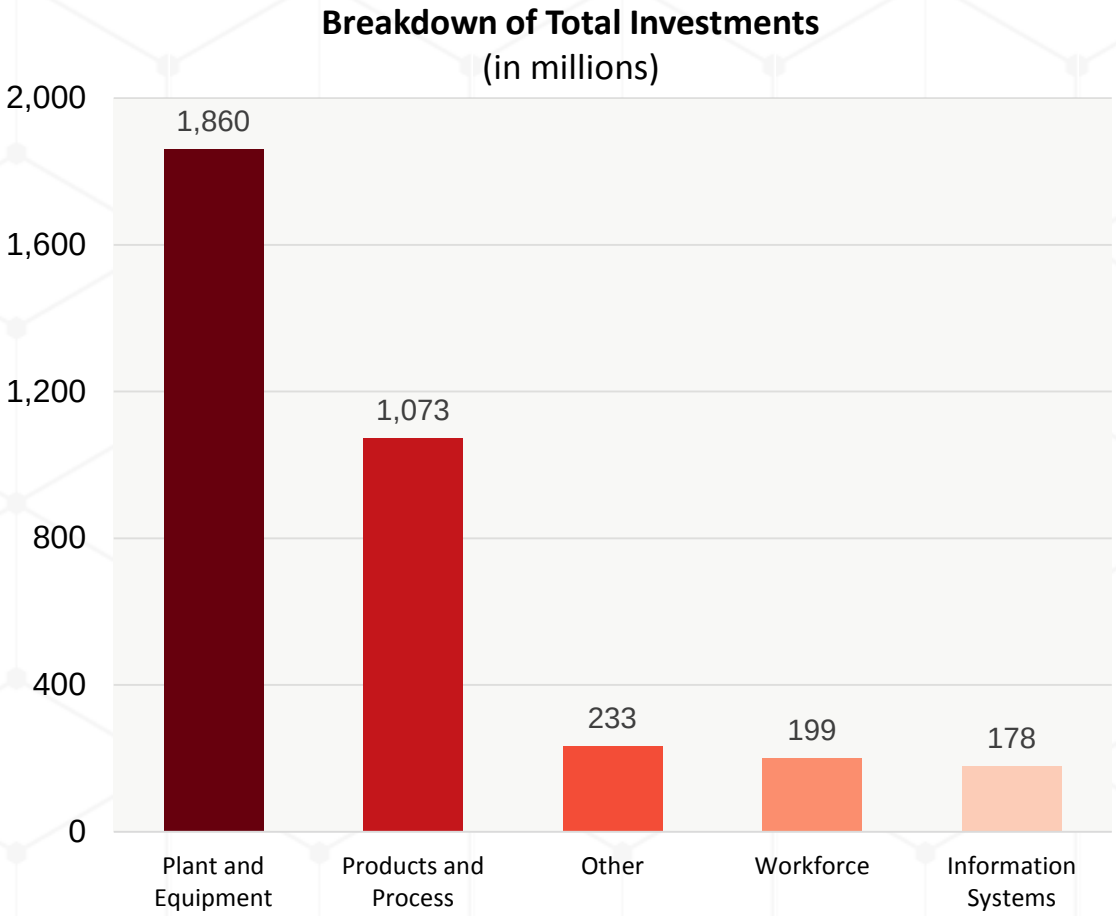



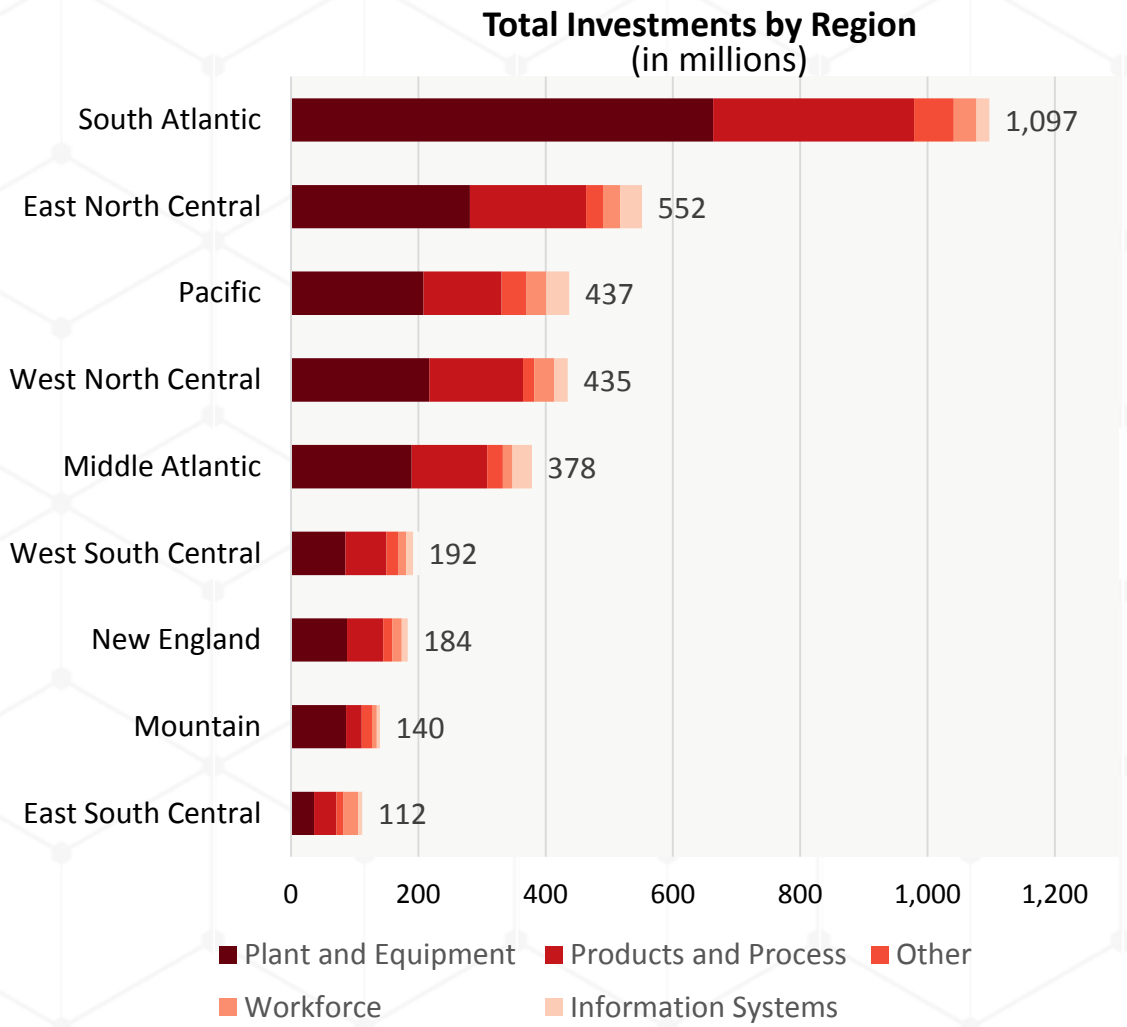
# Total Jobs by Industry



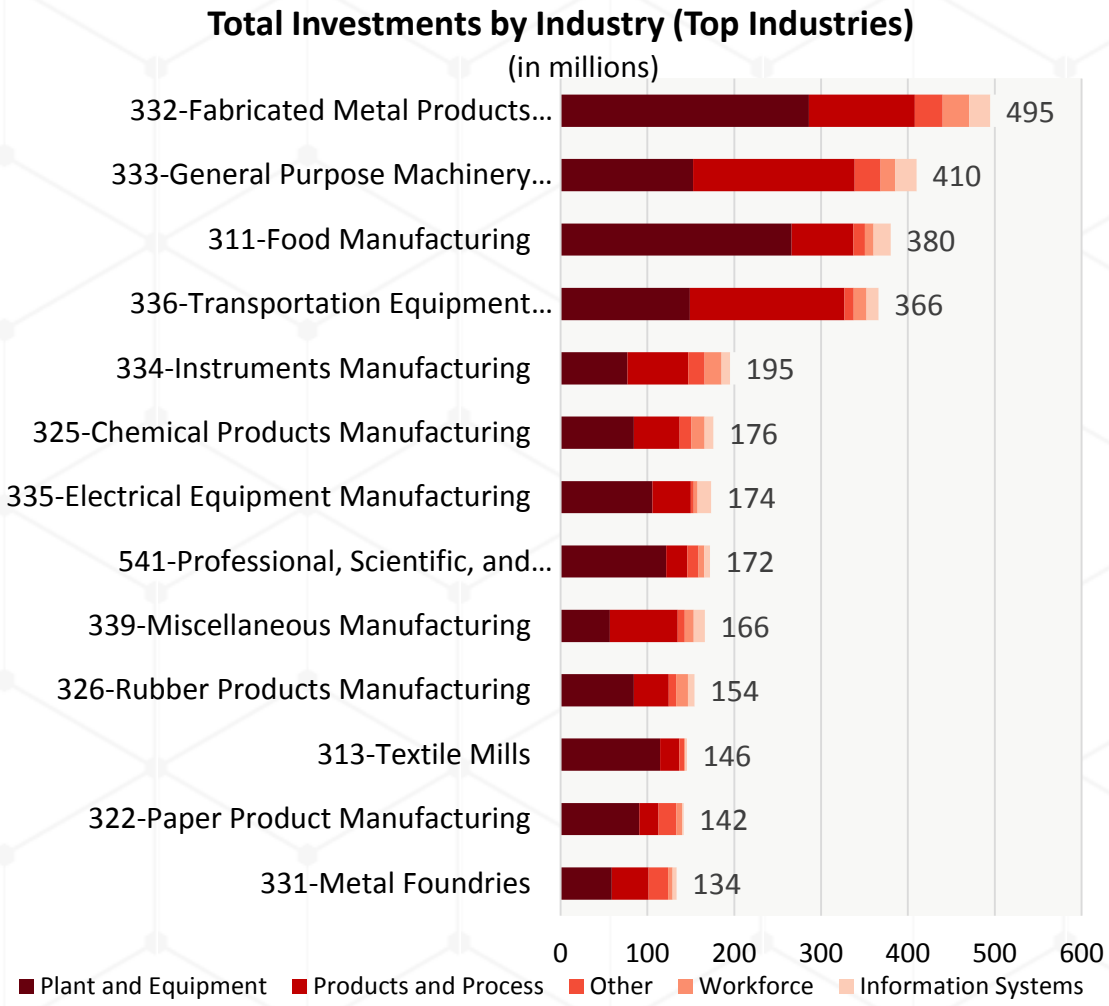



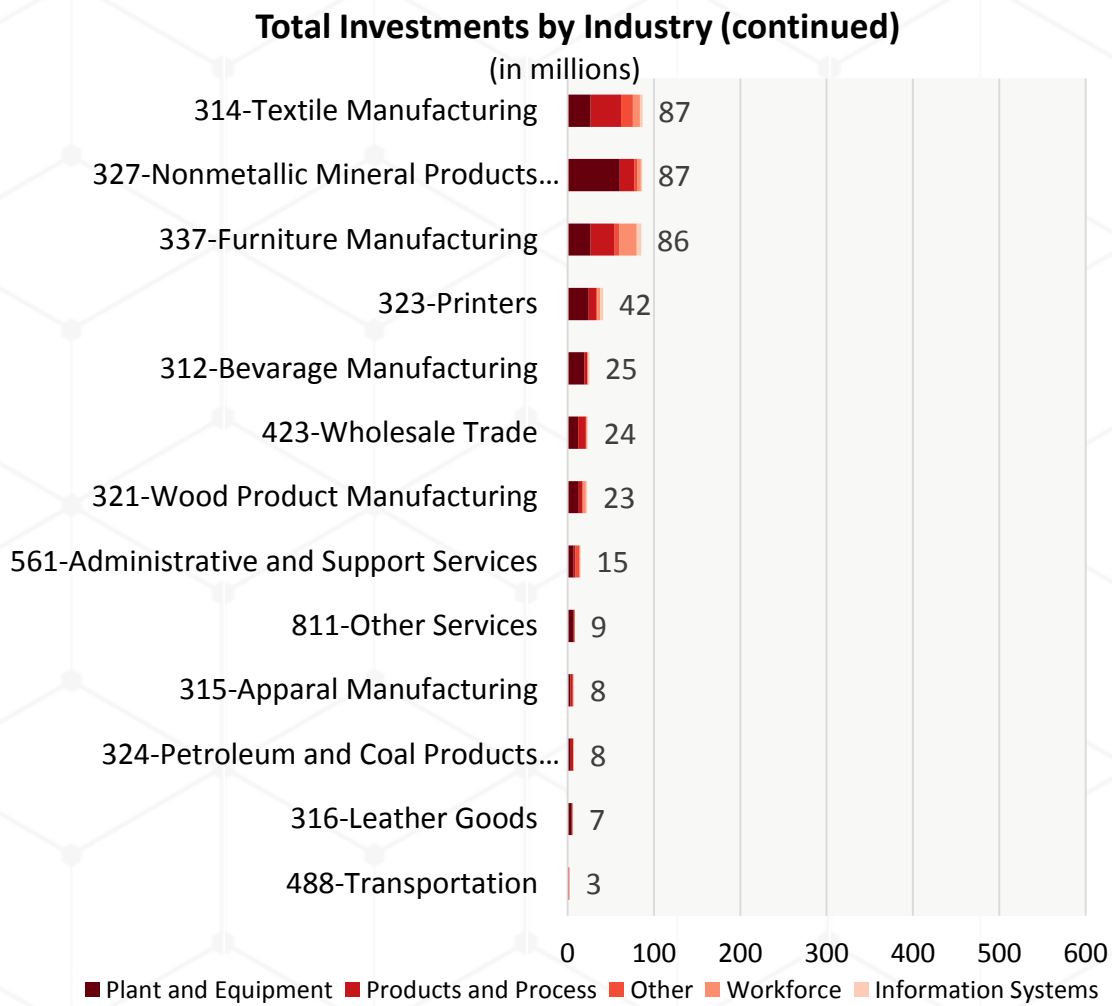
# Overview of Total Investments



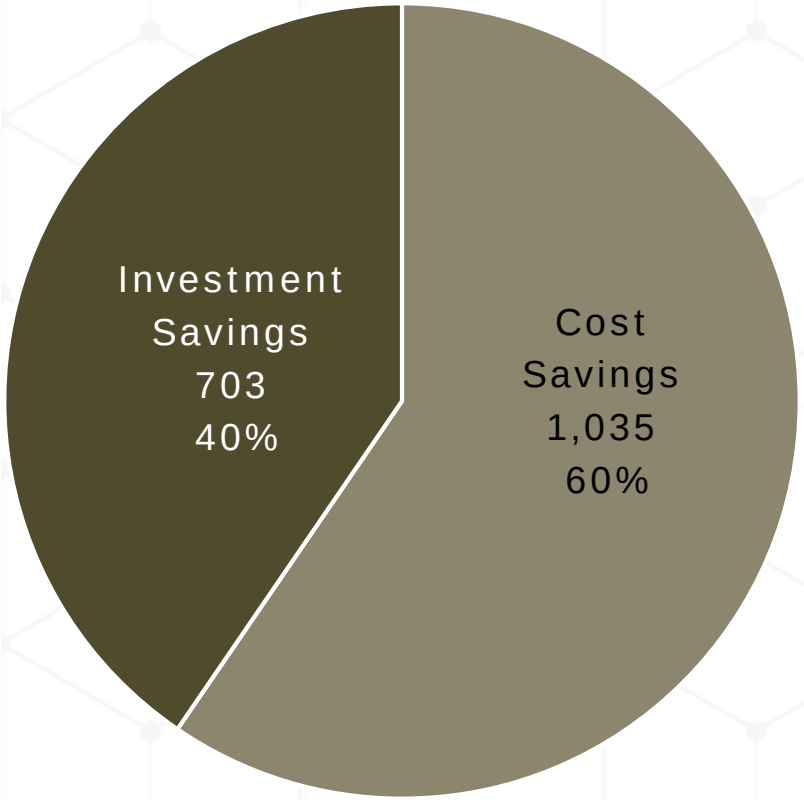
# Total Investments by Industry



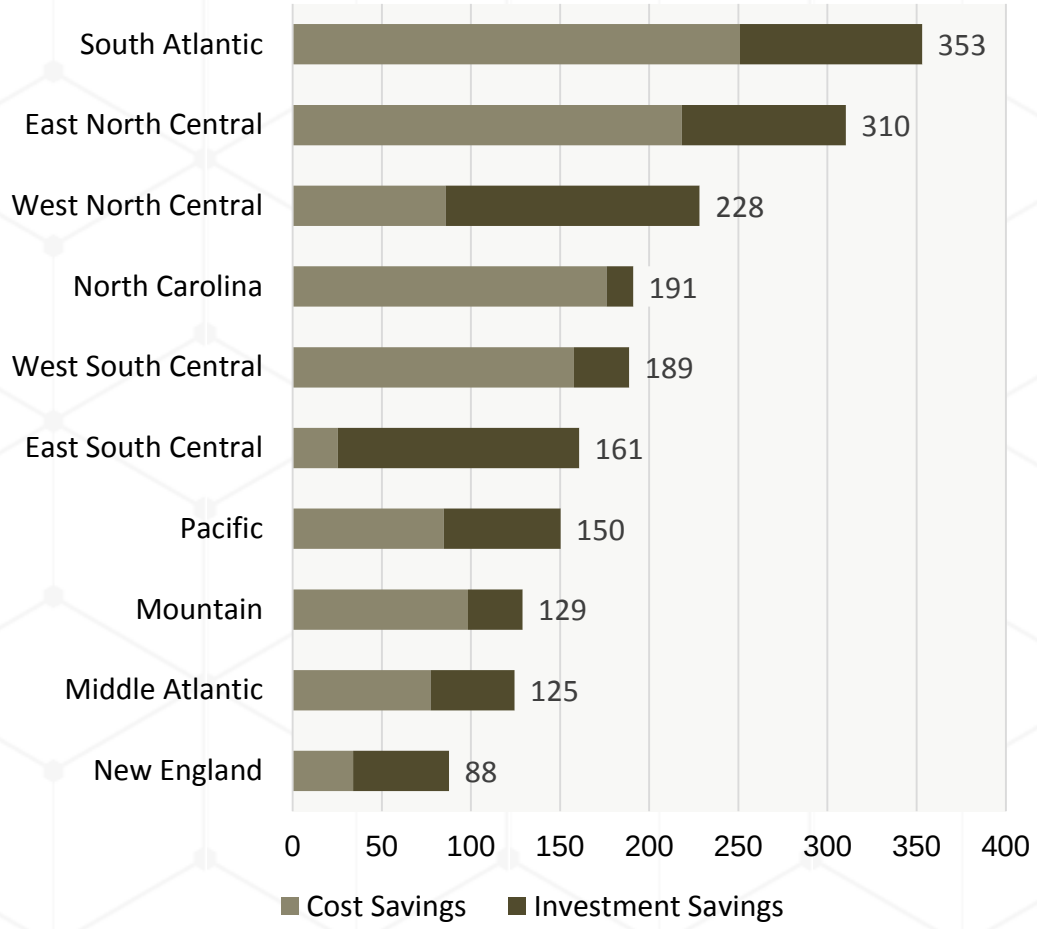



# Cost Savings and Investment Savings

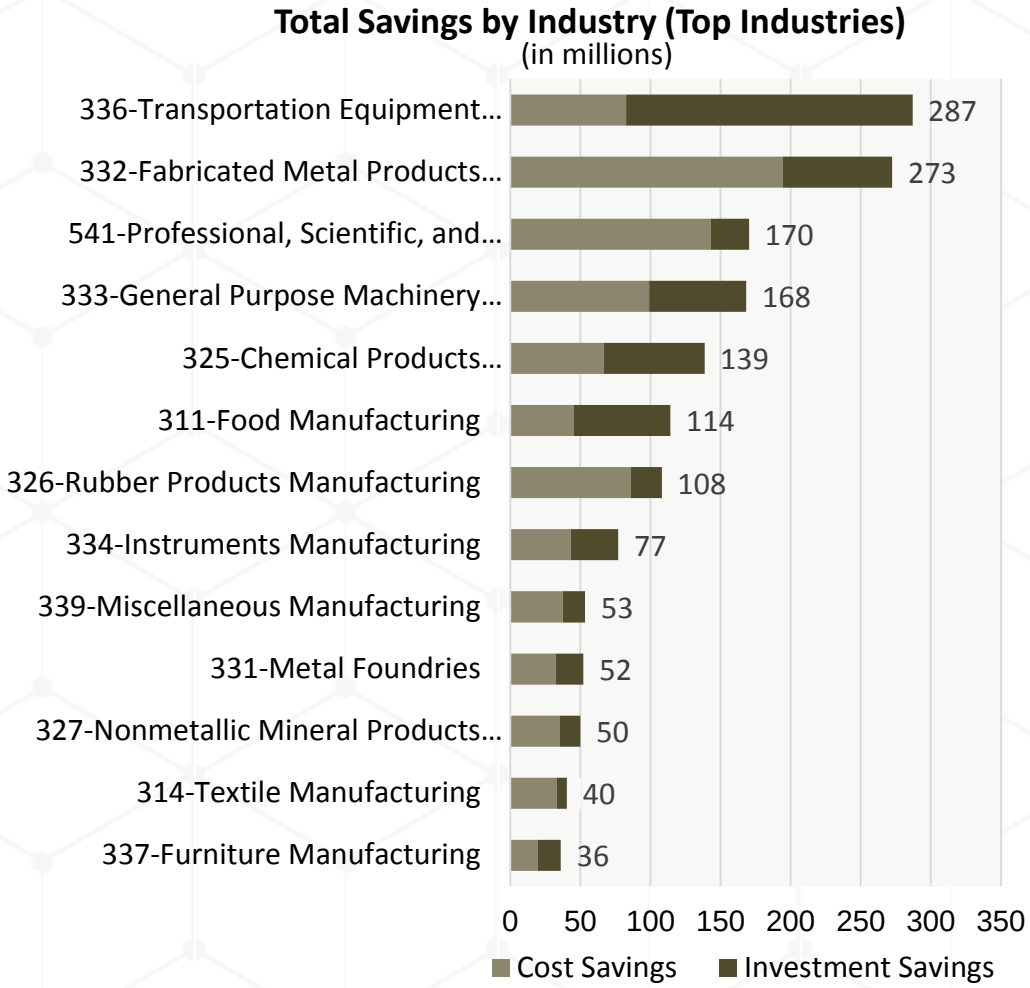
**Total Cost Savings & Total Investment Savings**
(in millions)

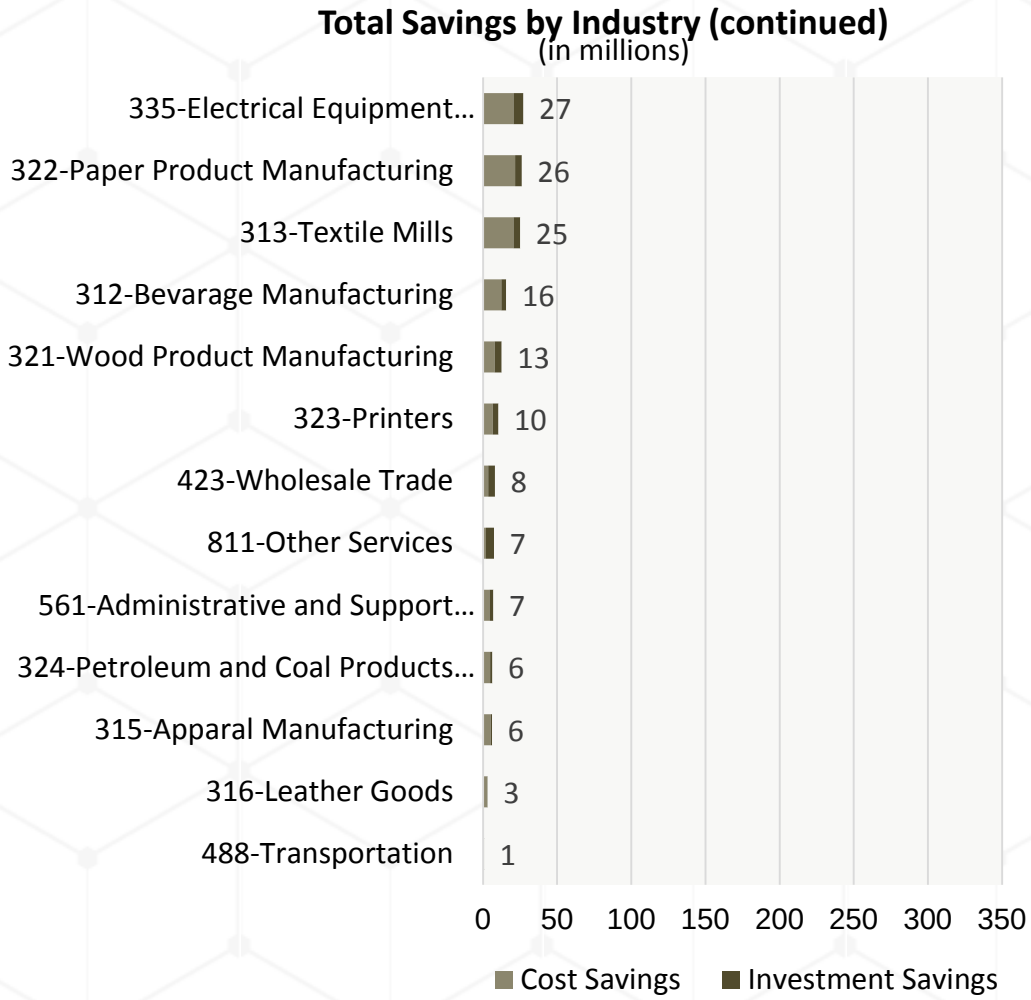



**Total Savings by Region**
(in millions)

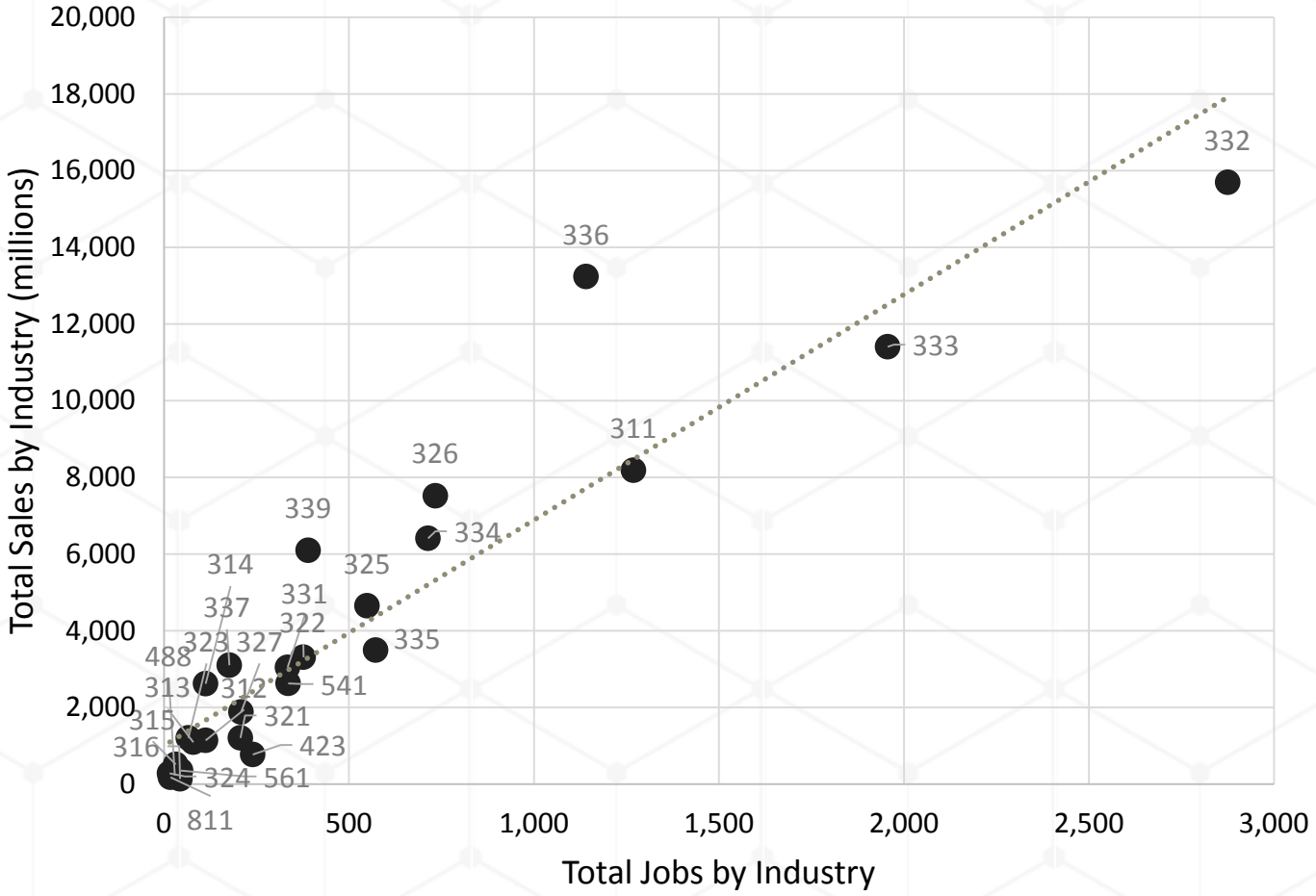


# Total Savings by Industry



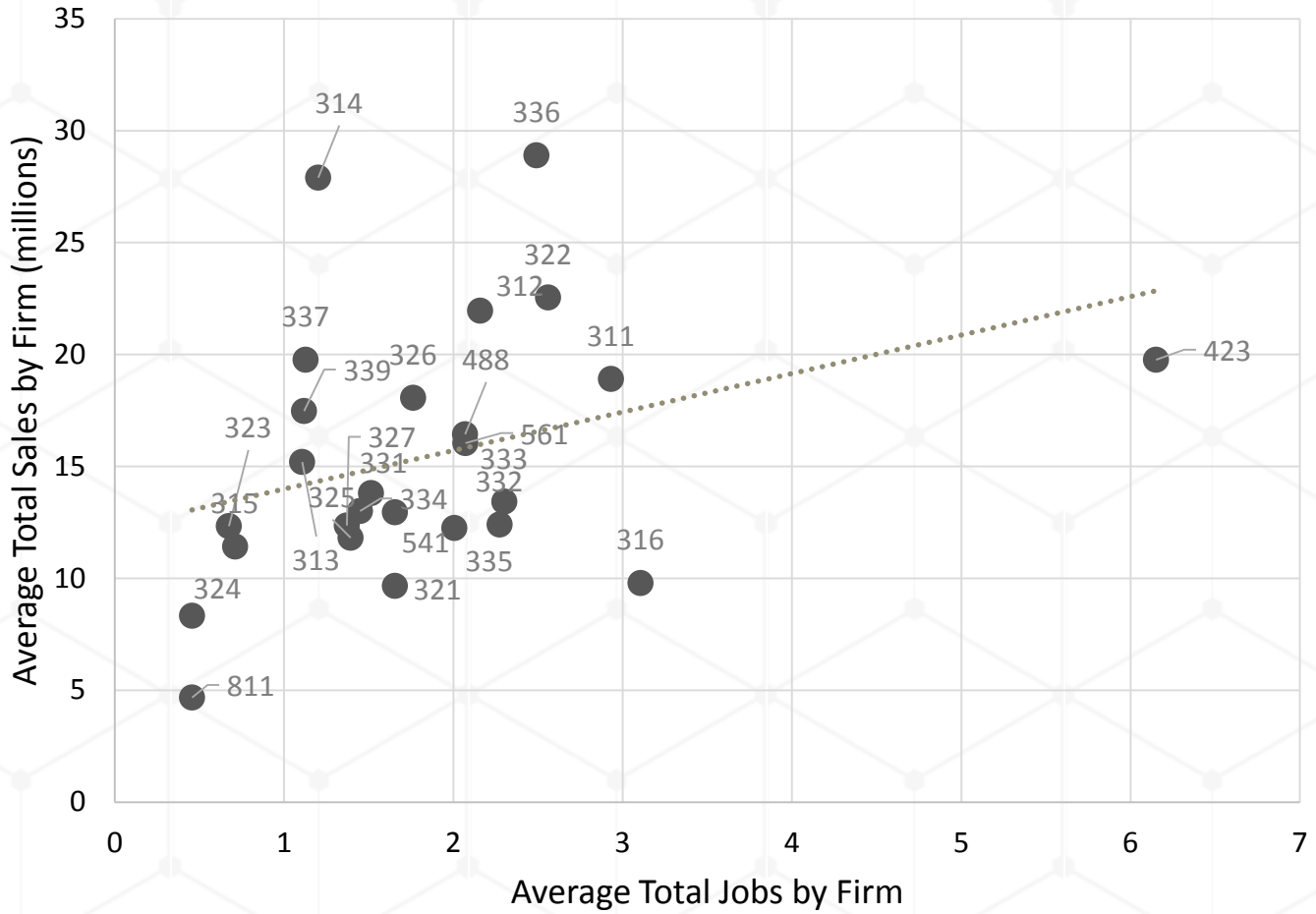



# Total Sales and Total Jobs by Industry




| NAICS-Industry | NAICS-Industry (continued) |
|---|---|
| 311-Food Manufacturing | 331-Metal Foundries |
| 312-Bevarage Manufacturing | 332-Fabricated Metal Products Manufacturing |
| 313-Textile Mills | 333-General Purpose Machinery Manufacturing |
| 314-Textile Manufacturing | 334-Instruments Manufacturing |
| 315-Apparal Manufacturing | 335-Electrical Equipment Manufacturing |
| 316-Leather Goods | 336-Transportation Equipment Manufacturing |
| 321-Wood Product Manufacturing | 337-Furniture Manufacturing |
| 322-Paper Product Manufacturing | 339-Miscellaneous Manufacturing |
| 323-Printers | 423-Wholesale Trade |
| 324-Petroleum and Coal Products Manufacturing | 488-Transportation |
| 325-Chemical Products Manufacturing | 541-Professional, Scientific, and Technical Services |
| 326-Rubber Products Manufacturing | 561-Administrative and Support Services |
| 327-Nonmetallic Mineral Products Manufacturing | 811-Other Services |

# Total Sales and Total Jobs by Firm

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| 327-Nonmetallic Mineral Products Manufacturing | 811-Other Services |

MEP Economic Impact Analysis: Estimates of Fiscal Year 2017

# THE CHANGE FROM 2016 VS 2017

# Estimating FY17 Using FY16 Response Rates

The impacts estimated for FY17 are significantly higher than for FY16. A portion of this increase could be the result of the difference in several factors between the two fiscal years. We focus on two factors: a difference in the mix of industries served by the centers and the difference in the response rate to the survey.

With respect industry mix, REMI estimates dynamically a set of multipliers for each industry and thus the "spillover" effects to both indirect and induced jobs will vary by industry. In comparing the two periods, 4,601 center clients were included in both fiscal years, so they maintained the same industry identification in each of the two years. The difference in composition came about because of those clients who were included in fiscal year 2016 only and those clients who were included in fiscal year 2017 only. Although the industry mix of clients was comparable across both years, the clients reported a significant difference in the relative number of jobs impacted by MEP services in 3 of the 29 three-digit industries. These industries were food manufacturing (311), fabricated metal products (332), and computer and electronic product manufacturing (334). Food manufacturers (311) reported 374 jobs more jobs impacted in FY16 than in FY17, whereas fabricated metal products (332) reported 515 more jobs impacted in FY17 than in FY16, and computer and electronic manufacturers (334) reported 709 more jobs in FY17. In addition, clients in FY16 were classified in three industries in which no one appeared in FY17, with a total of 222 jobs.

# Estimating FY17 Using FY16 Response Rates (continued)

Although the number of clients served in FY16 was about the same as in FY17 (8,920 versus 8,928), the response rate to the survey was much higher in FY17 (82 percent versus 73 percent). As with the description of the difference in industry composition, we also divided the clients from FY16 and FY17 into three groups: 1) the group in which clients received services and responded to the survey in both years, 2) the group in which clients responded to the survey only in FY16, and 3) the group in which clients responded to the survey only in FY17. We found that the response rate of clients who responded in both years was nearly identical (82 percent) while the response rate for those who responded to the survey only in FY16 was much lower, 63 percent compared to 80 percent. We also found that those who responded to the survey in general were more likely to respond to the "jobs creation" question in FY17 than in FY16, 28 percent versus 20 percent.

While it is impossible to determine precisely how the difference in response rates affected the reported number of jobs created between the two years, considering the response of clients within each of the three groups described above is enlightening. At face value, the number of jobs created between FY16 and FY17 increased by 22 percent, while the response rate increased overall by 11 percent. We do know, however, that even with nearly identical response rates for those clients who received services both years, the reported number of jobs created increased 23 percent from FY16 to FY17. Further, clients who filled out the "jobs created" question in both years reported an increase of 24 percent. Therefore,

# Estimating FY17 Using FY16 Response Rates (continued)

we focused on the two groups that filled out the survey in only one of each of the two years. For those two groups, the response rate for FY16 only was 63 percent and the response rate for FY17 only was 80 percent—a 17 percentage-point increase. Nonetheless, clients in those two groups reported an increase of 23 percent in jobs created due to the services, similar to the increase reported by clients in the other groups. Obviously, the higher response rate in FY17 contributed to the reported increase in the number of jobs created, but by how much? The other groups exhibited an increase in jobs created of roughly 23 percent when the response rates were relatively the same. These two groups exhibited a similar increase in jobs created of 23 percent but with an 11 percentage-point increase in response rate, or roughly an additional 745 respondents. A conservative approach of estimating the number of jobs created in FY17 without the increase in response rate would be to reduce the number of respondents in FY17 to that in FY16 and multiply that number by the number of jobs created per respondent. Since that number is the same in both years, and so is the number of clients, this method would yield little difference in the number of jobs created in each of the two years. We then add this number to the reported number of jobs created by clients in the matched group for FY17. The actual reported number of jobs created are used for FY16. We did not adjust for differences in industry composition nor for those responses for which we had to substitute sales created because of missing observations for jobs created.

# Estimating FY17 Using FY16 Response Rates (continued)

While using all survey responses provided an estimated impact of 219,148 total jobs, controlling for comparable response rates reduces the impact estimates by about 7 percent to 203,254. Fewer responses also reduced estimates of gross domestic product (GDP) from $22 billion to $20.41 billion, output from $40.3 billion to $37.4 billion, personal income from $13.76 billion to $12.77 billion, and returns to the Treasury from $186 billion to $1.73 billion. Even with reduced responses and the associated impacts to inputs, the ratio of the return on the investment of $128 million was at 13.5:1.

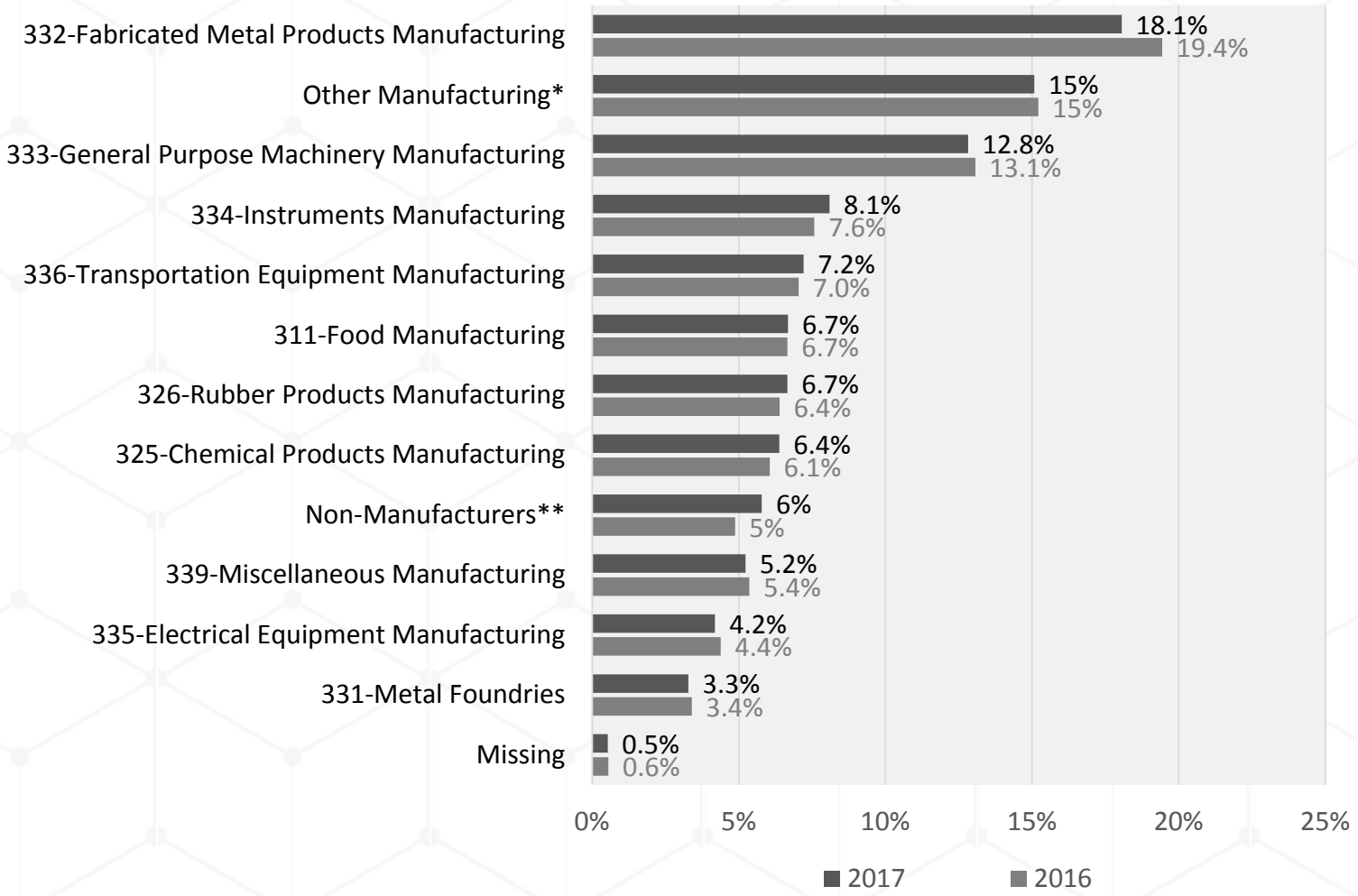
# Average Number Indicated MEP Affected a Positive Response: Change from 2016 to 2017

| Data Element (variable) | Number Indicated MEP Affected a Positive Response (2016) | (%) | Number Indicated MEP Affected a Positive Response (2017) | (%) | Difference |
|---|---|---|---|---|---|
| Number of jobs created | 2,406 | 37.0% | 2,789 | 38.6% | 1.6% |
| Number of jobs retained | 2,881 | 44.3% | 3,339 | 46.2% | 1.9% |
| Increase in sales | 2,088 | 32.1% | 2,421 | 33.5% | 1.4% |
| Retained sales | 2,242 | 34.5% | 2,739 | 37.9% | 3.4% |
| Cost savings | 3,217 | 49.4% | 3,600 | 49.8% | 0.4% |
| Investment in plant and equipment | 2,748 | 42.2% | 3,096 | 42.8% | 0.6% |
| Invest in products and processes | 2,442 | 37.5% | 2,900 | 40.1% | 2.6% |
| Investment in information system | 1,853 | 28.5% | 2,174 | 30.1% | 1.6% |
| Investment in workforce training | 3,315 | 50.9% | 3,812 | 52.7% | 1.8% |
| Other investments | 1,116 | 17.2% | 1,378 | 19.1% | 1.9% |
| Unnecessary investments | 2,272 | 34.9% | 2,472 | 34.2% | -0.7% |
| Total Responses | 6,507 | | 7,228 | | |

# FY17 Study Findings, Controlling for Change in Response Rates

| Forecast | Jobs | GDP | Output | Personal Income | Returns to Treasury | ROI Return on Investment |
|---|---|---|---|---|---|---|
| FY 16 Findings Using Firm Variables | 142,381 | $15.40* | $29.89* | $8.44* | $1.13* | 8.7:1 |
| FY 17 All Responses Using Firm Variables | 219,148 | $22.01* | $40.34* | $13.76* | $1.86* | 14.5:1 |
| FY 17 with FY16 Response Rates Using Firm Variables | 203,254 | $20.41* | $37.39* | $12.77* | $1.73* | 13.5:1 |

# Industry Mix

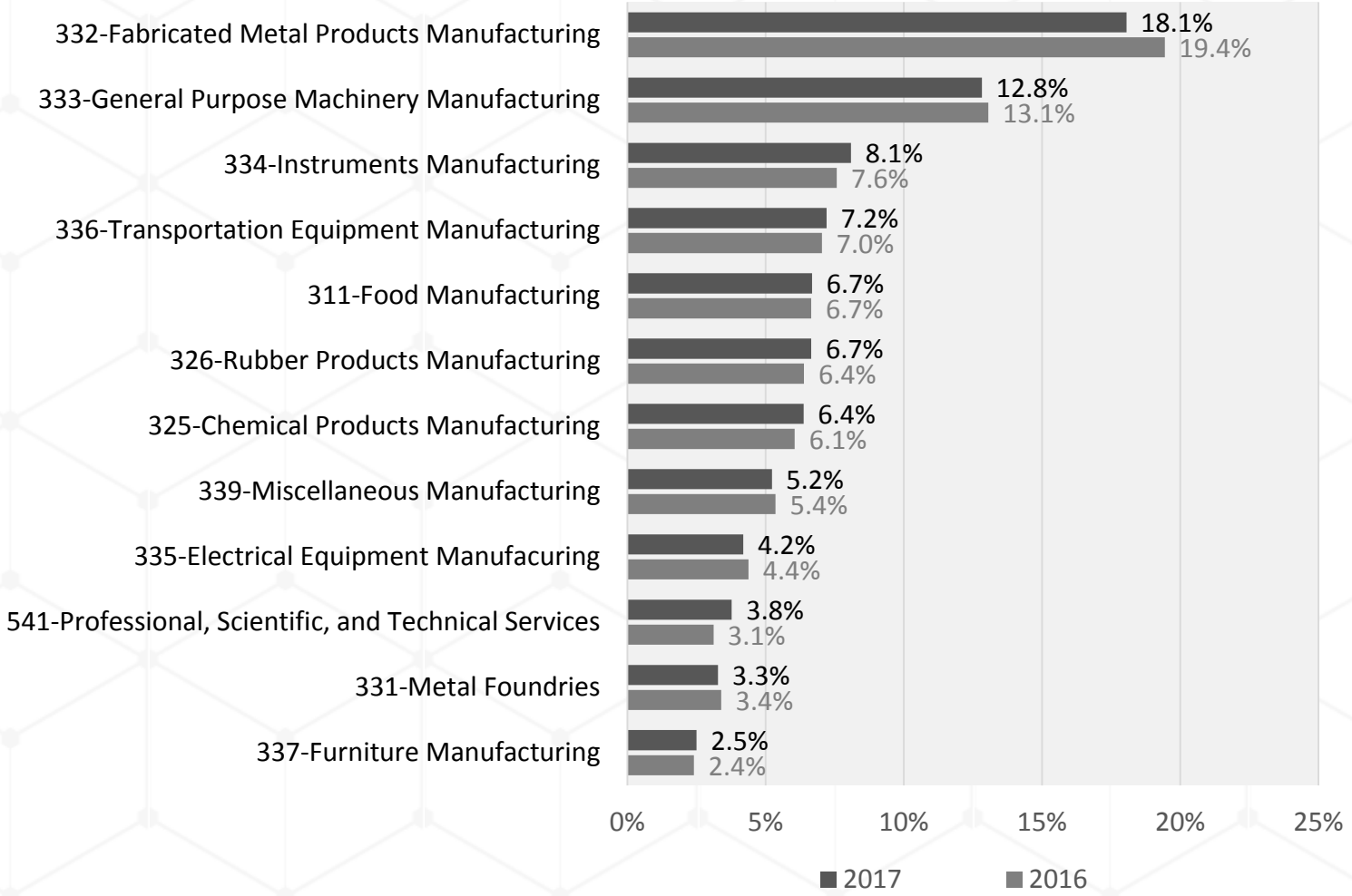



**Total Respondents**

| Industry | 2016 | 2017 |
|---|---|---|
| 332-Fabricated Metal Products Manufacturing | 1,265 | 1,305 |
| Other Manufacturing* | 990 | 1090 |
| 333-General Purpose Machinery Manufacturing | 850 | 927 |
| 334-Instruments Manufacturing | 493 | 585 |
| 336-Transportation Equipment Manufacturing | 458 | 521 |
| 311-Food Manufacturing | 433 | 483 |
| 326-Rubber Products Manufacturing | 416 | 481 |
| 325-Chemical Products Manufacturing | 394 | 461 |
| Non-Manufacturers** | 317 | 418 |
| 339-Miscellaneous Manufacturing | 349 | 378 |
| 335-Electrical Equipment Manufacturing | 285 | 303 |
| 331-Metal Foundries | 221 | 237 |
| Missing | 36 | 39 |

*-Includes NAICS: 312-316, 321-324, 327 & 337
**-Includes NAICS: 423, 488, 541, 561, & 811

# Industry Mix (continued)




**Total Respondents**

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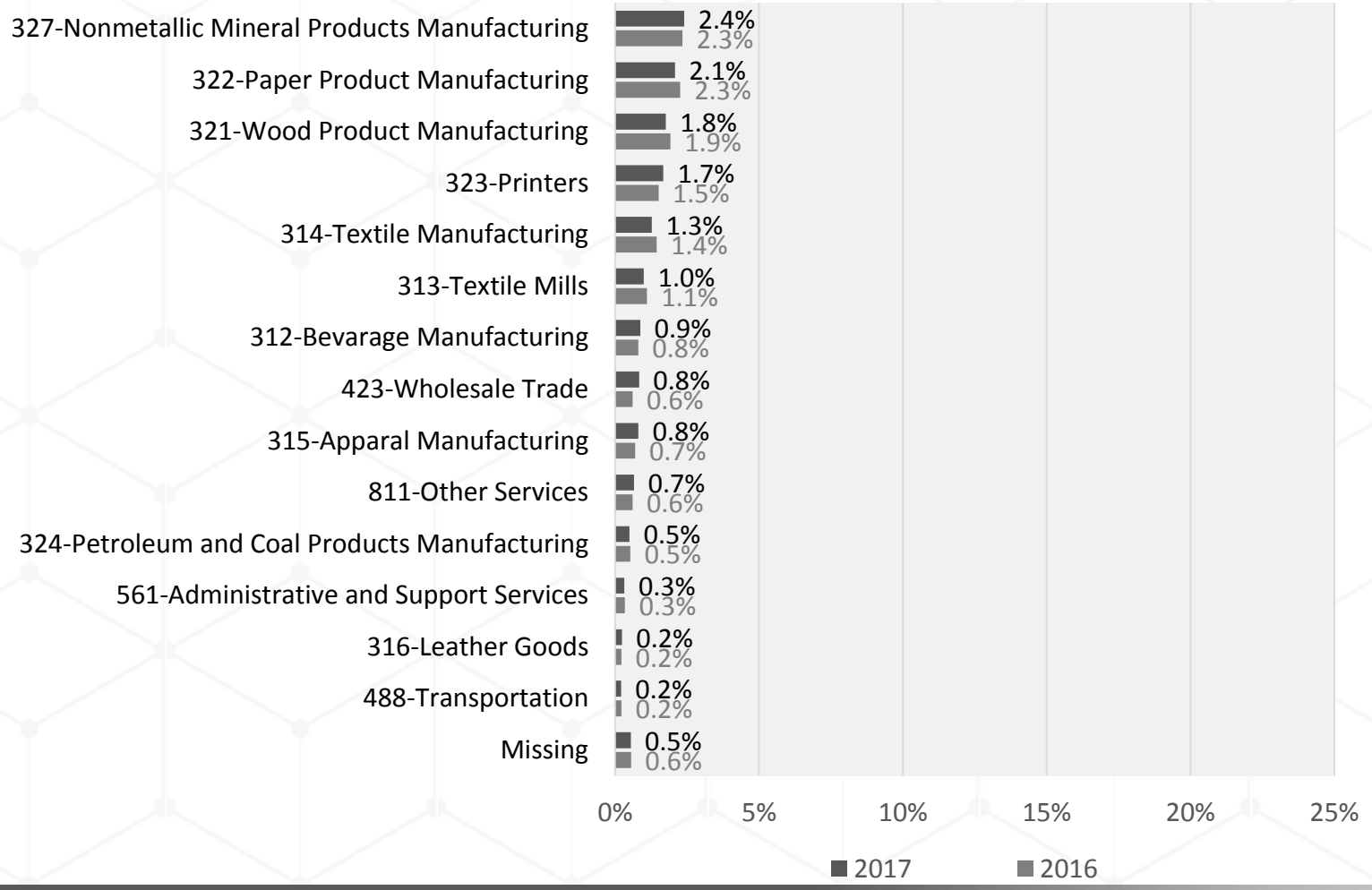
| 336-Transportation Equipment Manufacturing | 458 | 521 |
| 311-Food Manufacturing | 433 | 483 |
| 326-Rubber Products Manufacturing | 416 | 481 |
| 325-Chemical Products Manufacturing | 394 | 461 |
| 339-Miscellaneous Manufacturing | 349 | 378 |
| 335-Electrical Equipment Manufacturing | 285 | 303 |
| 541-Professional, Scientific, and Technical Services | 203 | 273 |
| 331-Metal Foundries | 221 | 237 |
| 337-Furniture Manufacturing | 157 | 181 |

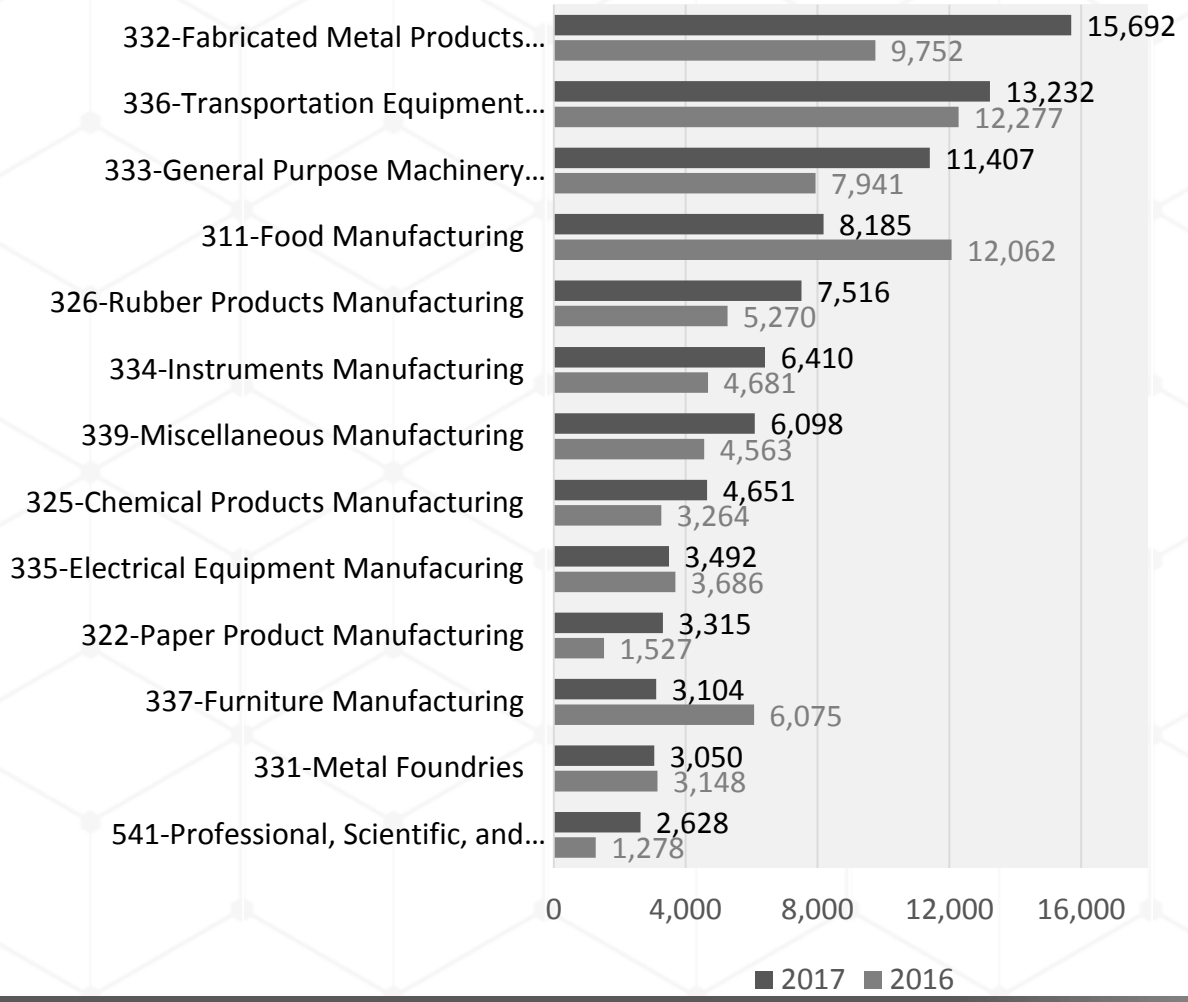
# Industry Mix (continued)

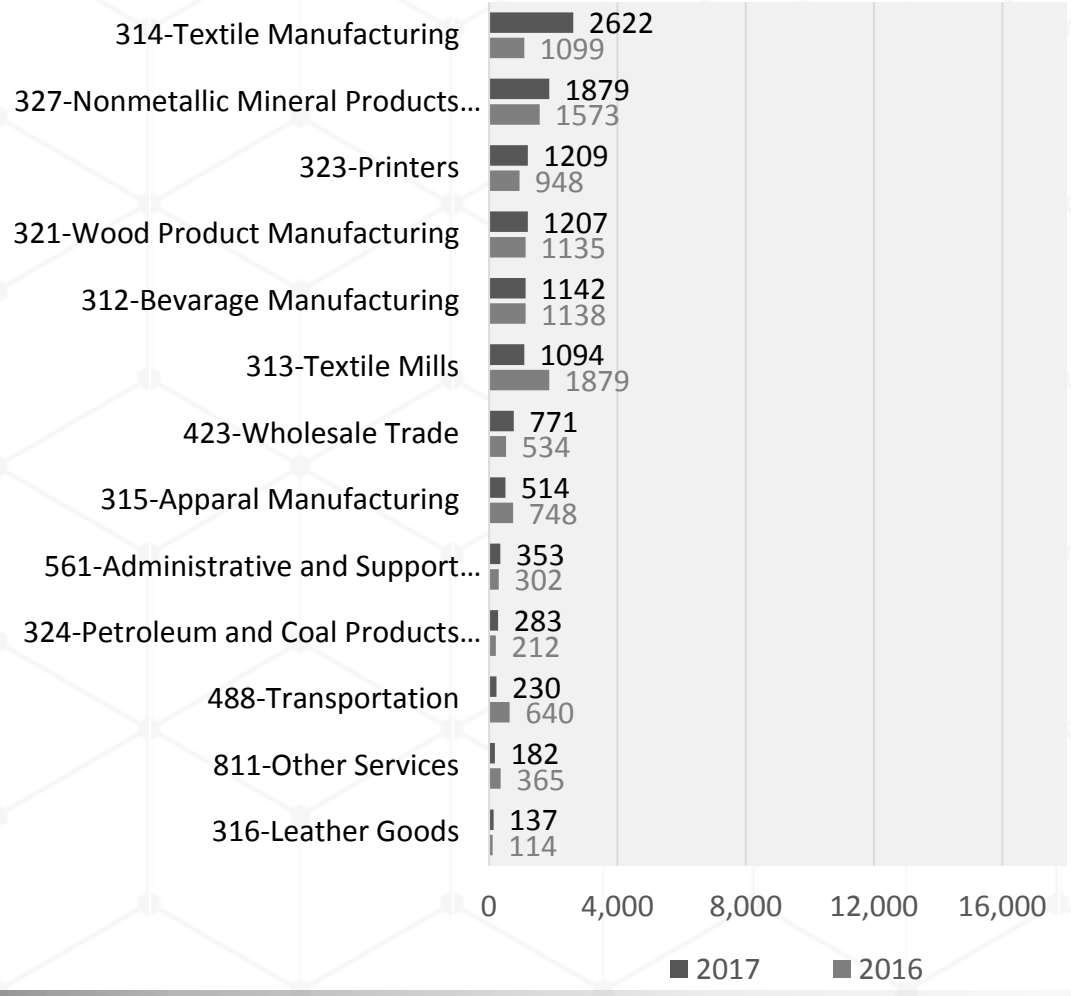



**Total Respondents**

| Industry | 2016 | 2017 |
|---|---|---|
| 327-Nonmetallic Mineral Products Manufacturing | 152 | 173 |
| 322-Paper Product Manufacturing | 147 | 150 |
| 321-Wood Product Manufacturing | 125 | 127 |
| 323-Printers | 98 | 121 |
| 314-Textile Manufacturing | 94 | 92 |
| 313-Textile Mills | 72 | 72 |
| 312-Bevarage Manufacturing | 52 | 63 |
| 423-Wholesale Trade | 39 | 60 |
| 315-Apparal Manufacturing | 45 | 58 |
| 811-Other Services | 39 | 47 |
| 324-Petroleum and Coal Products Manufacturing | 34 | 36 |
| 561-Administrative and Support Services | 22 | 23 |
| 316-Leather Goods | 14 | 17 |
| 488-Transportation | 14 | 15 |
| Missing | 36 | 39 |

# Total Jobs per Industry



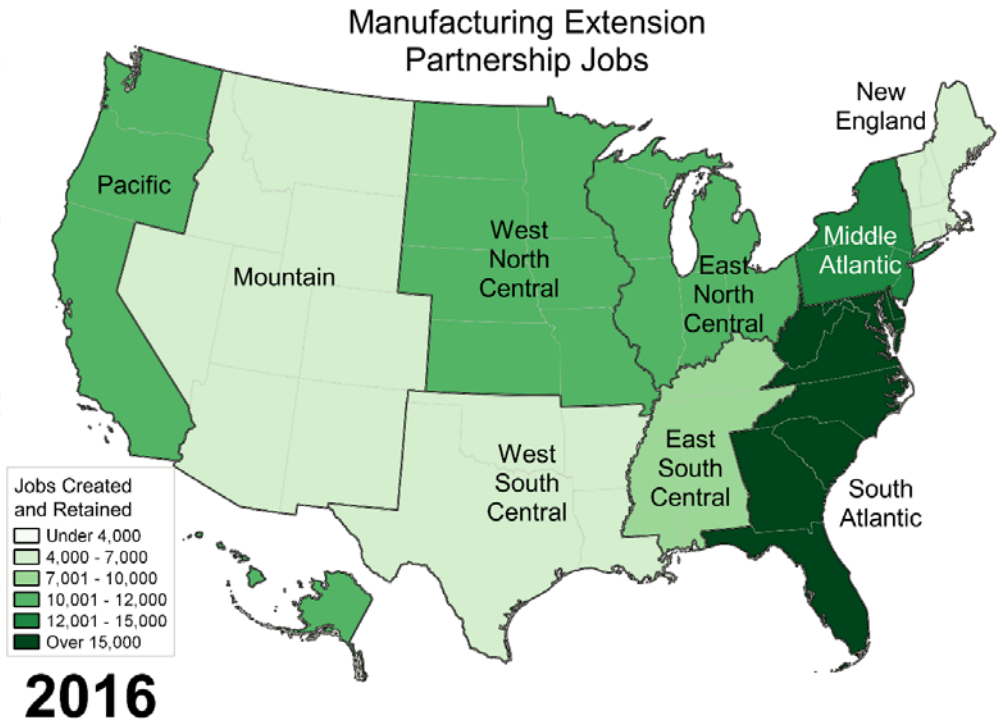



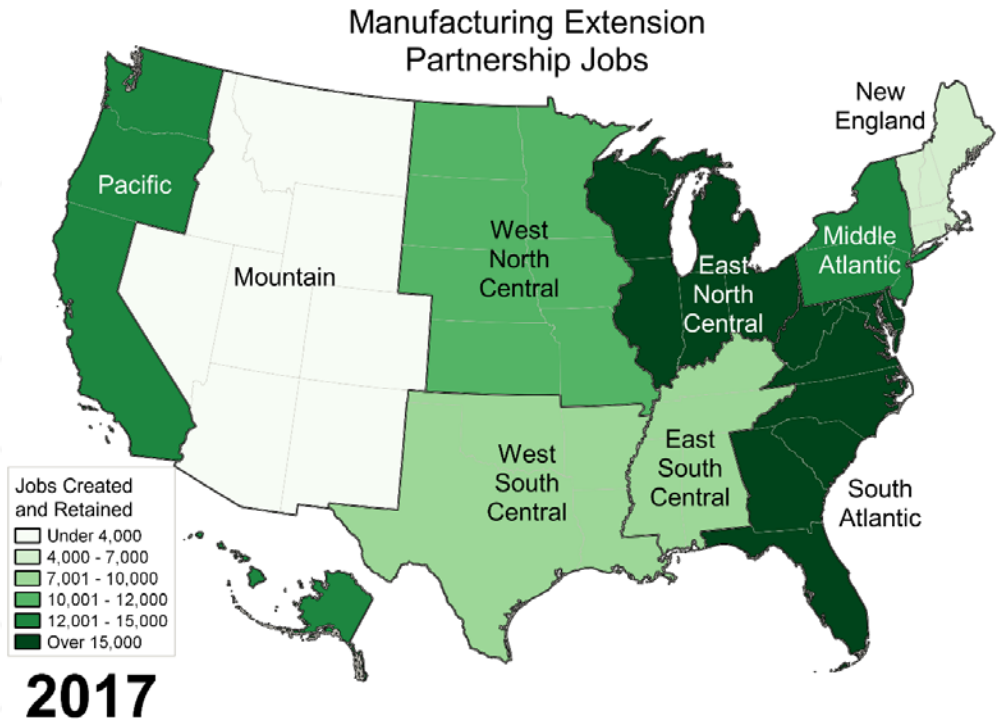
MEP Economic Impact Analysis: Estimates of Fiscal Year 2017

# GEOGRAPHY OF IMPACTS: COMPARING FY16 TO FY17

# Total Jobs

Q6 and 7: Did the services you received directly lead you to create any jobs or retain any jobs over the past 12 months? How much?

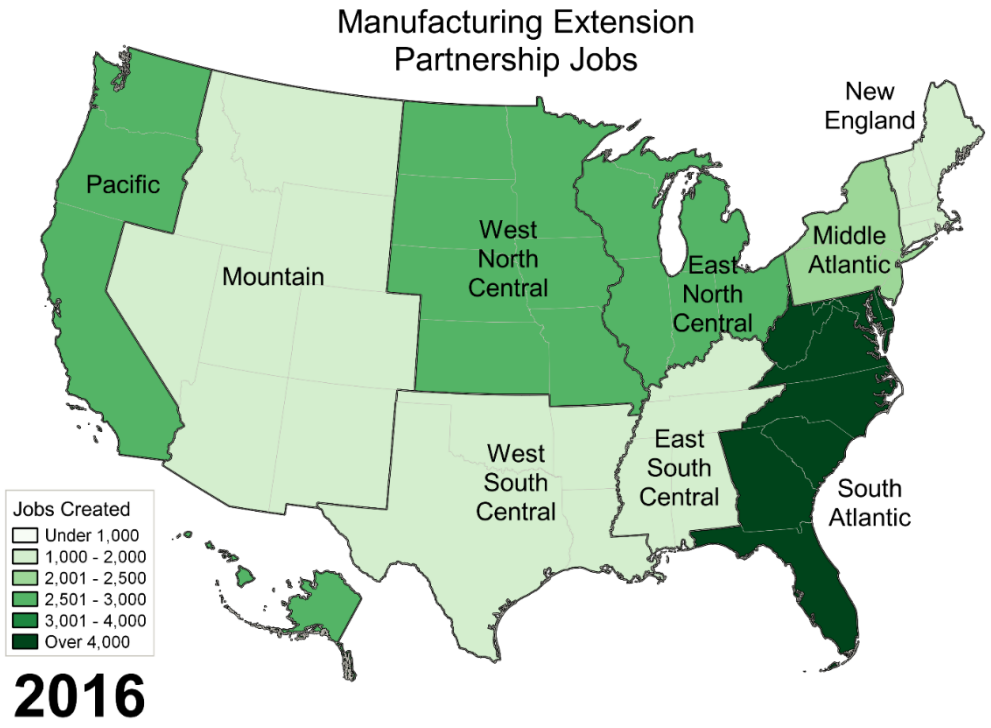


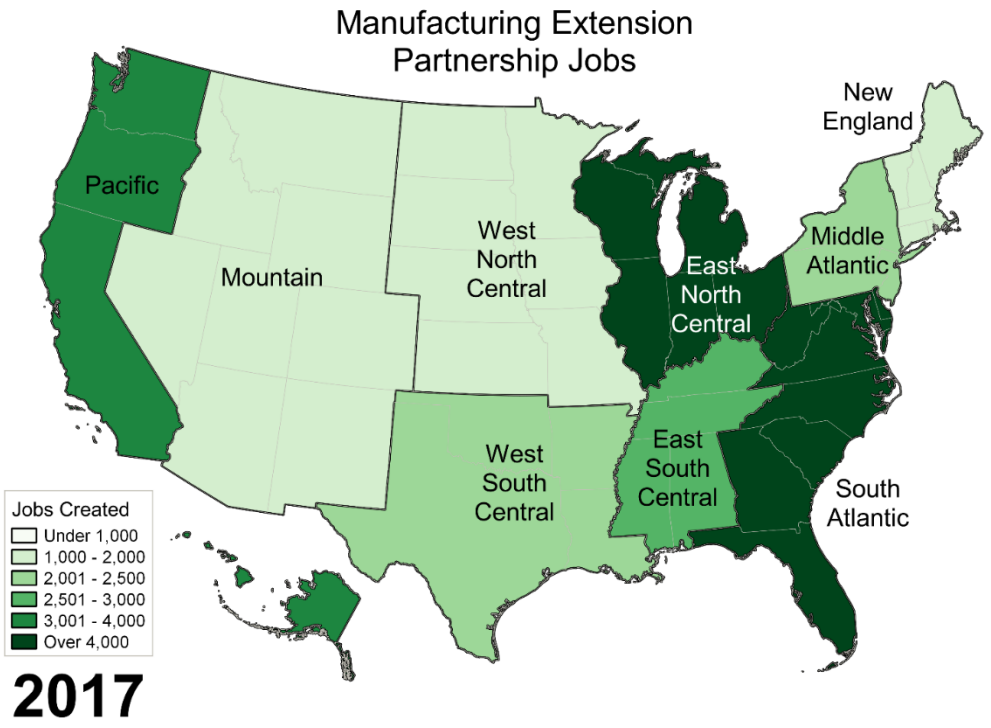




Total reported jobs increased overall by 16.4 percent, or 14,140, between FY16 and FY17. The East North Central region reported the largest increase, with an additional 8,612 jobs. Growth in total reported jobs was also strong in the West South Central and Pacific regions at 4,715 and 4,099 jobs, respectively. The Mountain, East South Central, and West North Central regions reported negative growth, with relative reductions of 1,310, 1,222, and 761, respectively.

# Job Creation

Q6: Did the services you received directly lead you to create any jobs over the past 12 months? How much?

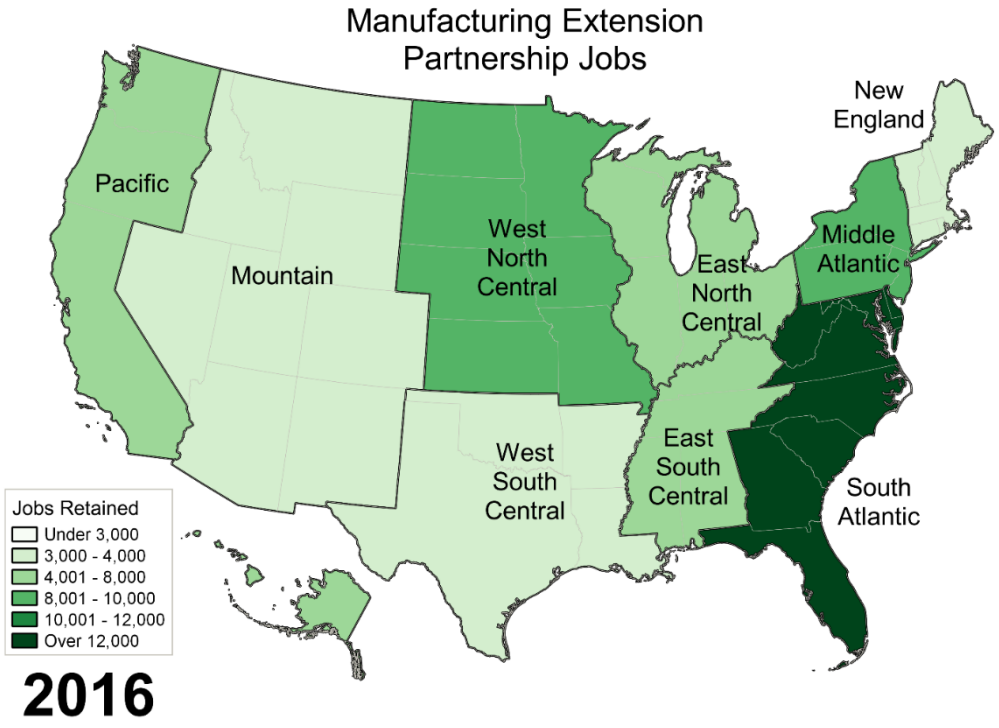


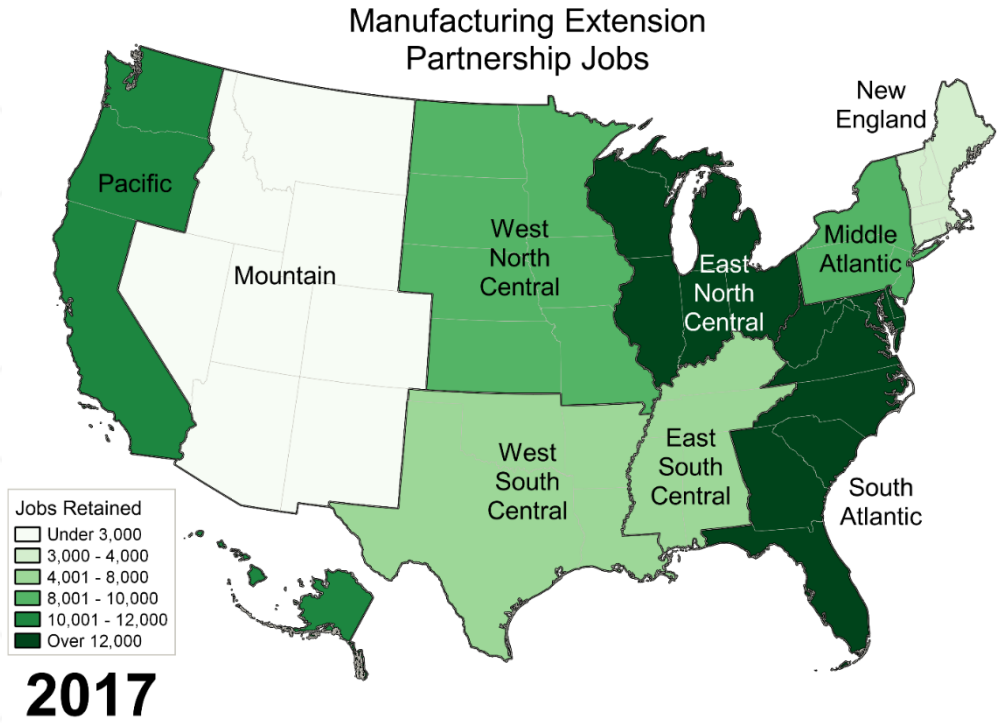




About one third of the increase in jobs was due to the creation of net new jobs. Of the overall increase in the 4,557 new jobs, not quite half were attributable to the East North Central region with an increase of 2,102 jobs. The East South Central, West South Central, and Pacific regions all gained new jobs relative to FY16 at 1,423, 1,079, and 1,048, respectively. The New England region was about the same, and the Mid-Atlantic, South Atlantic, Mountain, and West North Central regions all reported slightly fewer jobs created in FY17 than in FY16.

# Retained Jobs

Q7: Did the services you received lead you to retain any jobs over the past 12 months? How much?

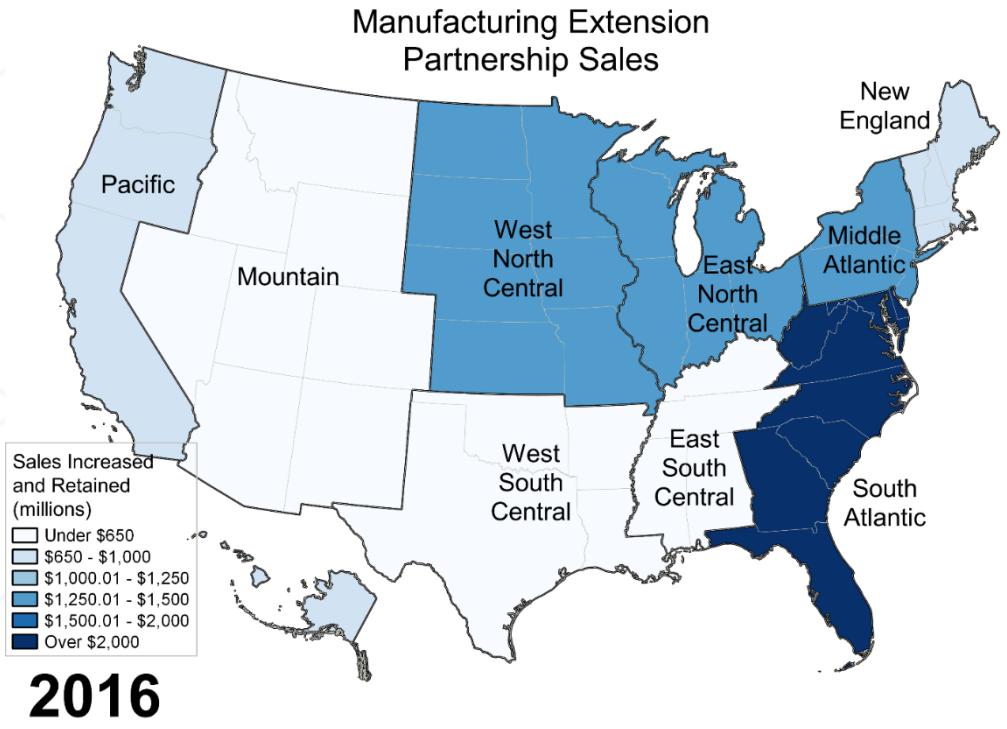


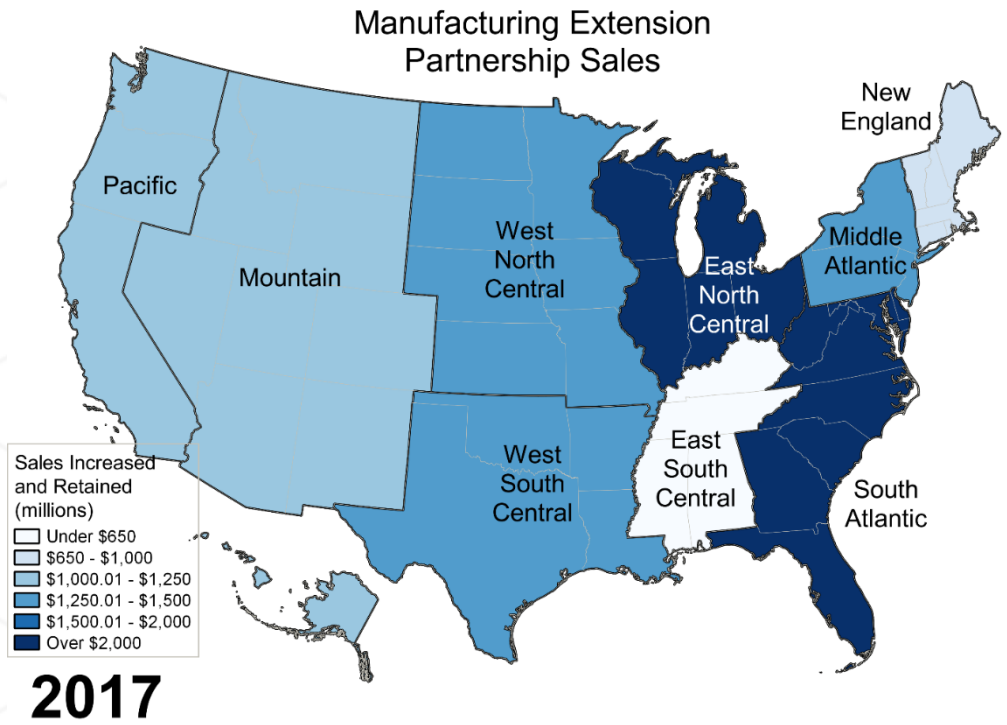




The East North Central region also accounted for the largest share of retained jobs, 6,510. Nearly two thirds of the 9,623 net retained jobs nationally were from this region. The West South Central (3,636 jobs), Pacific (3,051), and South Atlantic (1,902) regions also reported increases in retained jobs. The two regions with significantly fewer reported jobs include the East South Central (-2,645) and Mountain (-936) regions.

# Total Sales

Q4 and 5: Over the past 12 months, did the services you received directly lead to an increase in sales or to retain sales that would have otherwise been lost at your establishment? How much?

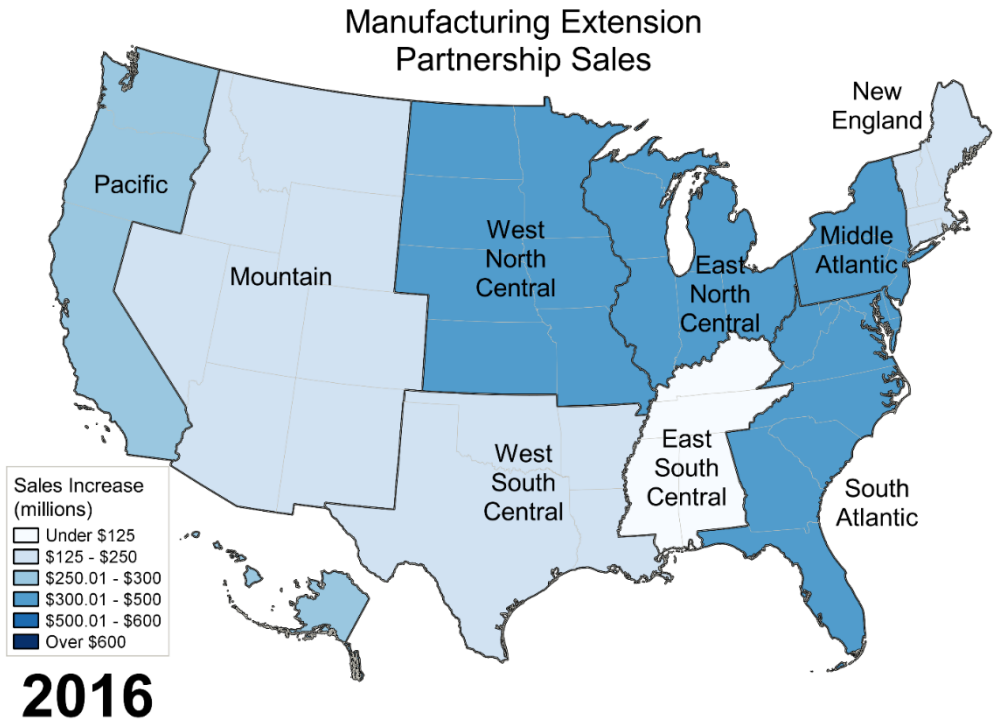


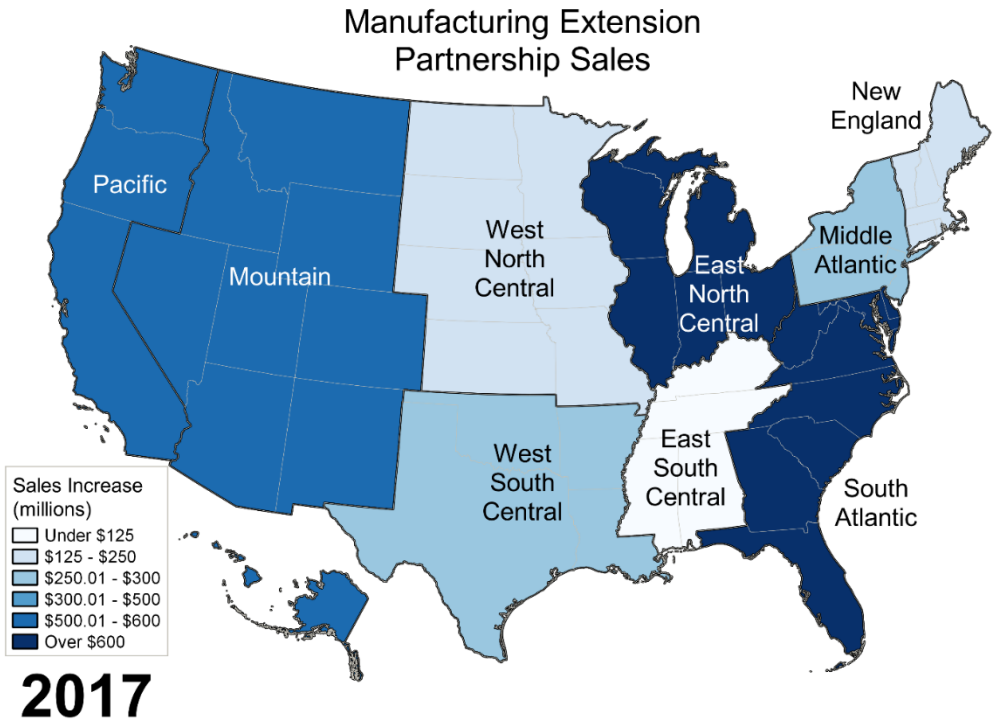




Reported total sales increased overall by $3.3 billion between FY16 and FY17. Leading the growth in sales was the East North Central region at more than $1.3 billion, with the West South Central region just under $1 billion ($982 million). The Mountain and Pacific regions saw more moderate gains ($449 million and $435 million, respectively). The New England ($179 million) and East South Central ($167 million) regions also increased sales. The South Atlantic (-2.65 million), West North Central (-$26 million), and Mid-Atlantic (-$153 million) regions all reported declines in total sales.

# Increased Sales

Q4: Did the services you received directly lead to an increase in sales at your establishment over the past 12 months? How much?

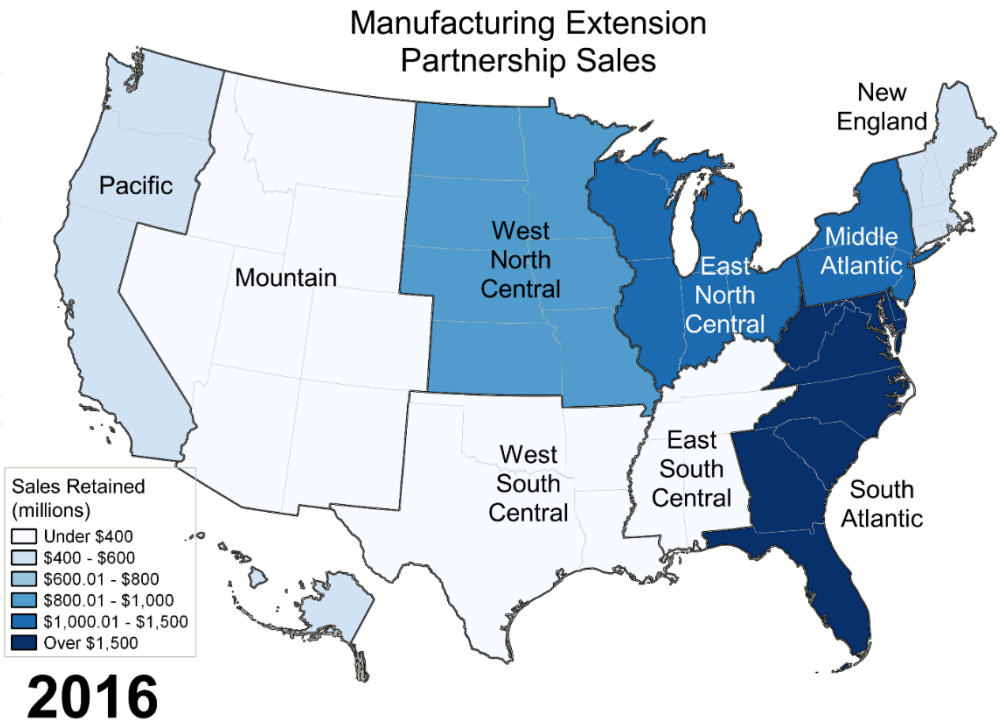


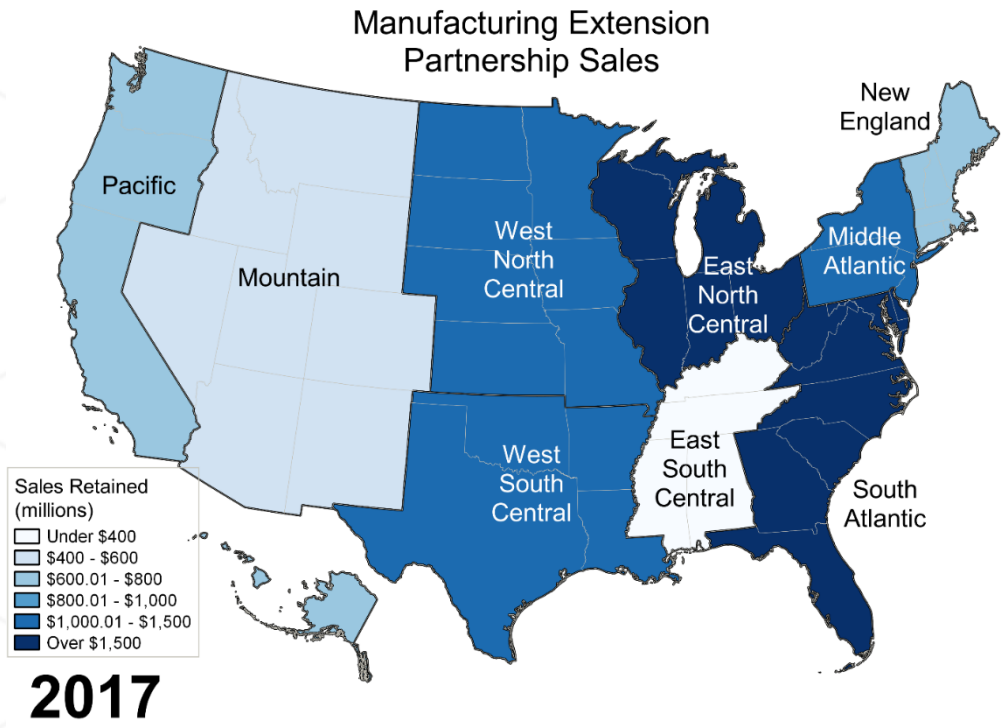




While most of the net growth in reported total sales was in retained sales, reported new sales increased overall by $1.2 billion. The East North Central, South Atlantic, and Mountain regions made the largest net contributions, at $410 million, $316 million, and $311 million, respectively. These gains were offset by small net losses in the West North Central (-$83 million), Mid-Atlantic (-$81 million), and East South Central (-$10 million) regions.

# Sales Retained

Q5: Over the past 12 months, did the services you received directly lead you to retain in sales that would have otherwise been lost? How much?

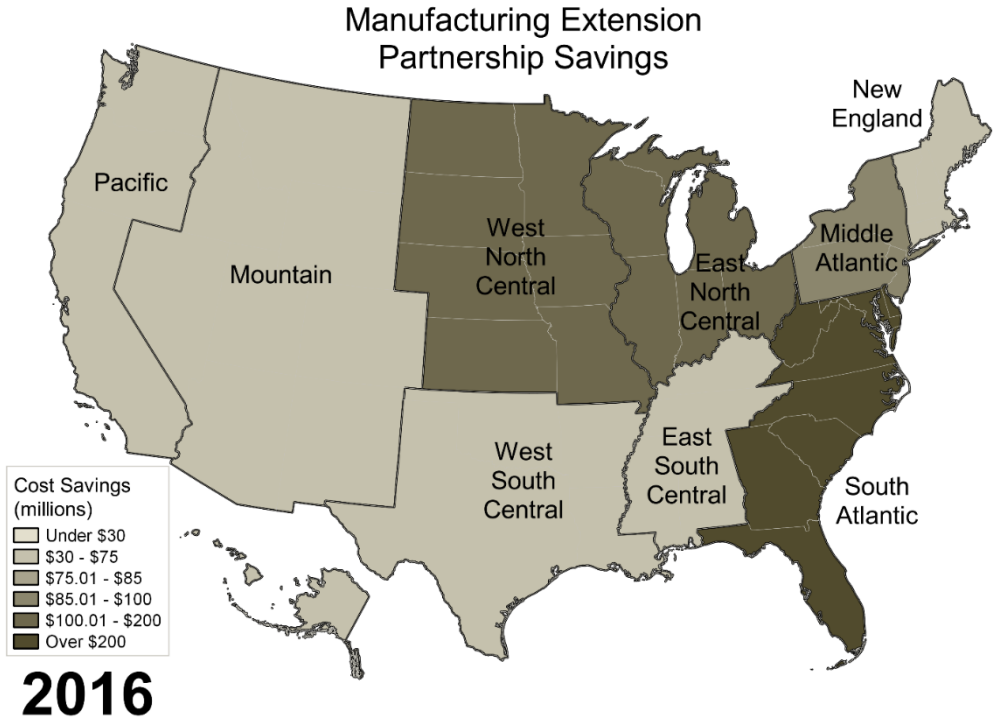


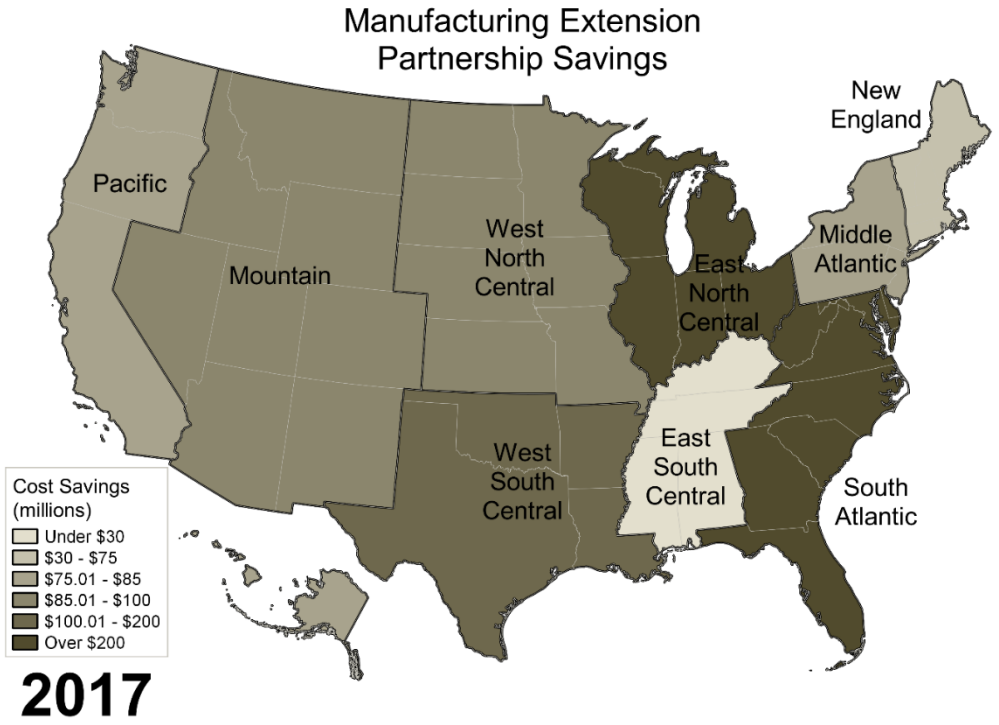




Almost two thirds of the change to total reported sales nationally was from increased retained sales, which totaled $2.1 billion. The East North Central and West South Central regions accounted for about 84 percent of reported net sales, at $917 million and $859 million, respectively. Mountain, East South Central, New England, and Pacific all had increases that ranged from $137 million to $203 million. While the Mid-Atlantic region saw a decline of $72 million, the South Atlantic region experienced a decline of -$319 million.

# Cost Savings

Q8: Did the services you received directly result in cost savings in labor, materials, energy, overhead, or other areas over what would otherwise have been spent in the past 12 months? How much?

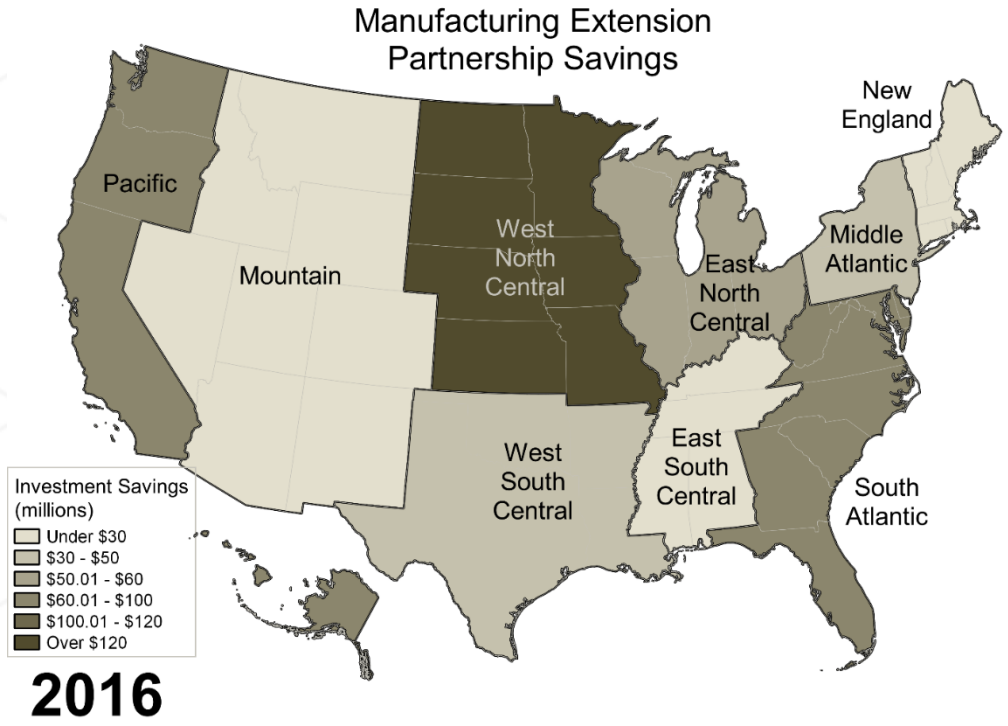


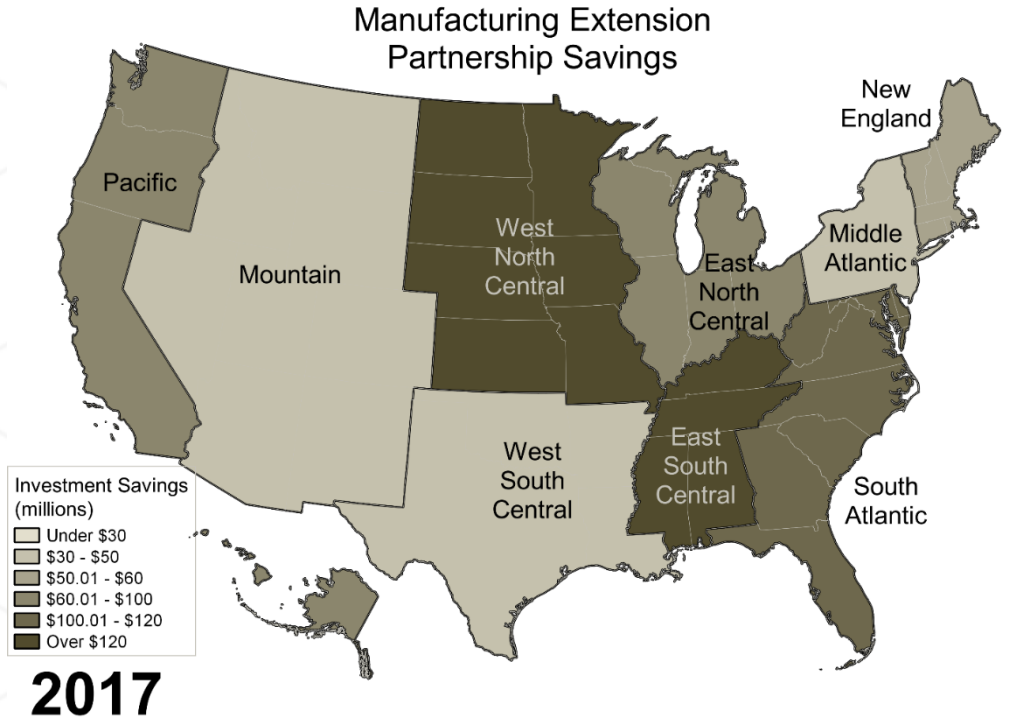




Between FY16 and FY17, cost savings increased by a net of $183 million for the United States. Cost savings topped over $1 billion in FY17. The region leading growth in savings was West South Central, with a $98 million increase. Other regions with large savings include East North Central ($66.5 million), Mountain ($64.9 million), and Pacific ($22 million). A few regions saw modest reductions in cost savings, including South Atlantic (-$30.6 million), Mid-Atlantic (-$22 million), and West North Central (-$15.6 million).

# Investment Savings

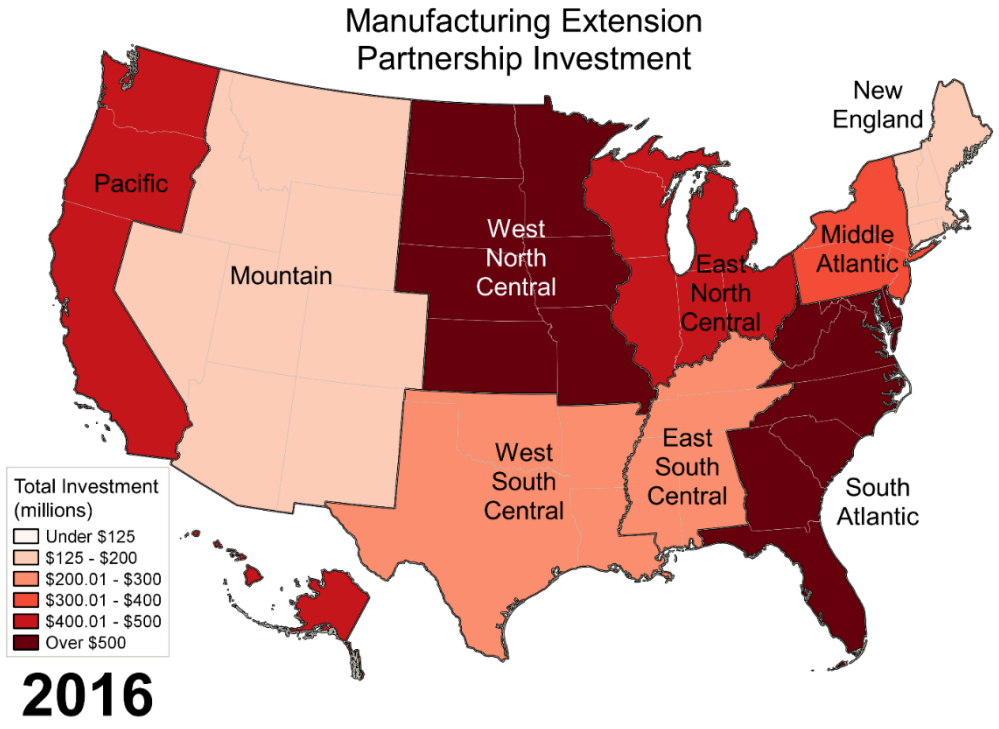
Q10: As a result of the services you received, did your establishment avoid any unnecessary investments or save on any investments in the past 12 months? How much was saved/avoided?

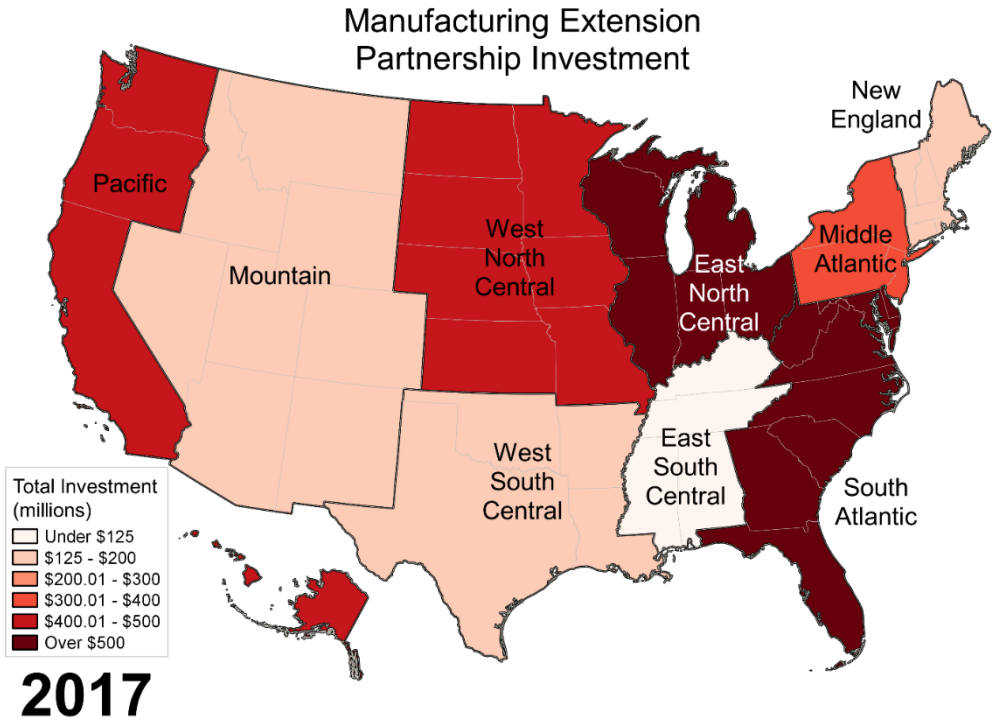



Net investment savings overall were $703 million for FY17, about a 37 percent increase from FY16. Most of the savings were in the East South Central region, which had an increase of $120 million. The other two regions with significant gains included East North Central at $35 million and New England at $27.7 million. Only one region, Pacific, saw a significant decline in investment savings at -$19.7 million.

# Total Investment

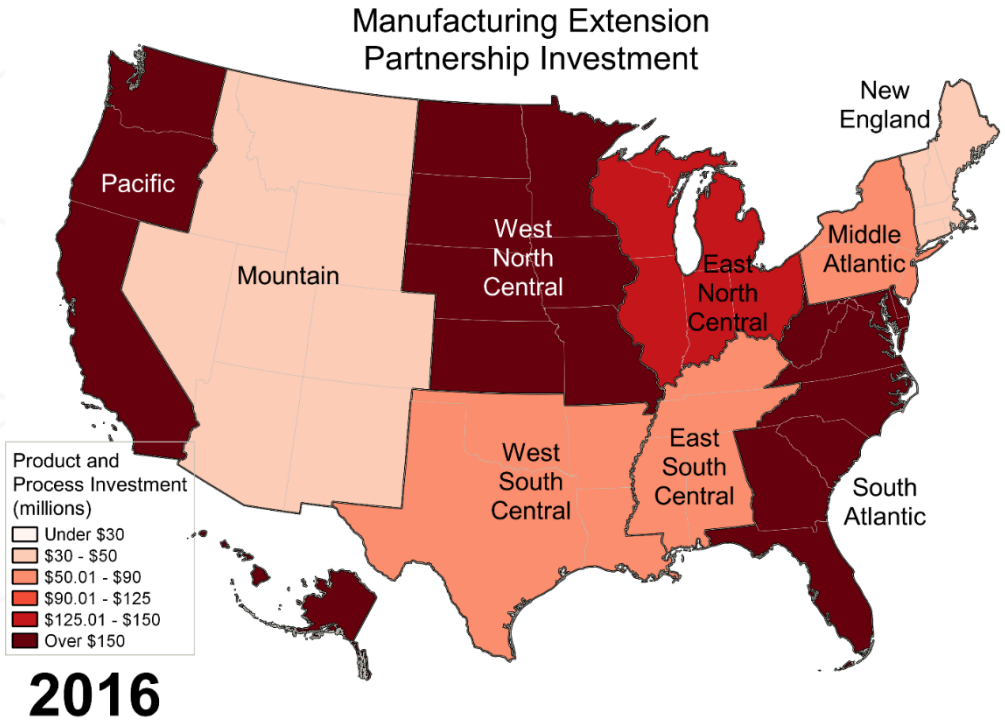


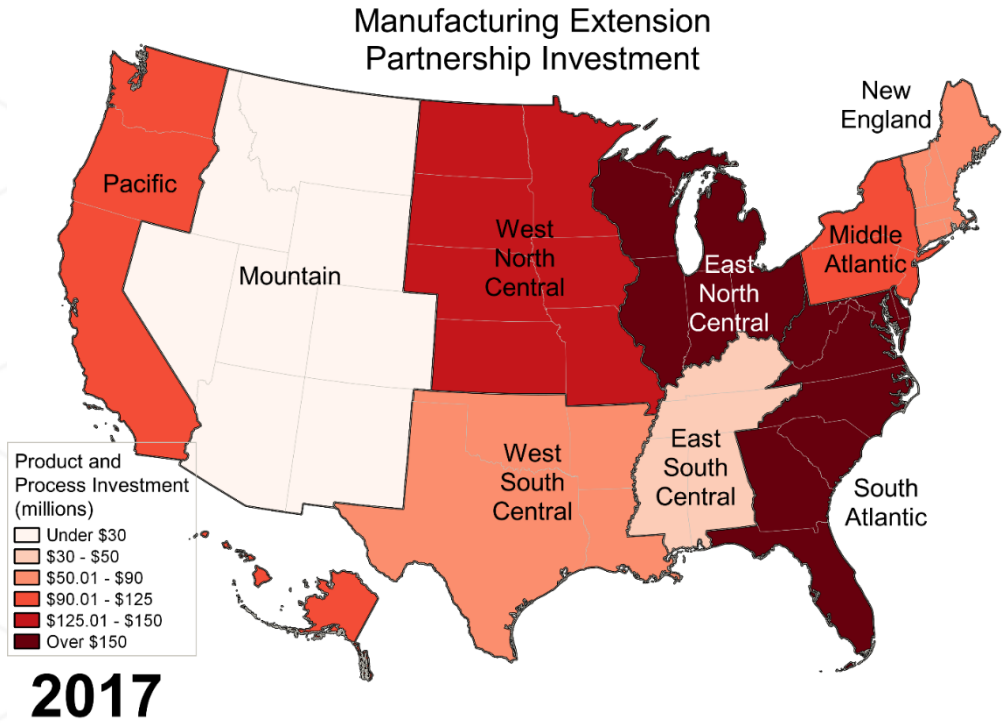




While comprised of several different inputs, the net change in total investment between FY16 and FY17 was $45 million, with total investment in both years at about $3.5 billion. The range of regional change in investment swung from an increase of $262 million in the South Atlantic region to a nearly offsetting decline of $252 million in the West North Central region.

# Products and Process Investment

Q9a: As a result of the services you received, has your establishment increased its investment over the past 12 months in new products or processes? How much?

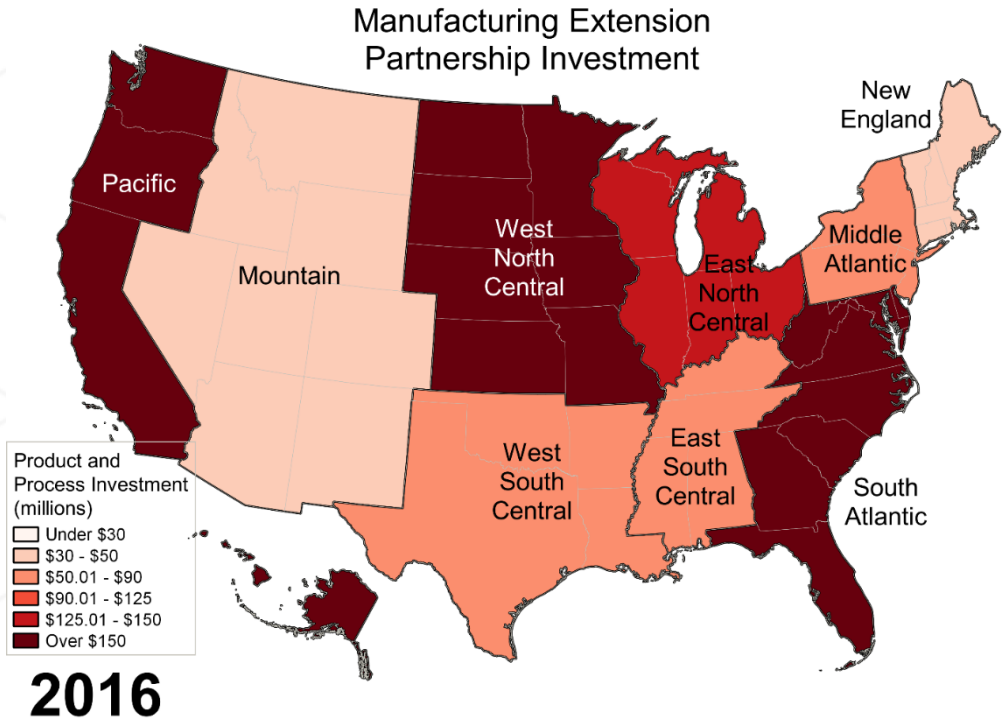


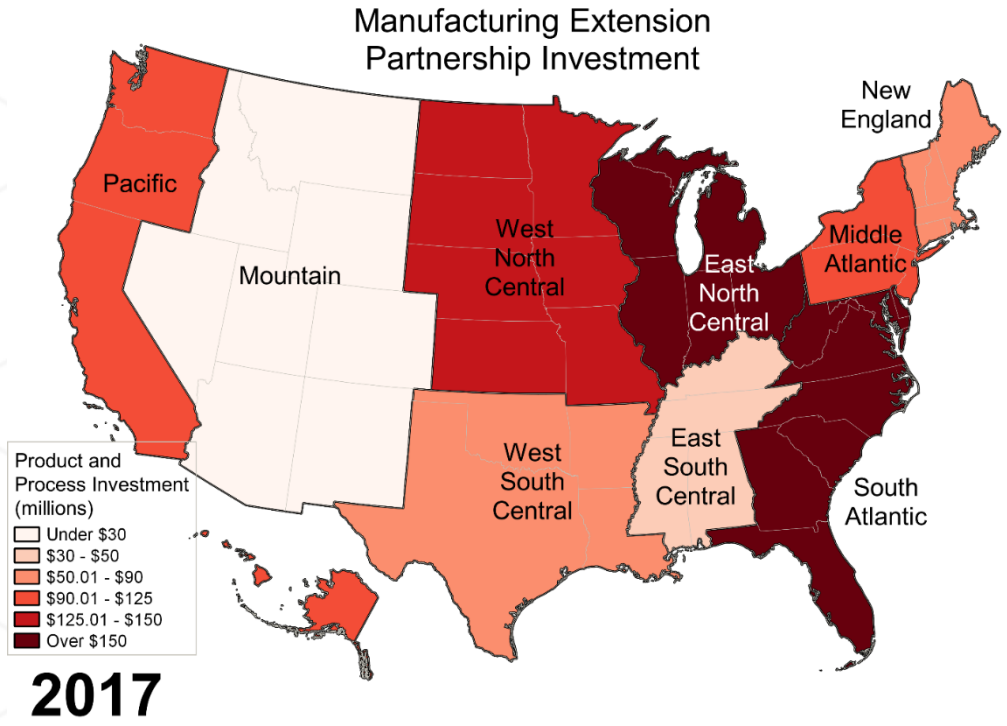




Much like total investment, there was only a small net change of $3.6 million on total products and process investments of $1.07 billion. While some regions saw increases, such as the South Atlantic ($119.6 million) and East North Central ($46.8 million) regions, others saw a relative decline, such as in the West North Central (-$154.3 million), Pacific (-$28.0 million), and East South Central (-$22.7 million) regions.

# Plant and Equipment Investment

Q9b: As a result of the services you received, has your establishment increased its investment over the past 12 months in plant or equipment? How much?

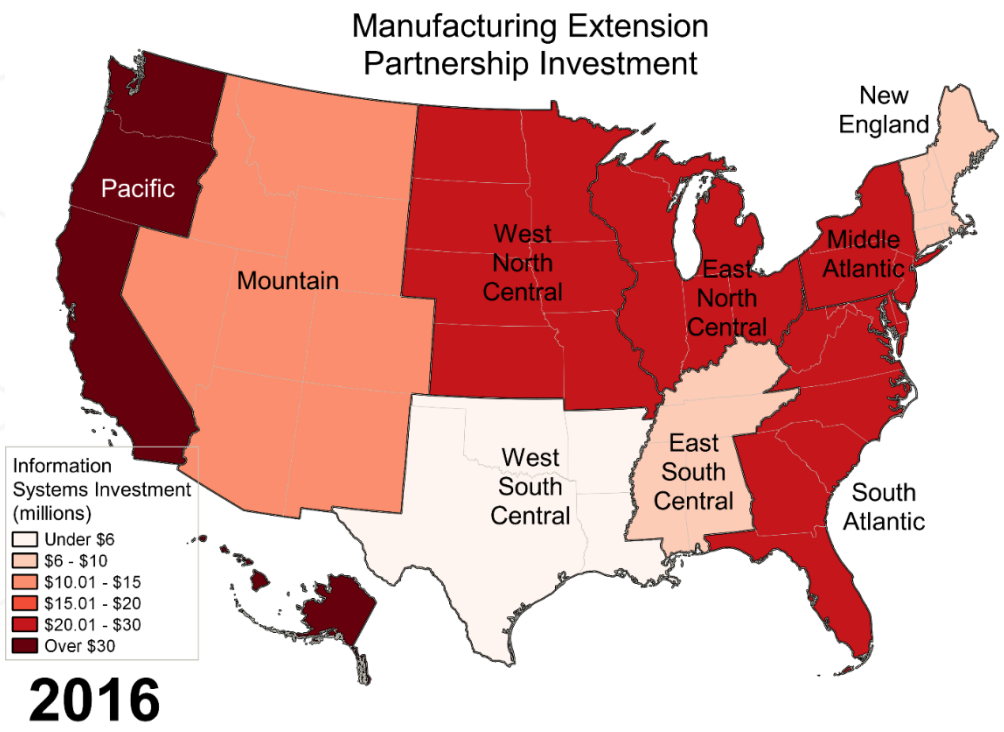


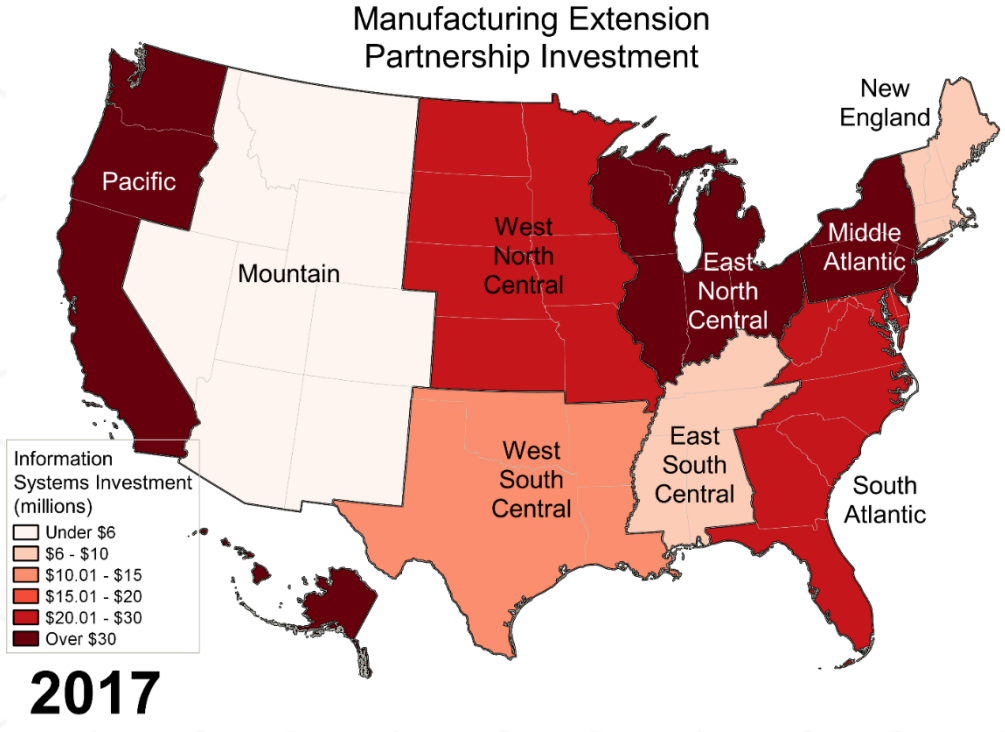




Plant and equipment investment, like other forms of investment, is relatively static between FY16 and FY17, at about $1.8 billion, with only a positive change overall of $33.6 million. The largest net change in reported plant and equipment increases was in the South Atlantic region at $117.8 million. The rest of the changes among regions ranged from $46.7 million to -$52.6 million.

# Systems and Software Investment

Q9c: As a result of the services you received, has your establishment increased its investment over the past 12 months in information systems or software? How much?

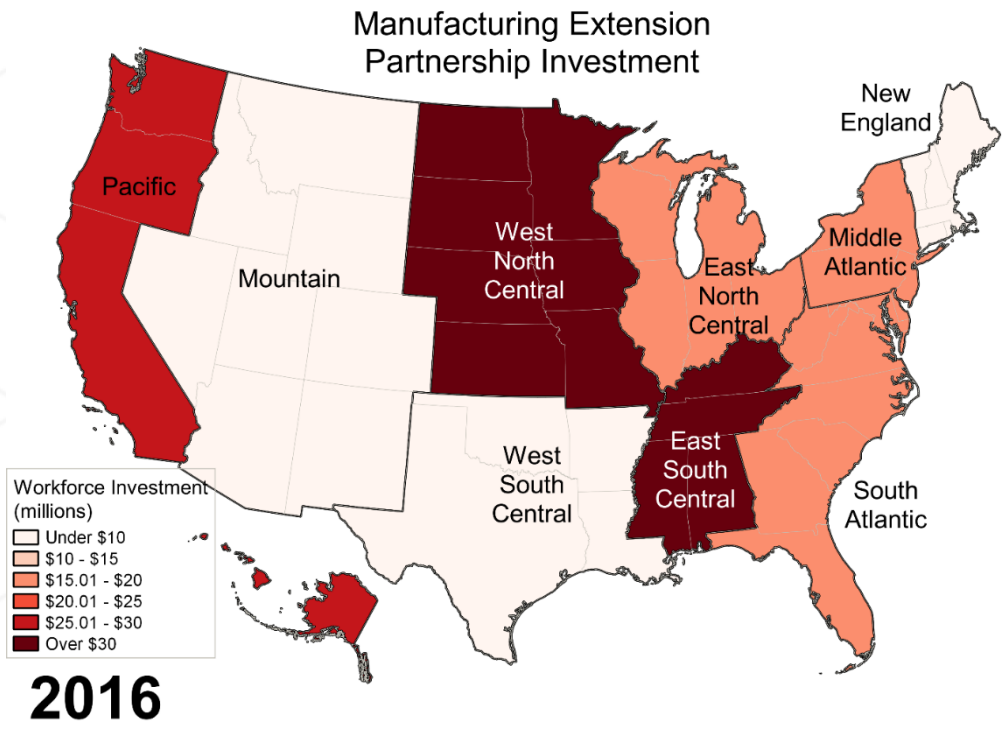


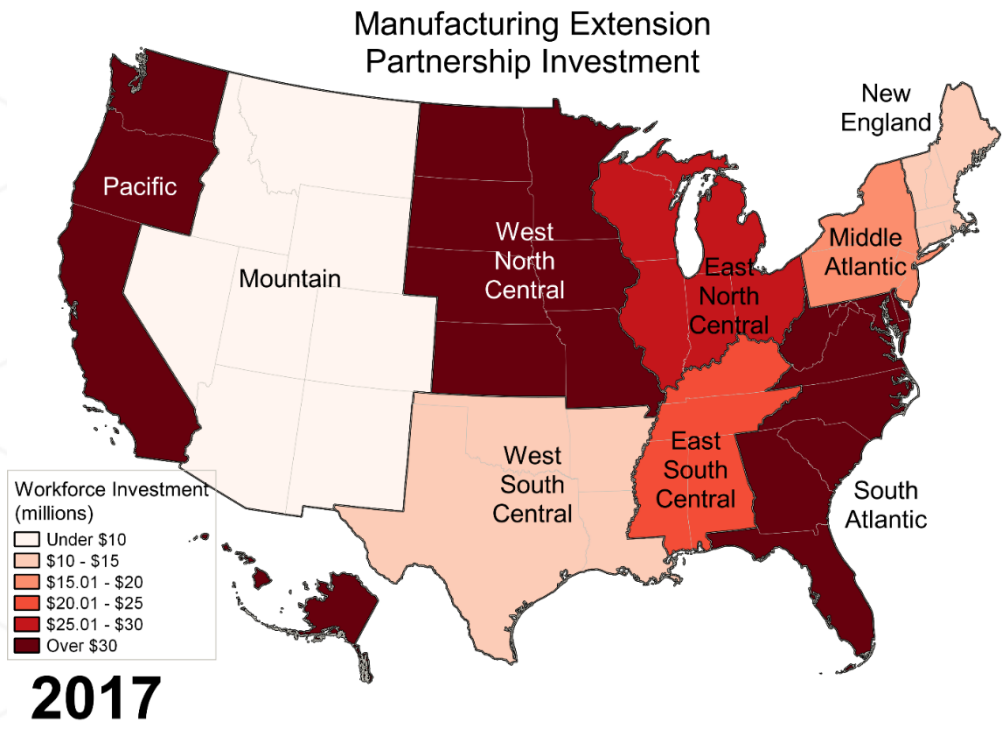




Systems and software increased slightly between FY16 and FY17, from $169 million to $178 million. While the base values are not high, the changes in regional investment are relatively small, from an increase in the East North Central region of $13.5 million, to decreases of $5.6 million in the Pacific and $5.4 million in the Mountain regions.

# Workforce Investment

Q9d: As a result of the services you received, has your establishment increased its investment over the past 12 months in workforce practices or employee skills? How much?

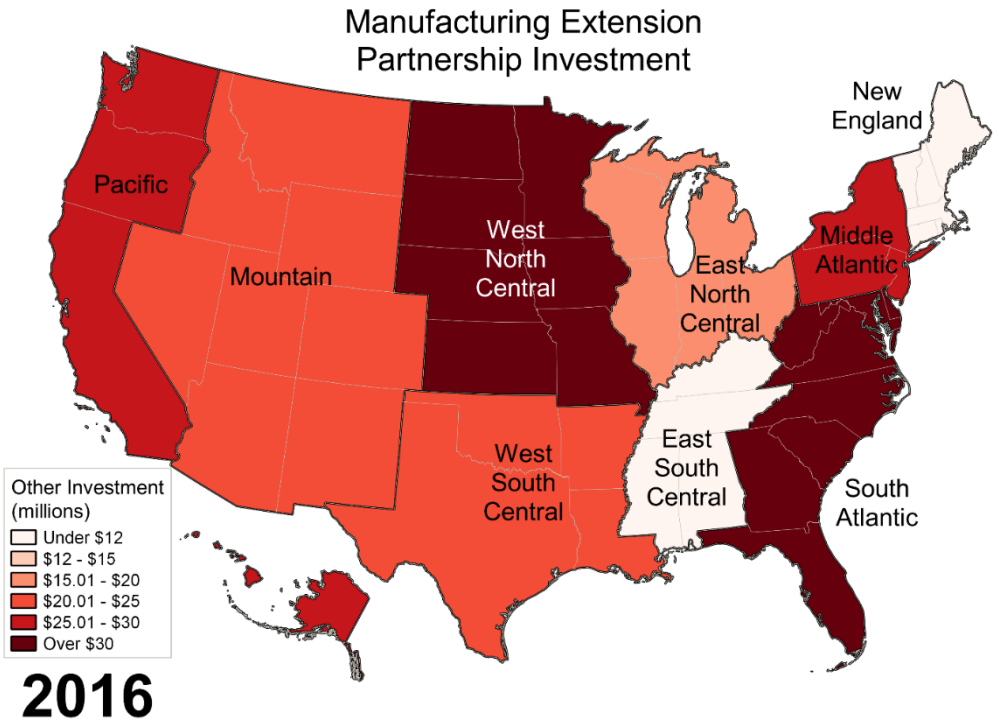


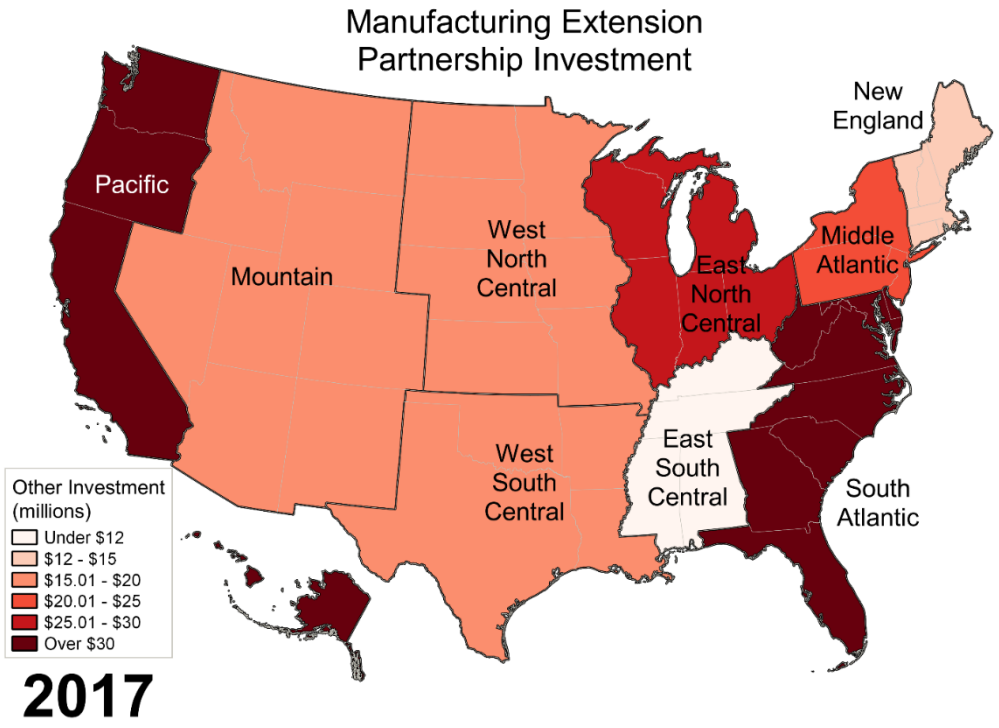




This area of investment is relatively small when compared to other investments such as Plant and Equipment. Investment for FY17 decreased from the previous year by about $11 million. While the South Atlantic ($16.7 million) and East North Central ($9.2 million) regions showed increases, the East South Central and West North Central regions experienced nearly a $24 million decline between the two fiscal years.

# Other Investment

Q9e: As a result of the services you received, has your establishment increased its investment over the past 12 months in other areas of business? How much?



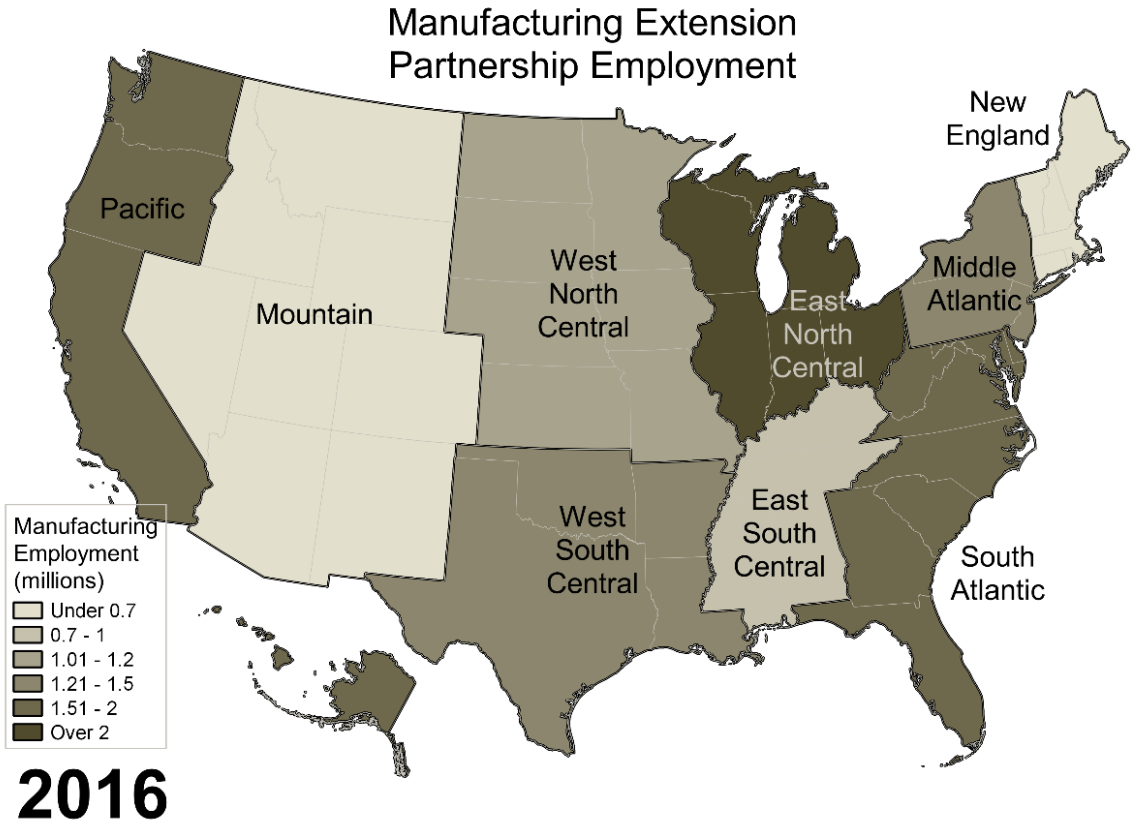



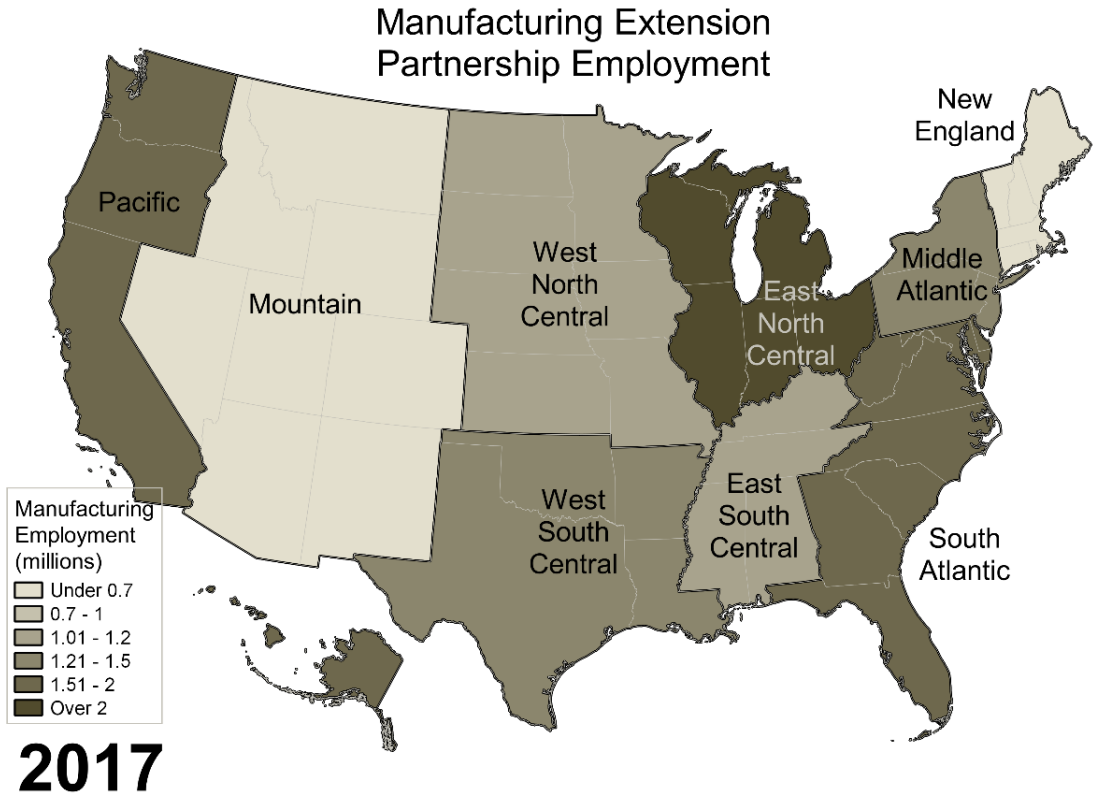

Other areas of business investment had small gains of almost $6 million between the two fiscal years, starting from a base of $227 million in FY16. Investment increases topped out at $10.5 million in the Pacific region, with the East North Central and New England regions each increasing by slightly more than $8 million. The West North Central region saw the biggest decline at $18.7 million, with the Mountain region experiencing a decline of $6.3 million.

MEP Economic Impact Analysis: Estimates of Fiscal Year 2017

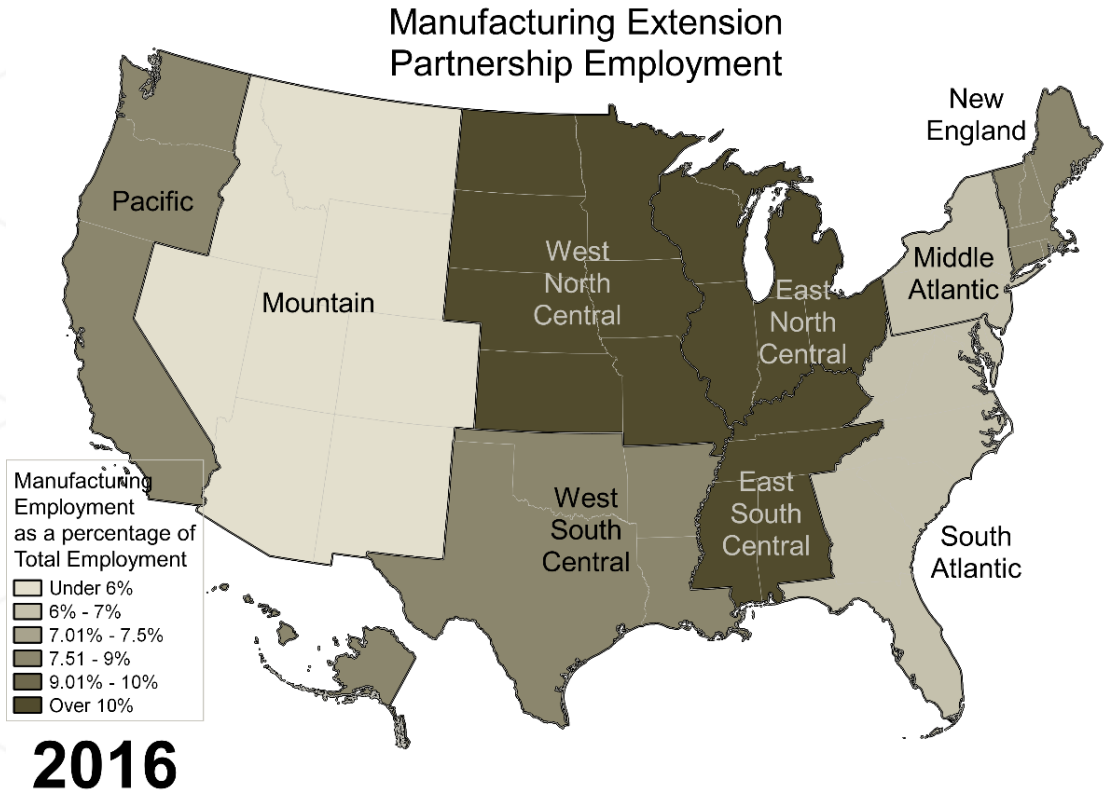
# THE STATE OF MANUFACTURING IN THE UNITED STATES

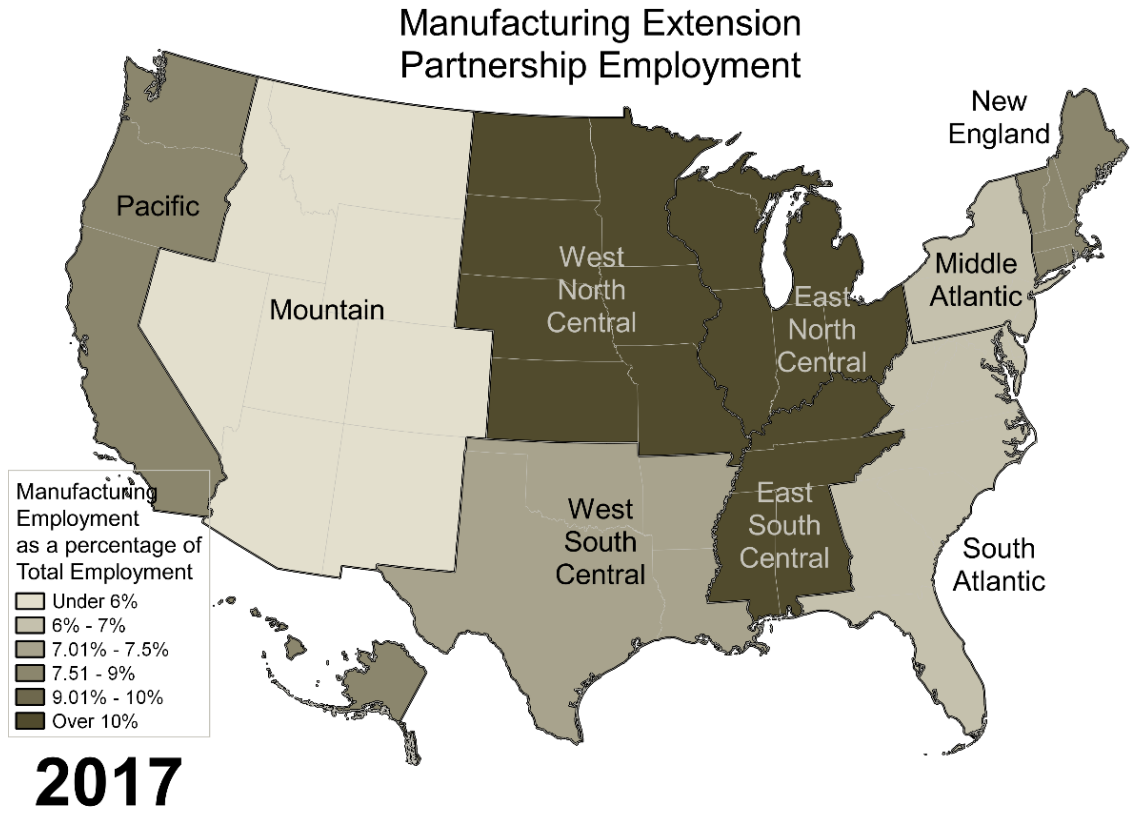
# Total Manufacturing Jobs



# Percent of Manufacturing Jobs



MEP Economic Impact Analysis: Estimates of Fiscal Year 2017

# W.E. UPJOHN INSTITUTE FOR EMPLOYMENT RESEARCH

# About the Upjohn Institute

The W.E. Upjohn Institute for Employment Research is an activity of the W.E. Upjohn Unemployment Trustee Corporation, which was established in 1932 to address issues of unemployment during the Great Depression.

The Upjohn Institute is a private, nonprofit, nonpartisan, independent research organization devoted to investigating the causes and effects of unemployment, to identifying feasible methods of insuring against unemployment, and to devising ways and means of alleviating the distress and hardship caused by unemployment.

Upjohn's broad objectives are to: (1) link scholarship and experimentation with issues of public and private employment and unemployment policy; (2) bring new knowledge to the attention of policy makers and decision makers; and (3) make knowledge and scholarship relevant and useful in their applications to the solutions of employment and unemployment problems.

Upjohn Institute professionals contributing to the authorship of this report are Jim Robey, Ph.D., Director, Regional Economic and Planning Services; Randall Eberts, Ph.D., President; Carlesa Beatty, Kathleen Bolter, Marie Holler, Brian Pittelko, and Claudette Robey.

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MEP Economic Impact Analysis: Estimates of Fiscal Year 2017

# APPENDICES

# Appendix I: Economic Outcome Definitions

As with most economic impact studies, this study focuses on four main economic outcome variables and a tax revenue variable:

- Jobs created or retained
- Change in gross domestic product (GDP)
- Change in income
- Change in output
- Returns to the U.S. Treasury (tax revenue).

The REMI model generates these outcomes for the national economy using the survey responses as inputs. Each of five variables are described in this section.

**Jobs Created or Retained**

- The estimated number of jobs created or retained by MEP activities.
- These jobs are simply "jobs" as counted by the U.S. Bureau of Economic Analysis (BEA) and can be either full- or part-time positions.
- These jobs are likely distributed across a number of industries.
- In any given industry, a "job" may represent a summation of positions across a number of industries in which each industry has less than one complete position.
  - The impact study may report one "job" but the spending patterns in the study may generate positions in three industries; however, each industry may require only one third of a person.
  - In this case, the three industries that employ one third of a person each to meet demand would sum to one "job" in the REMI model.

# Appendix I: Economic Outcome Definitions

**Jobs Created or Retained (continued)**

Employment is comprised of three elements:

- Direct – The employment created by actual investment, growth, or change
- Indirect – Employment created by the need of the new firm to purchase goods and services, essentially the local supply chain
- Induced – The household that supplies goods and services to the workers in the prior two elements
  - Examples include education, dry cleaners, accountants, gas stations, lawyers, and grocers.

**Gross Domestic Product**

- GDP is an economic measure of the value of goods and services produced within the U.S. It is broadest measure of economic activity within a region or country. It consists of compensation of employees, taxes on production and imports, less subsidies, and gross operating surplus. It does not include intermediate inputs, so it is a measure of the value labor and capital contribute to production.

**Gross Output**

- Gross output includes both GDP and expenditures on intermediate inputs. In that way, it is considered double counting but is an essential statistical tool to understand the interrelationships between industries. Gross output is principally a measure of an industry's sales or receipts, so it is similar to the sales reported by individual MEP clients. For the purposes of the model, the sales and receipts are aggregated at the national level.

**Income**

- National income is the goods and services produced by citizens and residents of the U.S. (i.e., gross national product) minus the consumption of fixed capital (i.e., depreciation).

# Appendix I: Economic Outcome Definitions

**Returns to the U.S. Treasury**

- Returns to the U.S. Treasury are estimated using average (mean) personal income for all additional workers (direct, indirect, and induced) who were employed as a result of MEP client activities. Using 2016 Internal Revenue Service (IRS) tax tables, the tax incidence for the mean wage is estimated and then applied to all workers. Although this is an estimate, we acknowledge that some workers will earn more and some will earn less than the average. Similarly, some workers will pay more taxes and some will pay less than the reported value. Note that the average tax based on the average wage is not discounted by any legal form of tax adjustment, including short form or itemized deductions.

# Appendix II: NAICS Codes

311-Food Manufacturing

312-Bevarage Manufacturing

313-Textile Mills

314-Textile Manufacturing

315-Apparal Manufacturing

316-Leather Goods

321-Wood Product Manufacturing

322-Paper Product Manufacturing

323-Printers

324-Petroleum and Coal Products Manufacturing

325-Chemical Products Manufacturing

326-Rubber Products Manufacturing

327-Nonmetallic Mineral Products Manufacturing

331-Metal Foundries

332-Fabricated Metal Products Manufacturing

333-General Purpose Machinery Manufacturing

334-Instruments Manufacturing

335-Electrical Equipment Manufacturing

336-Transportation Equipment Manufacturing

337-Furniture Manufacturing

339-Miscellaneous Manufacturing

423-Wholesale Trade

488-Transportation

541-Professional, Scientific, and Technical Services

561-Administrative and Support Services

811-Other Services