The National-Level Economic Impact of the Manufacturing Extension Partnership (MEP)

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NIST
National Institute of Standards and Technology
U.S. Department of Commerce

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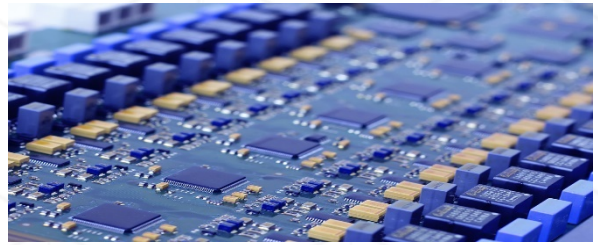
MEP • MANUFACTURING EXTENSION PARTNERSHIP









MEP Economic Impact Analysis

EXECUTIVE SUMMARY

Study Overview

The Manufacturing Extension Partnership (MEP), which is part of the National Institute of 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. 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 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

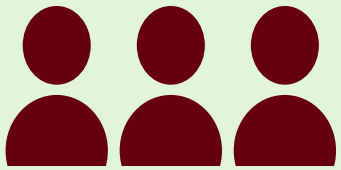
The study's purpose is to use the client-reported outcomes to estimate the overall effect of MEPs on the U.S. economy. Using the REMI model, the study forecasts the indirect and induced effects of the reported increase in jobs, sales, cost savings, and investments by MEP clients.

Study Overview

Two scenarios are presented. 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 assumption is not entirely realistic, since it does not take into account competition among firms and the displacement effects that occur from the competition across firms. This scenario is included to serve as an upper bound on the results. The second more accurate, yet conservative, scenario assumes that competition among firms reduces the outcomes as a result of competition.

The study takes the self-reported outcomes of MEP clients at face value, without attempting to validate the reported outcomes, and considers how the results would vary if only a fraction of the reported outcomes represented the actual effects of MEP activities. 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 study 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 FY2016 ($130 million). The results of the analysis are displayed on the next three slides.

The Unconstrained Model Using Industry Variables

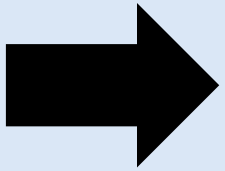


Jobs

575,870

GDP

$63.04*



Output

$130.15*

Personal Income

$34.64*

Returns to Treasury

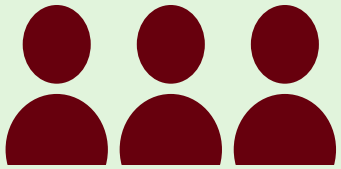
$4.66*

*Dollars in billions

The unconstrained model, assuming no competition or displacement between firms, adds 575,870 jobs to the United States that would not have been created or retained without the services and activities of the MEP centers. In addition to the annual increase in gross domestic product (GDP), output, and personal income, the MEP activities also increase tax revenue by $4.66 billion, which far exceeds the $130 million cost of the program each year.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

The Constrained Model Using Firm Variables

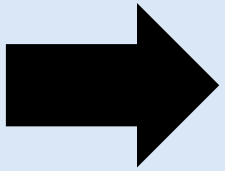


Jobs

142,381

GDP

$15.40*



Output

$29.89*

Personal Income

$8.44*

Returns to Treasury

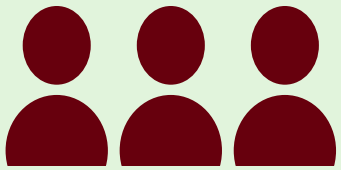
$1.13*

*Dollars in billions

The constrained model, assuming competition or displacement between firms, adds 142,381 jobs to the U.S. economy, which would not have been created or retained without the services and activities of the MEP Centers. Under this more conservative and realistic approach, MEP activities add $1.13 billion to the U.S. Treasury through an increase in personal income taxes. The increase in tax revenue to the U.S. Treasury would be higher if the model included corporate income taxes. With the model counting only income taxes, the tax revenues far exceed the cost of the program.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

MEP Breaks Even at About 11.5% Using Firm Variables

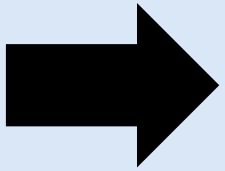


Jobs

16,532

GDP

$1.79*



Output

$3.46*

Personal Income

$0.98*

Returns to Treasury

$0.13*

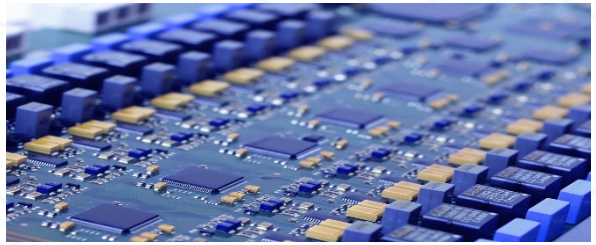
*Dollars in billions

This scenario estimates the proportion of the client-reported results that would generate enough additional tax dollars to exactly pay for the MEP program each year -- $130 million. The proportion is estimated to be 11.5 percent of the reported outcomes. Under this scenario, which assumes competition among firms, 16,532 jobs would be created and retained and GDP would increase by $1.79 billion during the year of the MEP activities.









MEP Economic Impact Analysis

MODELLING THE NET IMPACT OF MEP ACTIVITIES

Modelling 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 survey used in this analysis covers services and activities from the fourth quarter of 2015 through and including the third quarter of 2016. 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 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

Modelling the Net Impact

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 6,500 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 36 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 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 are also more likely to be growing and better able to leverage MEP-based services in adding jobs and sales. Because Upjohn did not attempt to

Modelling the Net Impact

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.

Decisions Regarding Data Elements

Although the survey includes both employment and sales, both can 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 6,500 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

Modelling the Net Impact

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. 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 inputting 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

Modelling the Net Impact

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.

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.

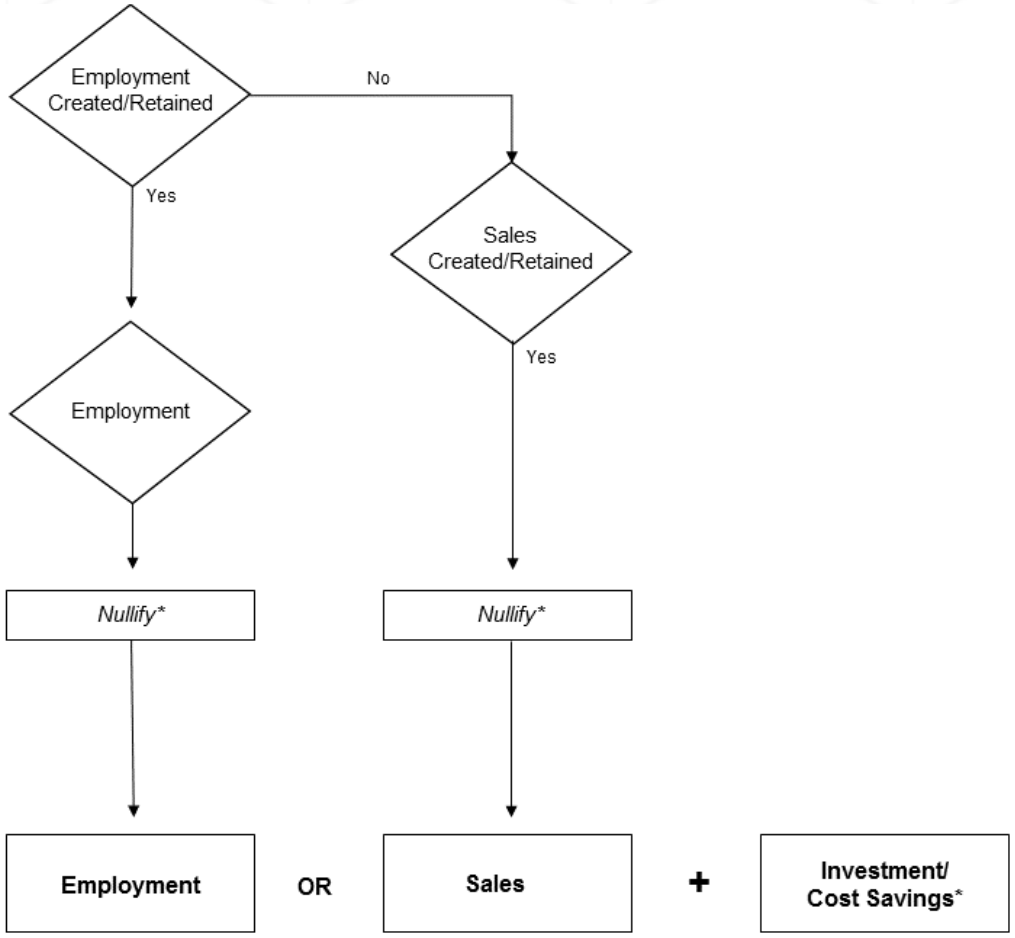


Figure 1: Upjohn's Decision Tree for Using Survey Data

Modelling the Net Impact

Assumptions Regarding Market Dynamics

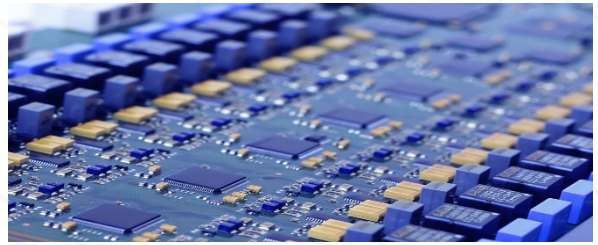
Since Ehlen and Brown's development of the guide, REMI has added some policy variables that are helpful in estimating impacts at the macro level. Part of the dilemma with this research is in attempting to estimate the effect that helping one company has on others who don't receive help from an MEP Center.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

SURVEY RESPONSES FROM MEP CENTERS

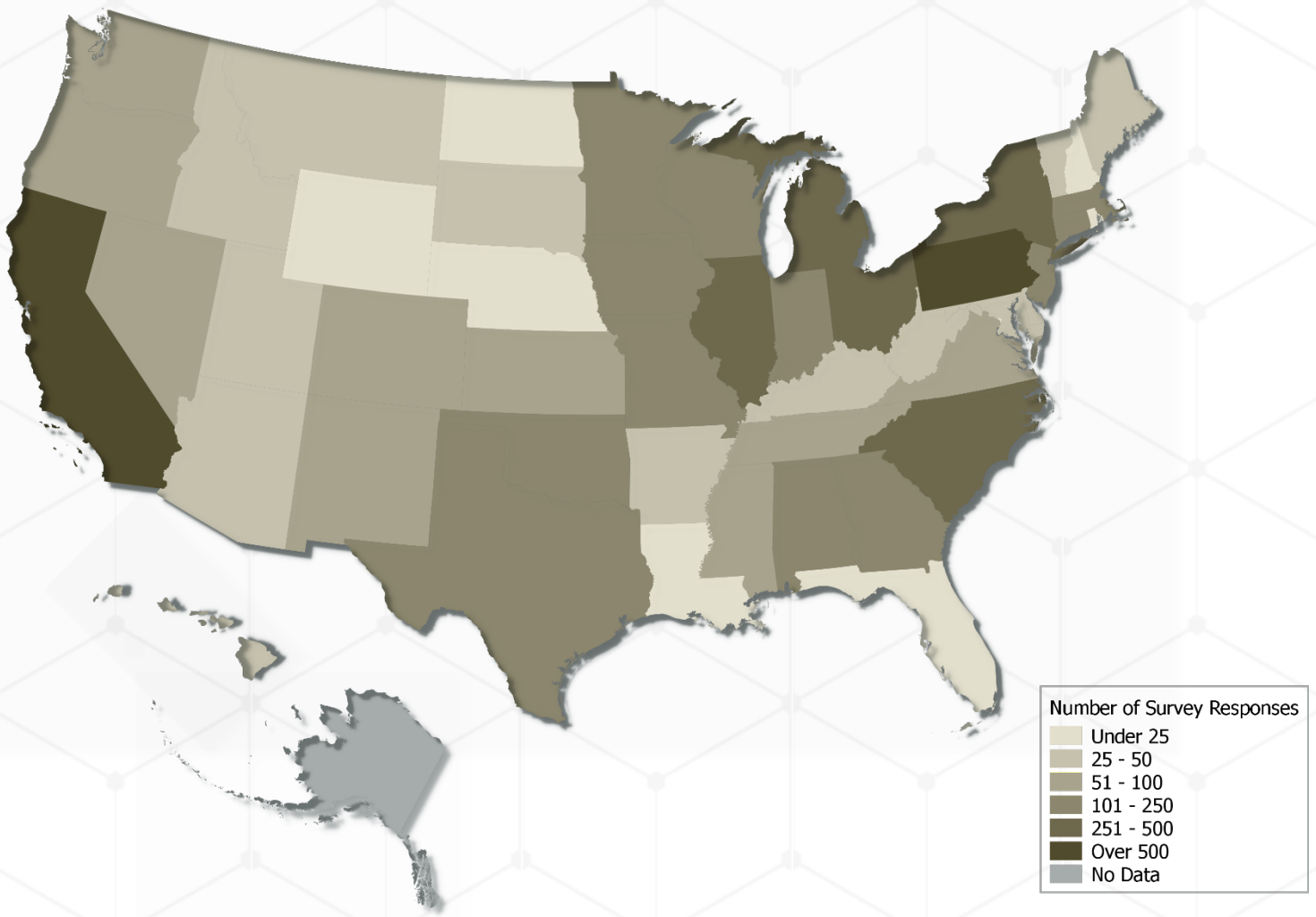
Survey Responses

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 the table, the percentage of "yes" responses ranged from 17 percent (other investments) to 50 percent (investment in workforce training). Only roughly 400 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, 56 percent of the respondents indicated a positive employment effect. Forty-five percent indicated a positive combined sales effect. About 40 percent of the surveys responded yes to both the employment and the sales questions, and a similar percentage responded no to both.

Even though 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.

Data Element (variable)	Number that Indicated MEP Affected a Positive Response
Number of jobs created	2,406
Number of jobs retained	2,811
Increase in sales	2,088
Retained sales	2,242
Cost savings	3,217
Investment in plant and equipment	2,748
Invest in products and processes	2,442
Investment in information system	1,853
Investment in workforce training	3,315
Other investments	1,116
Unnecessary investments	2,272
Total responses	6,507

Survey Responses



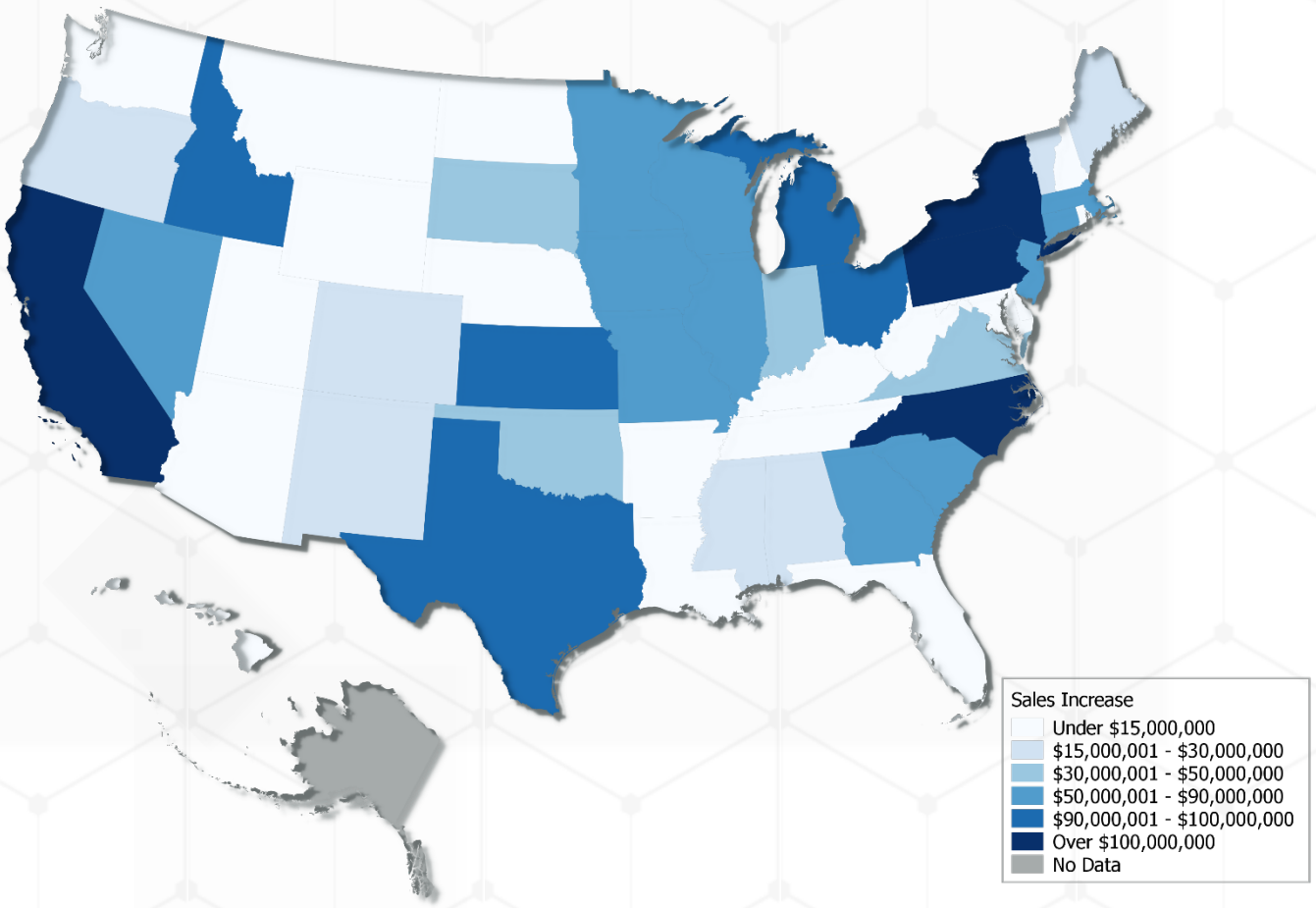
National Summary of Client-Reported Outcomes Resulting from MEP Center Activities: Q4 2015 to Q3 2016

Sales:	**+$9.33b**
○ Increased:	$2.33b
○ Retained:	$ 7b
Jobs:	**+86,541**
○ Created:	19,653
○ Retained:	66,888
Cost Savings:	**+$857m**
Investment Savings:	**+$514m**

Total Investment:	**+$3.5b**
○ Products & Process:	$1.07b
○ Plant & Equipment:	$1.83b
○ Systems & Software:	$134m
○ Workforce Practices & Employee Skills	$210m
○ Other Areas of Business:	$227m

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Sales Increased

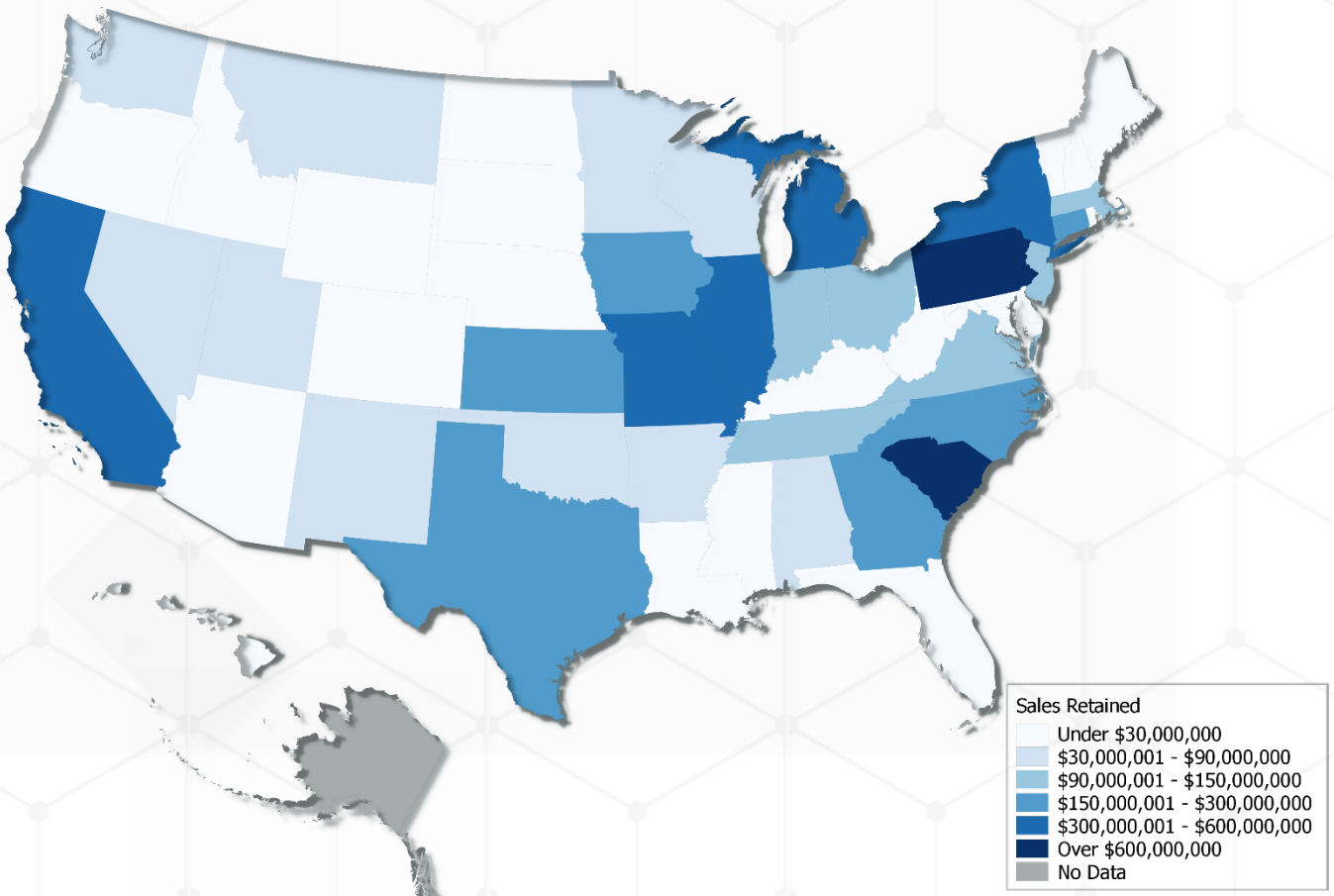


Q4: Did the services you received directly lead to an increase in sales at your establishment over the past 12 months? How much?

States with Largest Sales Increase		
1.	California	$217,512,441
2.	New York	$147,635,032
3.	Pennsylvania	$136,116,800
4.	North Carolina	$111,850,701
5.	Texas	$99,795,931

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Sales Retained



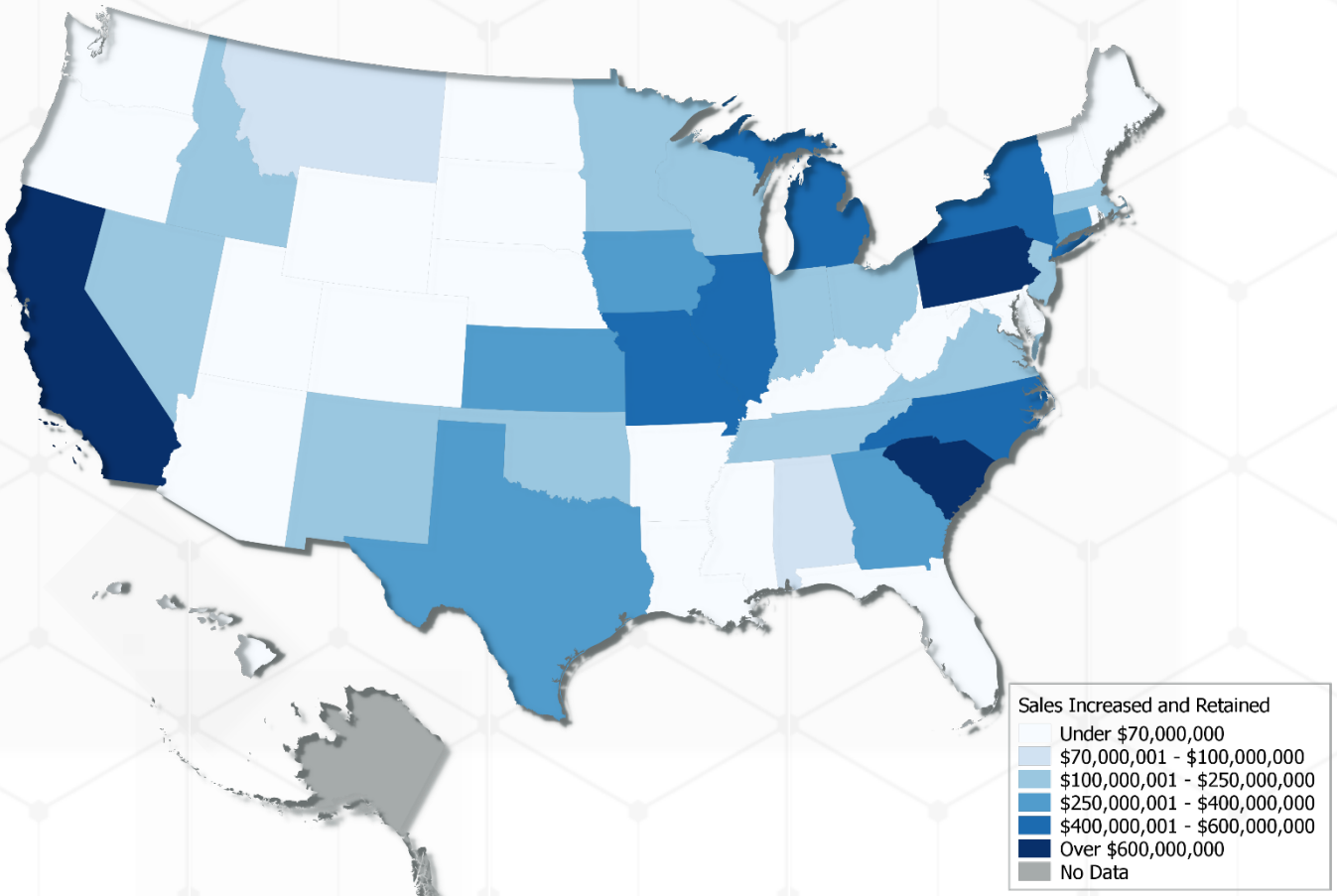
Q5: Over the past 12 months, did the services you received directly lead you to retain in sales that would have otherwise been lost? How much?

States with Most Sales Retained

1.	South Carolina	$1,280,000,000
2.	Pennsylvania	$616,155,348
3.	California	$428,530,594
4.	Michigan	$422,036,115
5.	Illinois	$367,960,000

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Total Sales Increased and Retained



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?

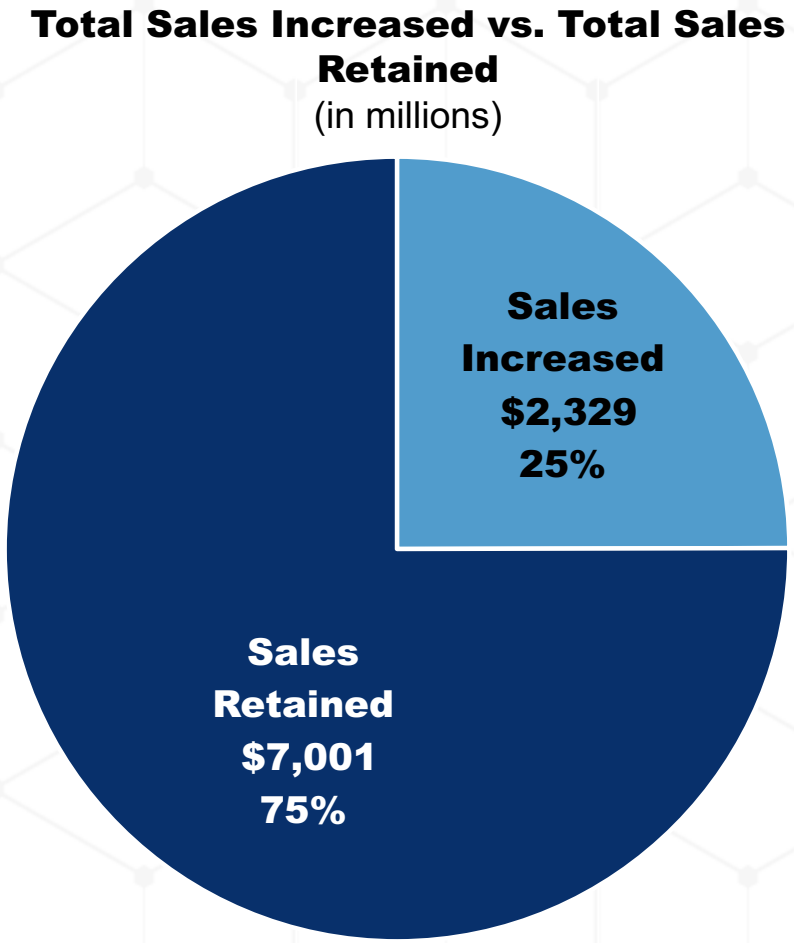
States with Highest Total Sales

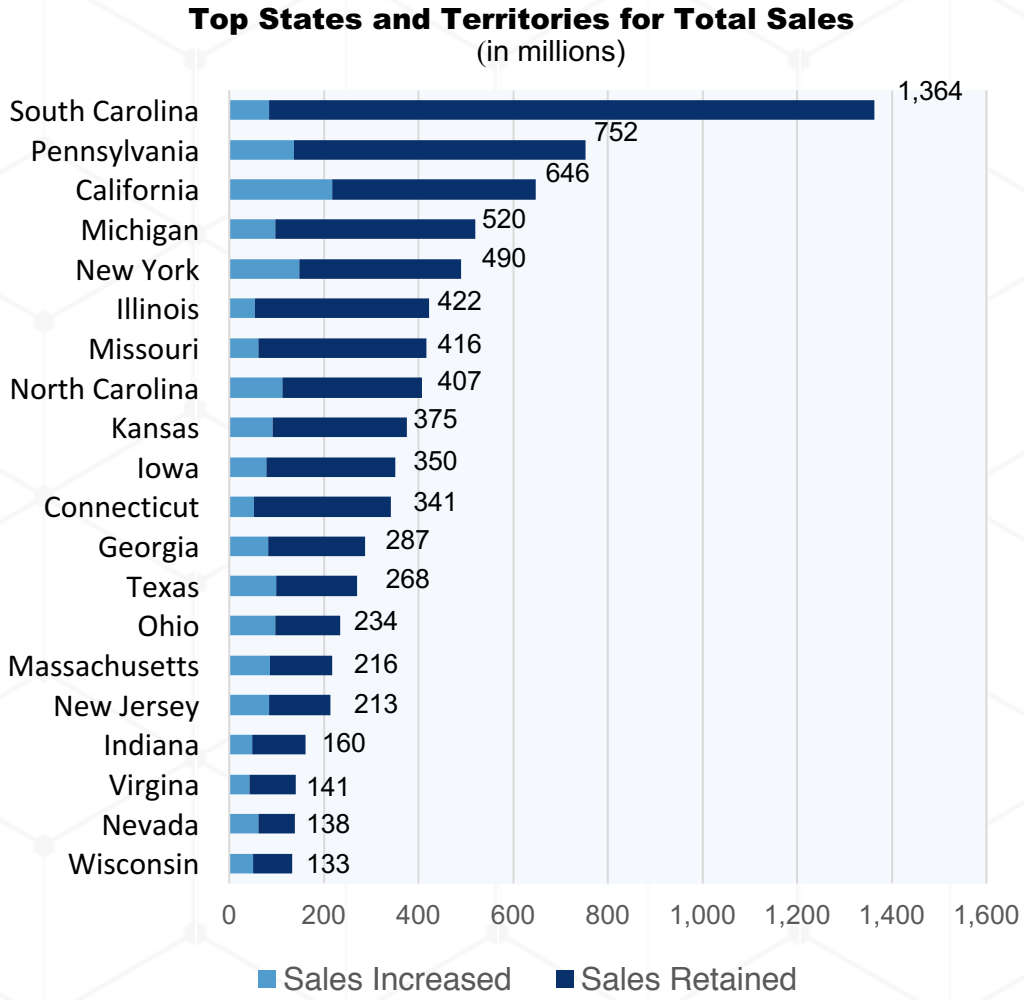
1.	South Carolina	$1,363,922,337
2.	Pennsylvania	$752,272,148
3.	California	$646,043,035
4.	Michigan	$519,514,415
5.	New York	$490,016,486

Firm sales or industry sales were used in REMI when employment wasn't available.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

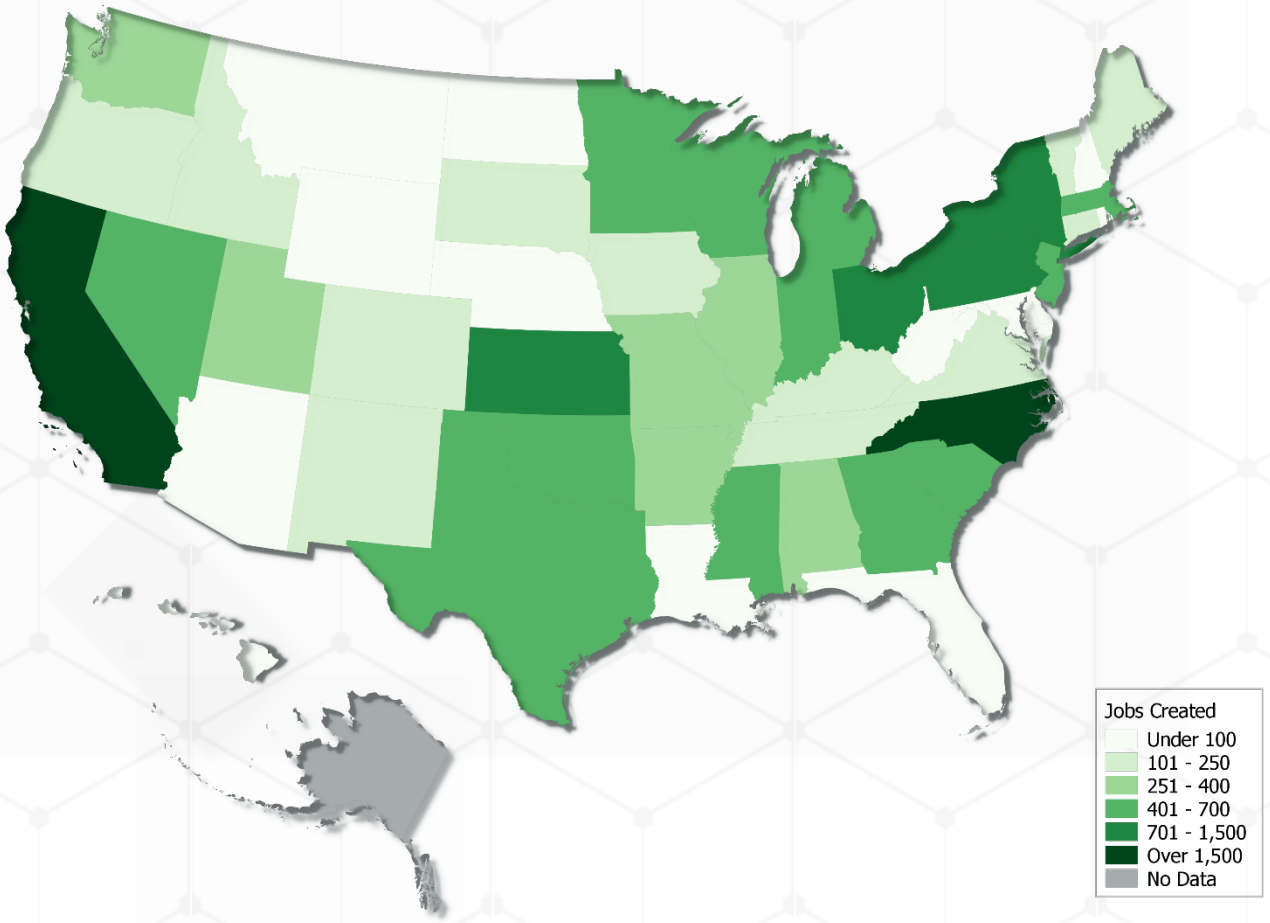
Overview of Total Sales





Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Jobs Created



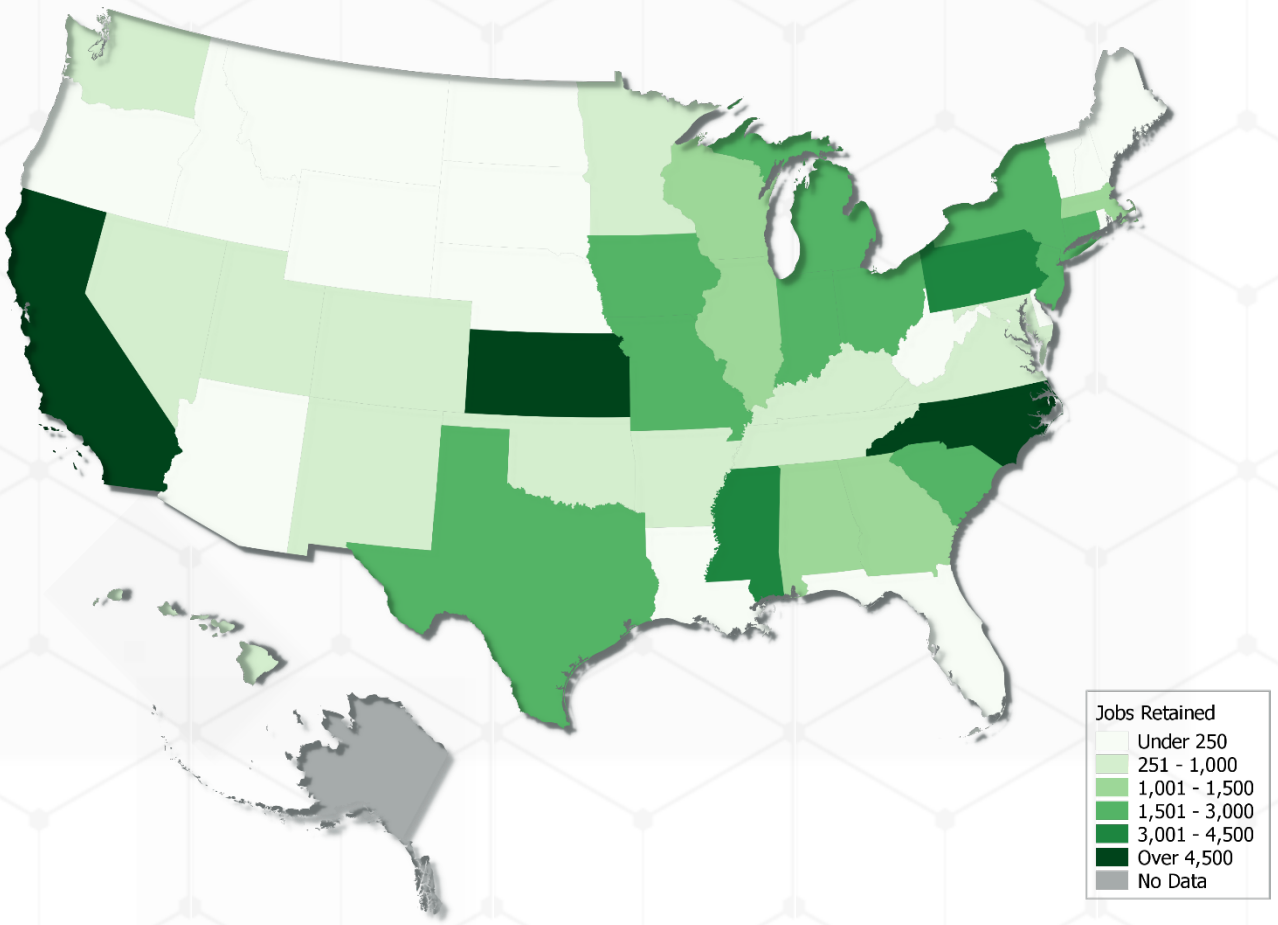
Q6: Did the services your received directly lead you to create any jobs over the past 12 months? How much?

States with Most Jobs Created

1.	North Carolina	2,895
2.	California	2,157
3.	Kansas	1,335
4.	Pennsylvania	1,148
5.	New York	755

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Jobs Retained



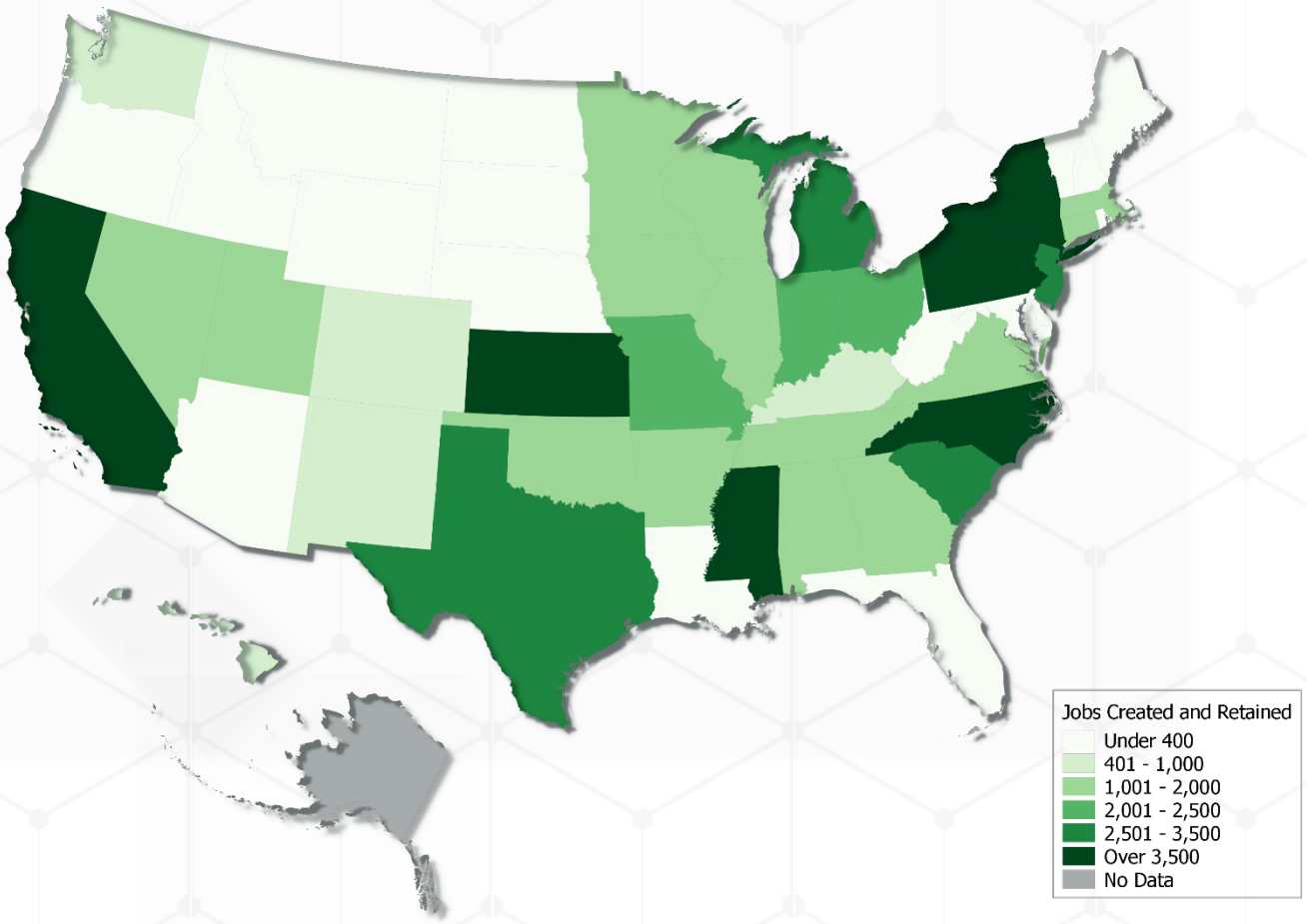
Q7: Did the services your received lead you to retain any jobs over the past 12 months? How much?

States with Most Jobs Retained

1.	North Carolina	7,440
2.	California	6,458
3.	Kansas	1,335
4.	Pennsylvania	4,420
5.	Mississippi	4,243

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Total Jobs Created and Retained



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

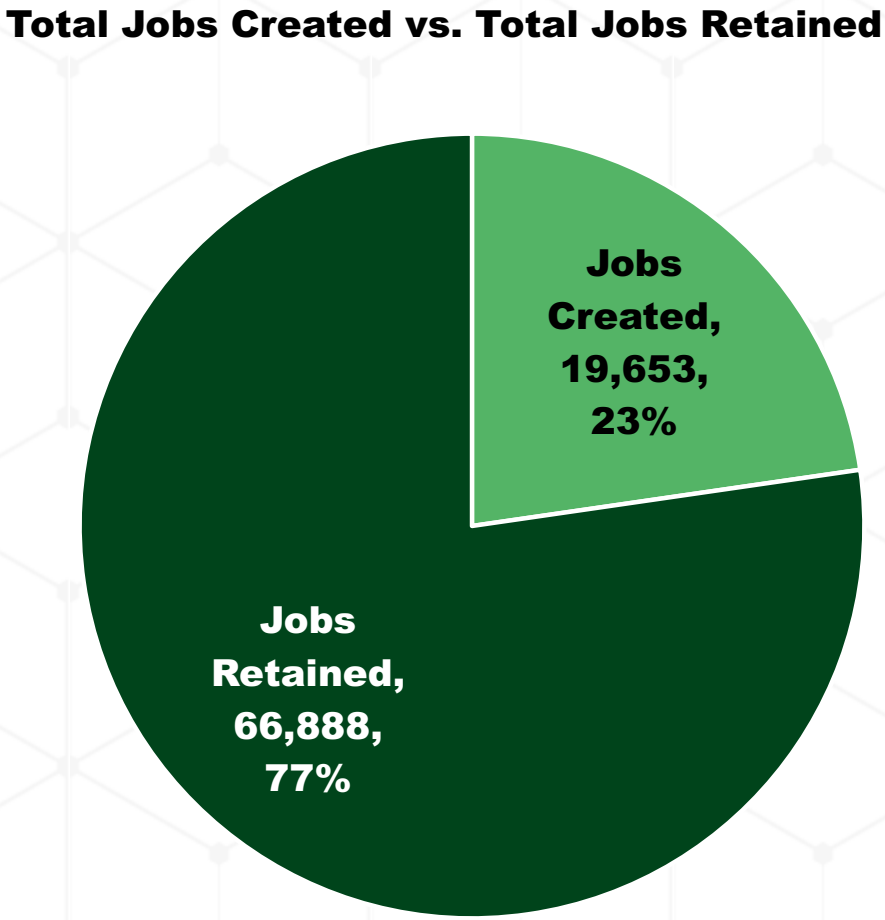
States with Highest Total Jobs

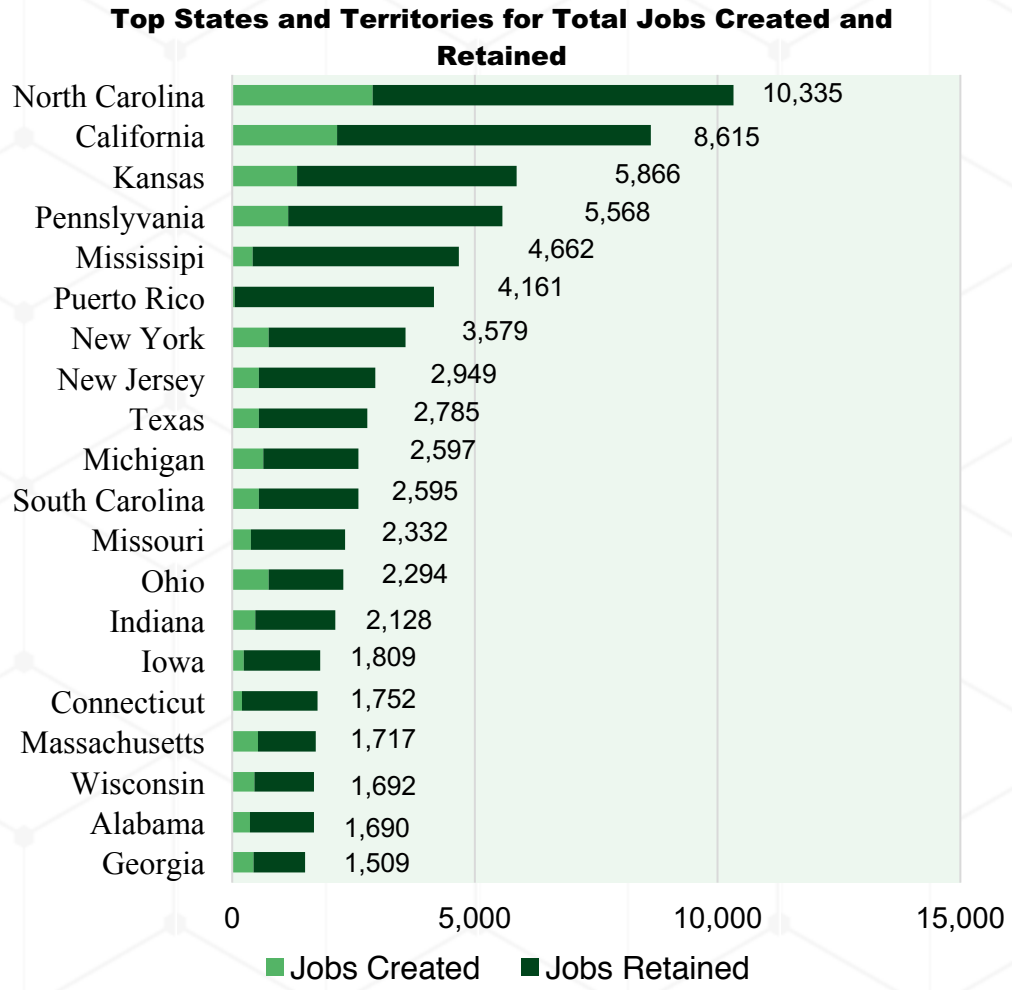
1.	North Carolina	10,335
2.	California	8,615
3.	Kansas	5,866
4.	Pennsylvania	5,568
5.	Mississippi	4,662

Jobs created and retained were used in REMI, when available, otherwise sales was used.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

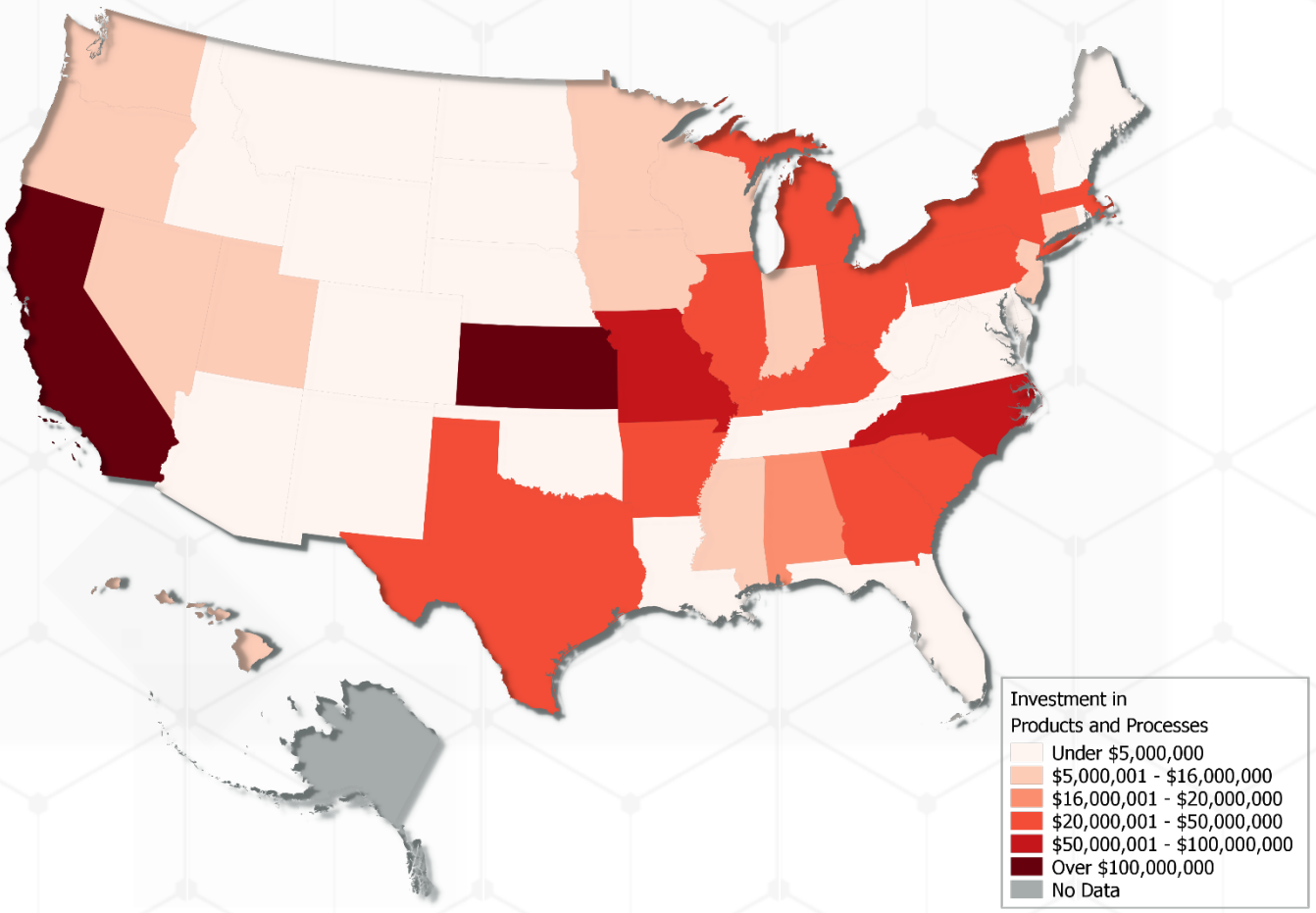
Overview of Total Jobs





Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Products and Process Investments



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?

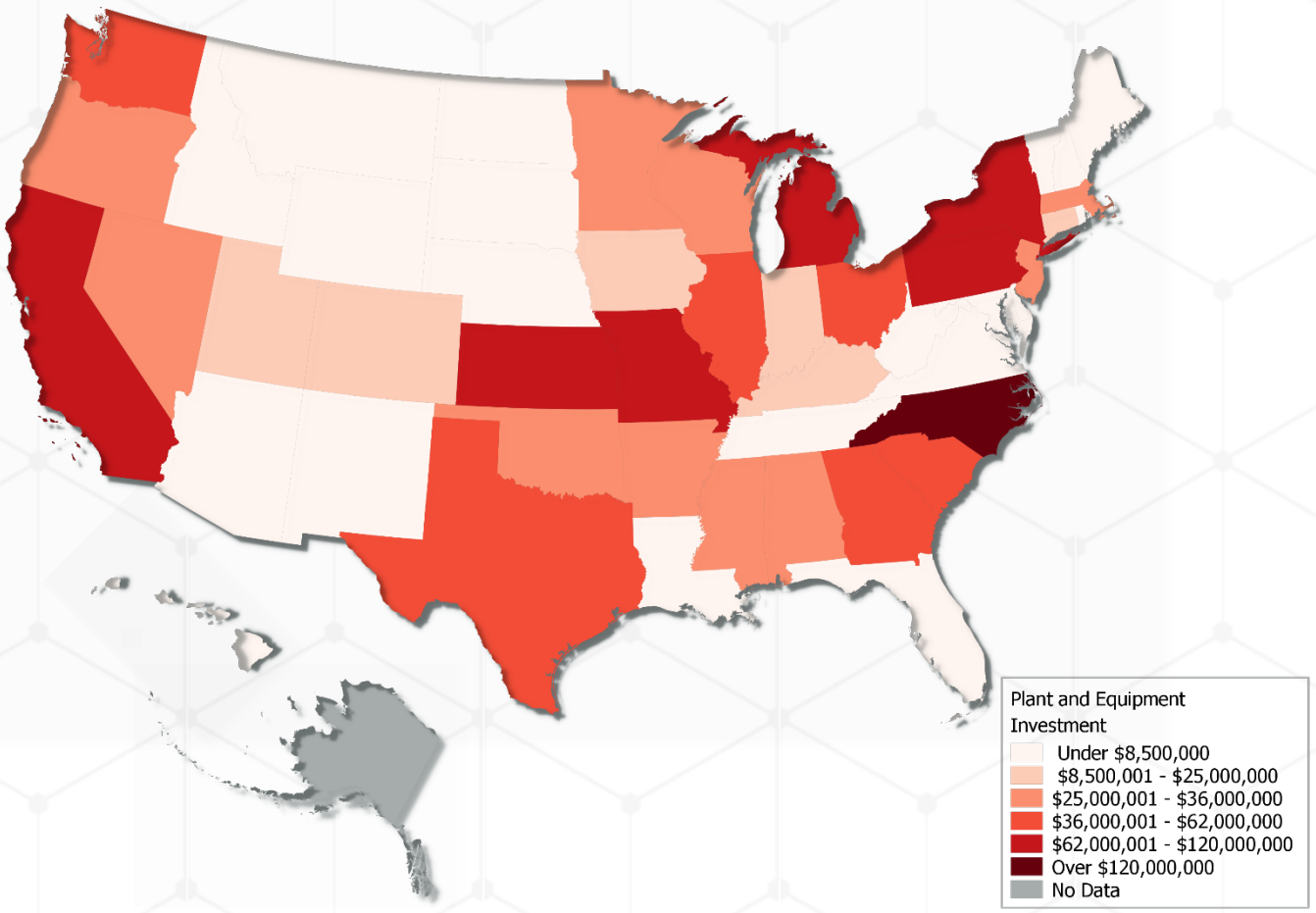
States with Most Investment in Products and Process

1.	Kansas	$224,273,000
2.	California	$122,526,887
3.	North Carolina	$99,983,089
4.	Missouri	$51,085,000
5.	Georgia	$49,946,000

For products and process investments, expenditures were equally split into two categories – Investment Spending in Equipment and Exogenous Final Demand in Professional, Scientific, and Technical Services.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Plant and Equipment Investments



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?

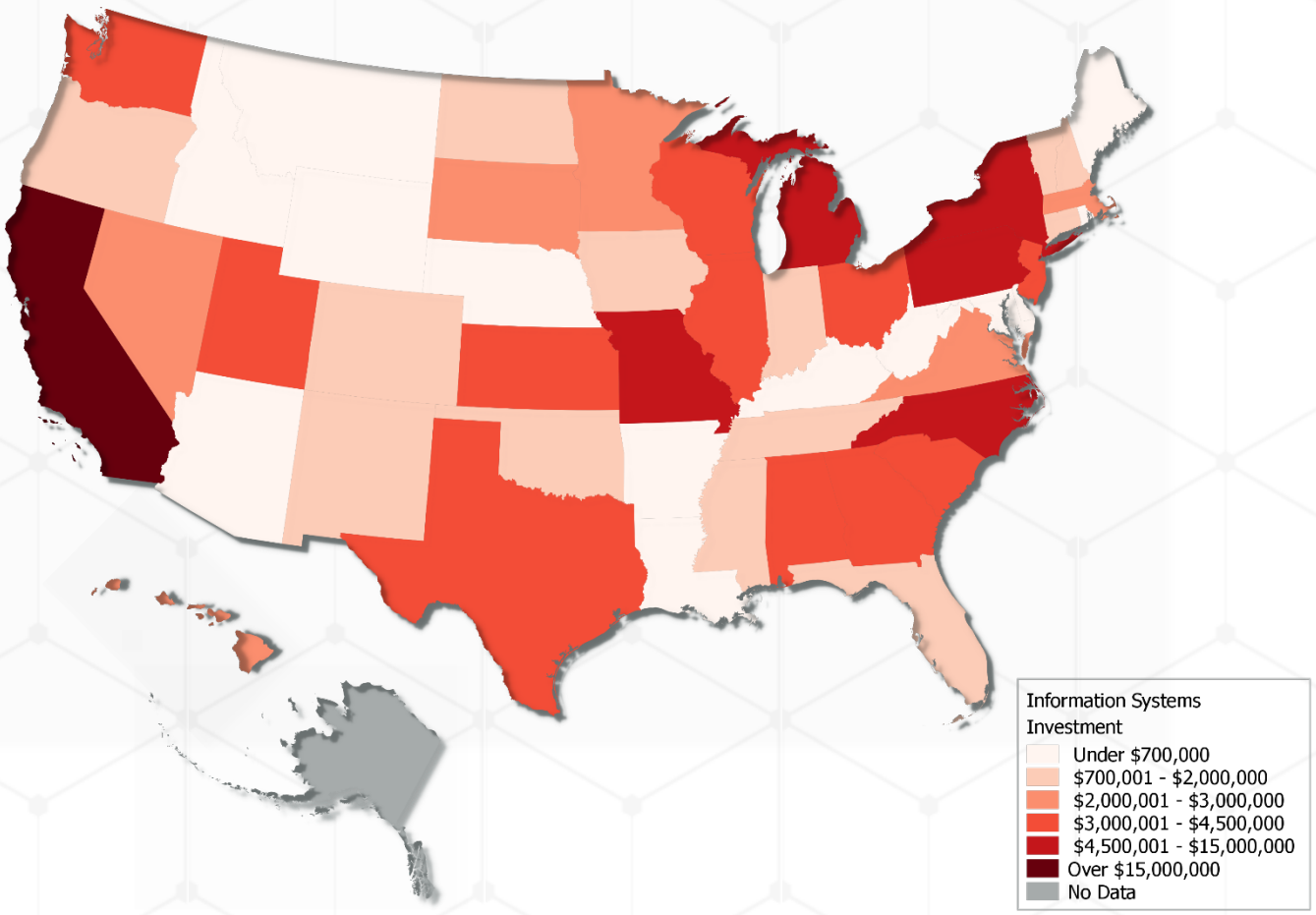
States with Most Plant and Equipment Investment

1.	North Carolina	$444,515,882
2.	Kansas	$119,779,999
3.	California	$99,340,709
4.	Michigan	$93,914,696
5.	New York	$90,710,045

For plant and equipment investments, expenditures were equally split into two categories – Investment Spending in Equipment and Industry Sales in the Construction Sector.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Information Systems & Software Investments



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?

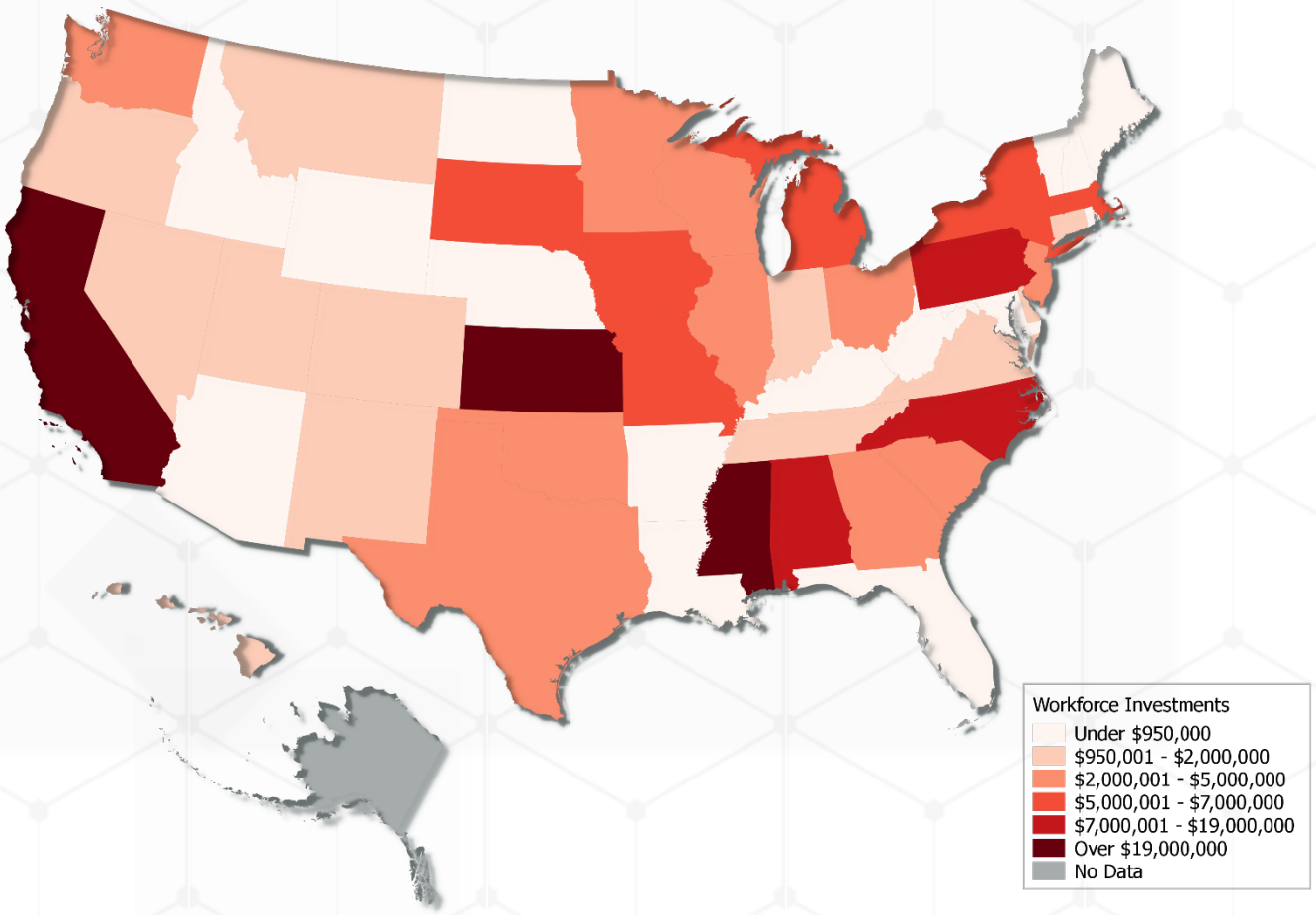
States with Most Information Systems Investment

1.	California	$34,936,408
2.	New York	$12,582,310
3.	Missouri	$11,181,943
4.	North Carolina	$9,369,233
5.	Michigan	$8,288,494

For information systems and software investments, expenditures were equally split into two categories – Investment Spending in Equipment and Investment Spending in Intellectual Property.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Workforce Investments



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?

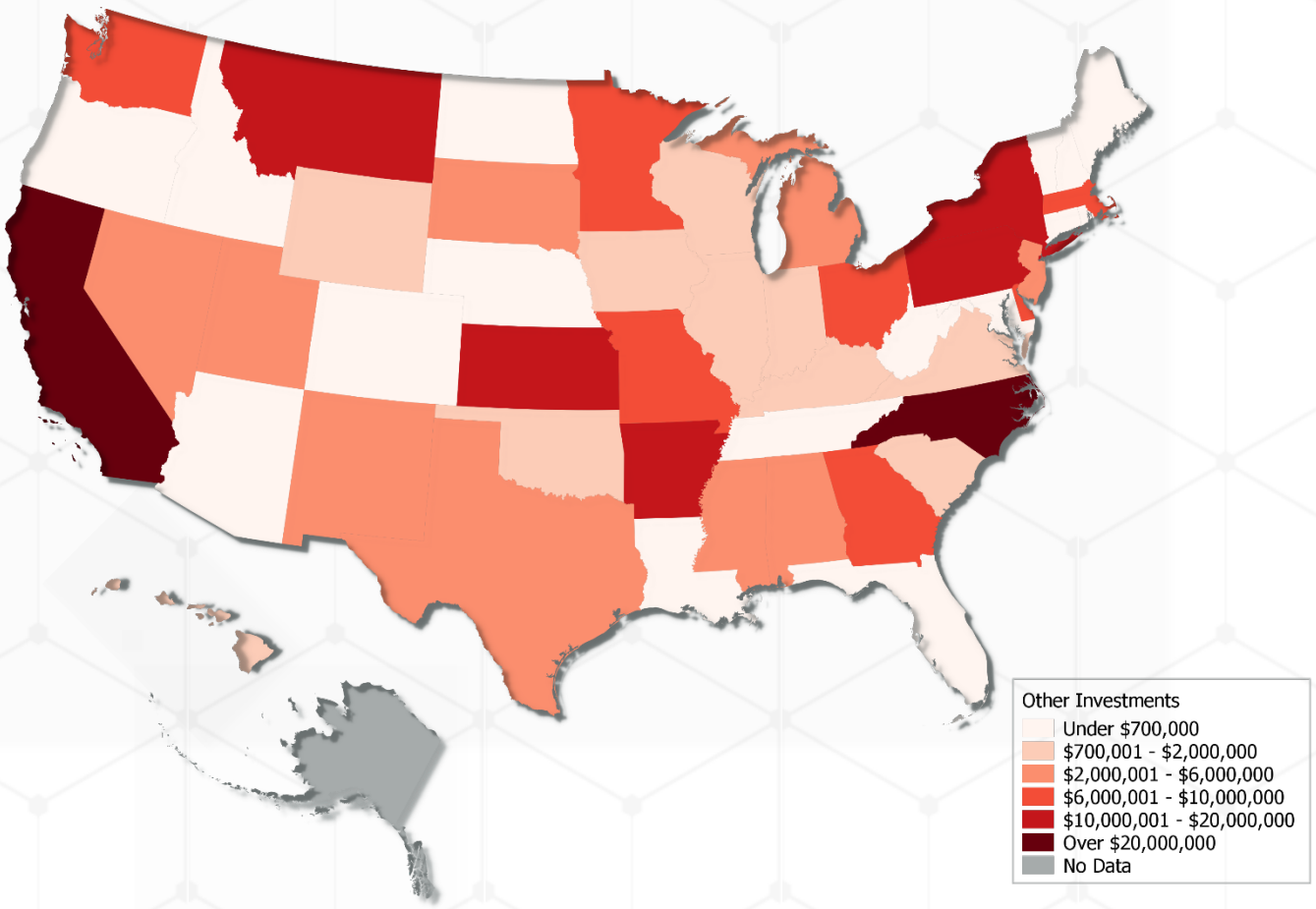
States with Most Workforce Investments

1.	Mississippi	$34,905,771
2.	Kansas	$32,342,900
3.	California	$19,008,100
4.	Alabama	$10,812,220
5.	Pennsylvania	$7,696,908

For workforce investments, expenditures were applied to industry sales in the education sector assuming that employees from this sector were employed either on site or off site to provide training.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Investments in Other Areas of Business



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?

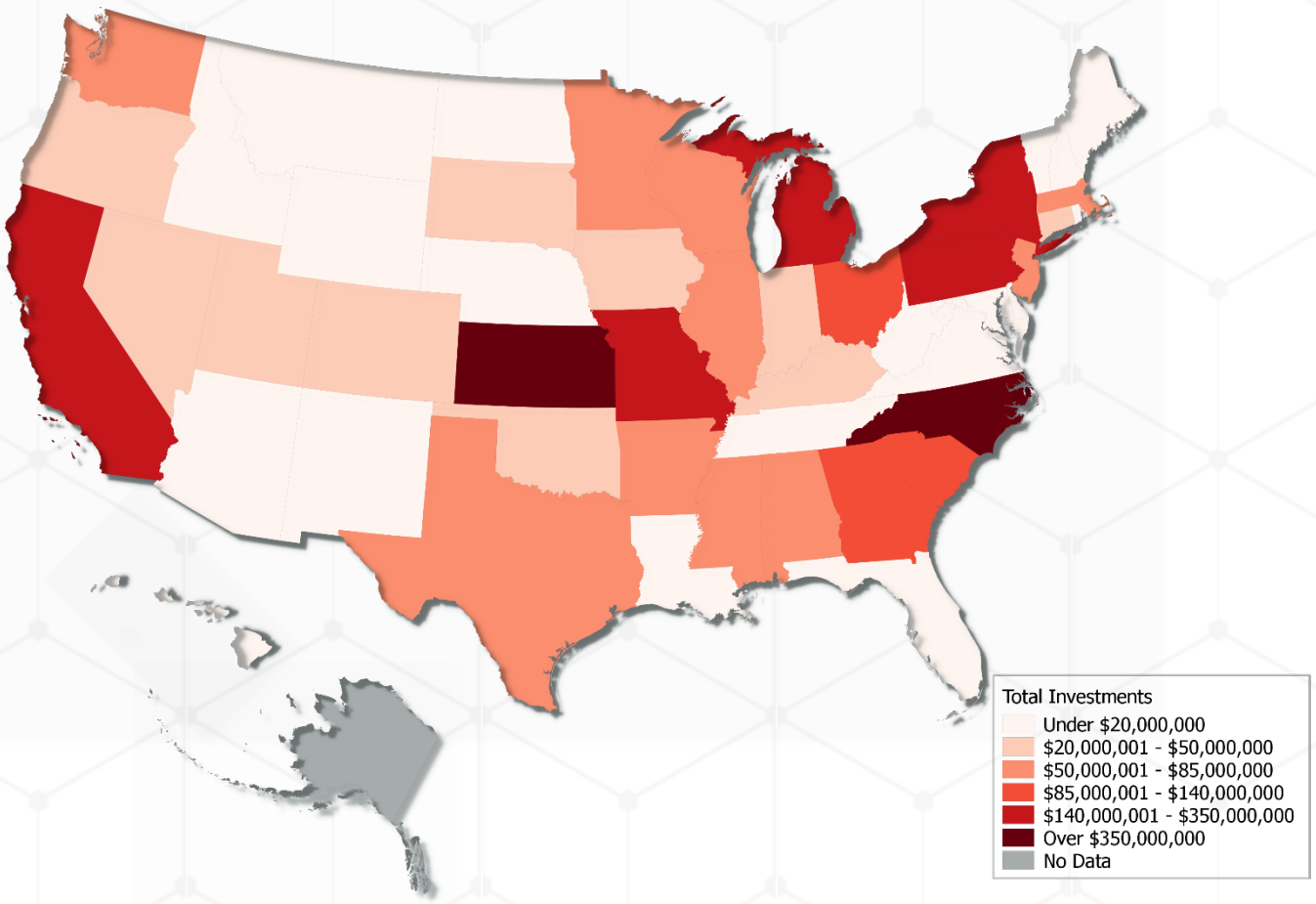
States with Most Investments in Other Areas of Business

1.	North Carolina	$36,358,610
2.	California	$20,159,848
3.	Arkansas	$14,035,750
4.	Kansas	$13,593,700
5.	Pennsylvania	$11,710,801

After conversations with MEP leadership, it was determined there was insufficient information to include this category of investment in other areas of business in the economic impact estimates.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Total Investments

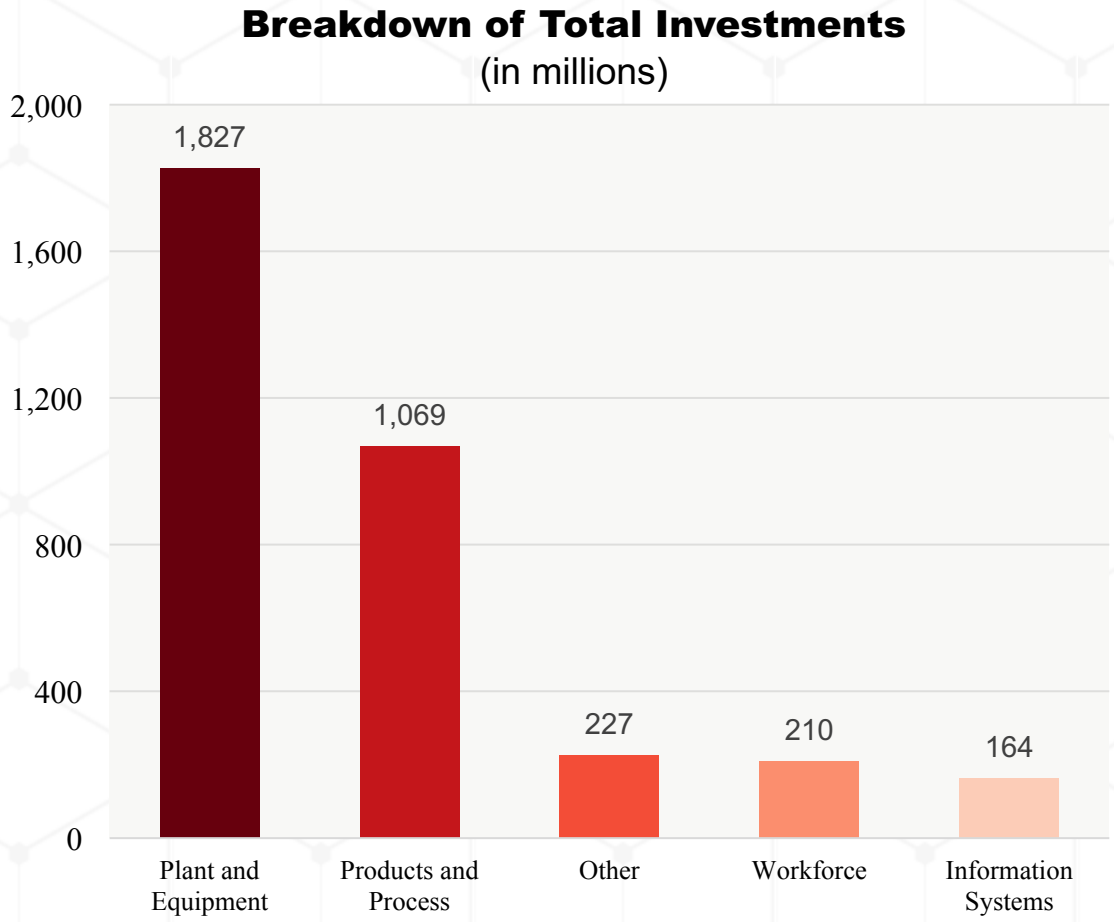


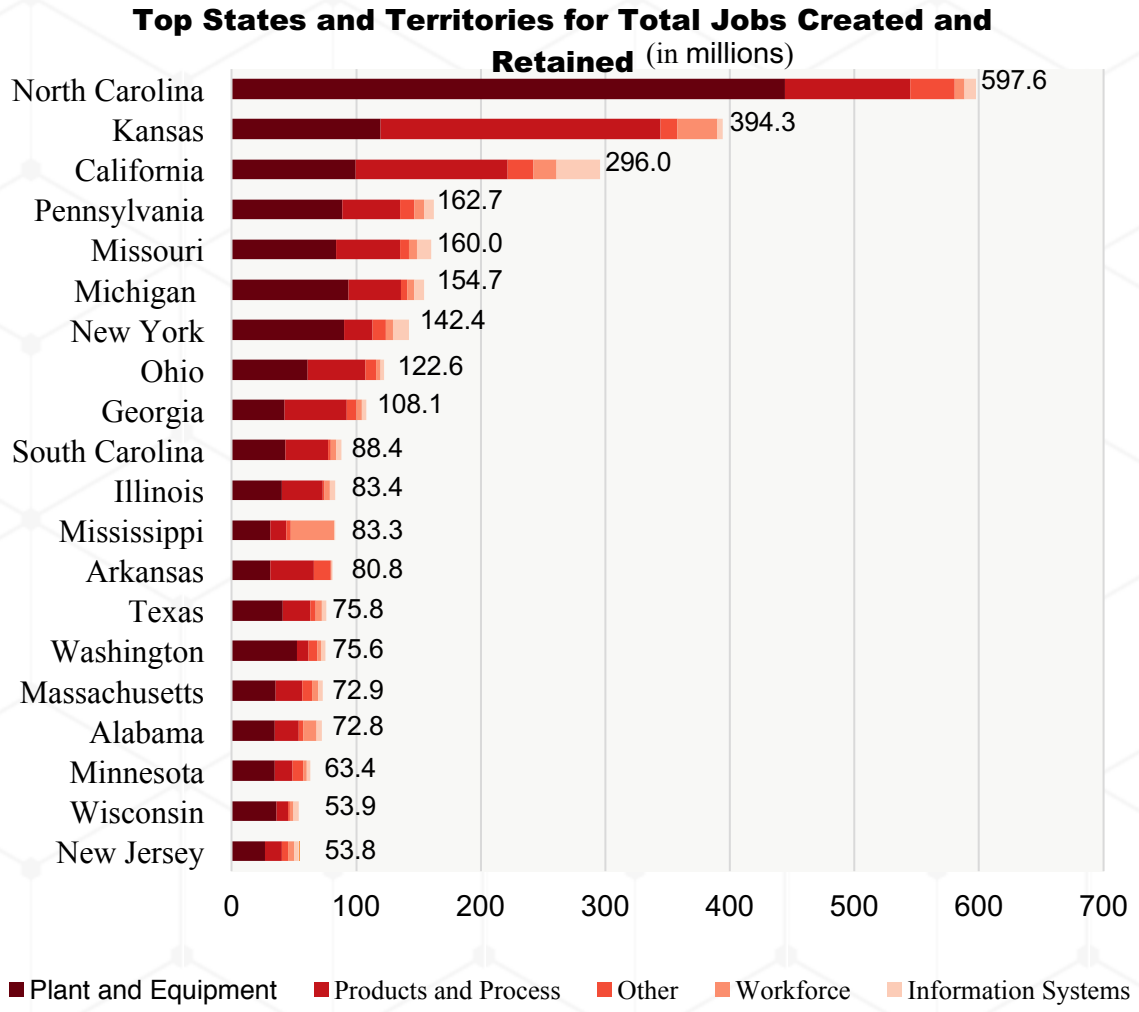
States with Highest Total Investment Increases

1.	North Carolina	$597,606,047
2.	Kansas	$394,263,599
3.	California	$295,971,952
4.	Pennsylvania	$162,677,906
5.	Missouri	$159,964,467

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

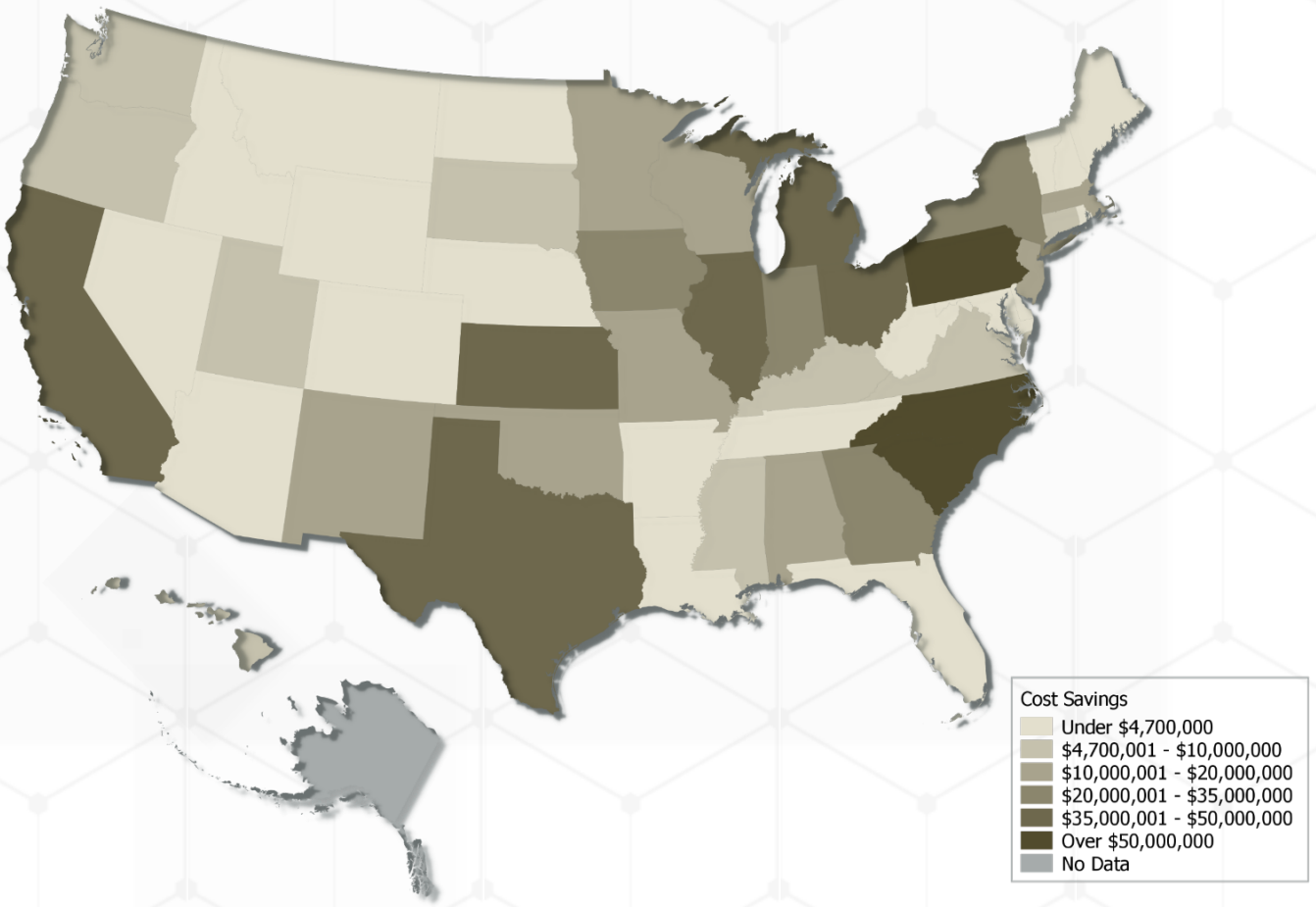
Overview of Total Investments





Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

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?

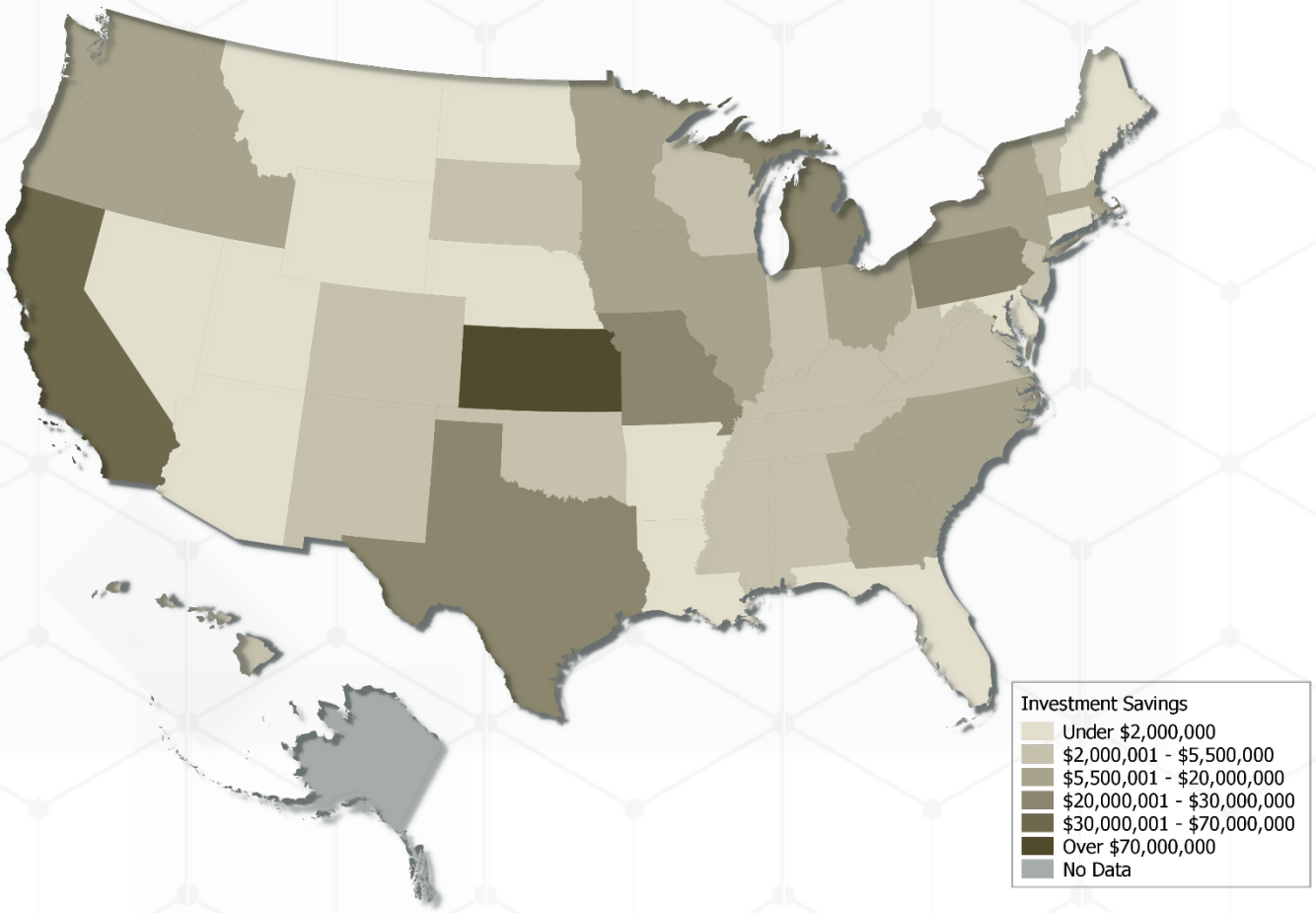
States with Most Cost Savings

1.	North Carolina	$175,971,388
2.	Pennsylvania	$53,628,925
3.	South Carolina	$53,223,120
4.	Kansas	$41,792,810
5.	Texas	$39,134,801

Cost savings were applied in REMI as reduced production costs.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Investment Savings



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

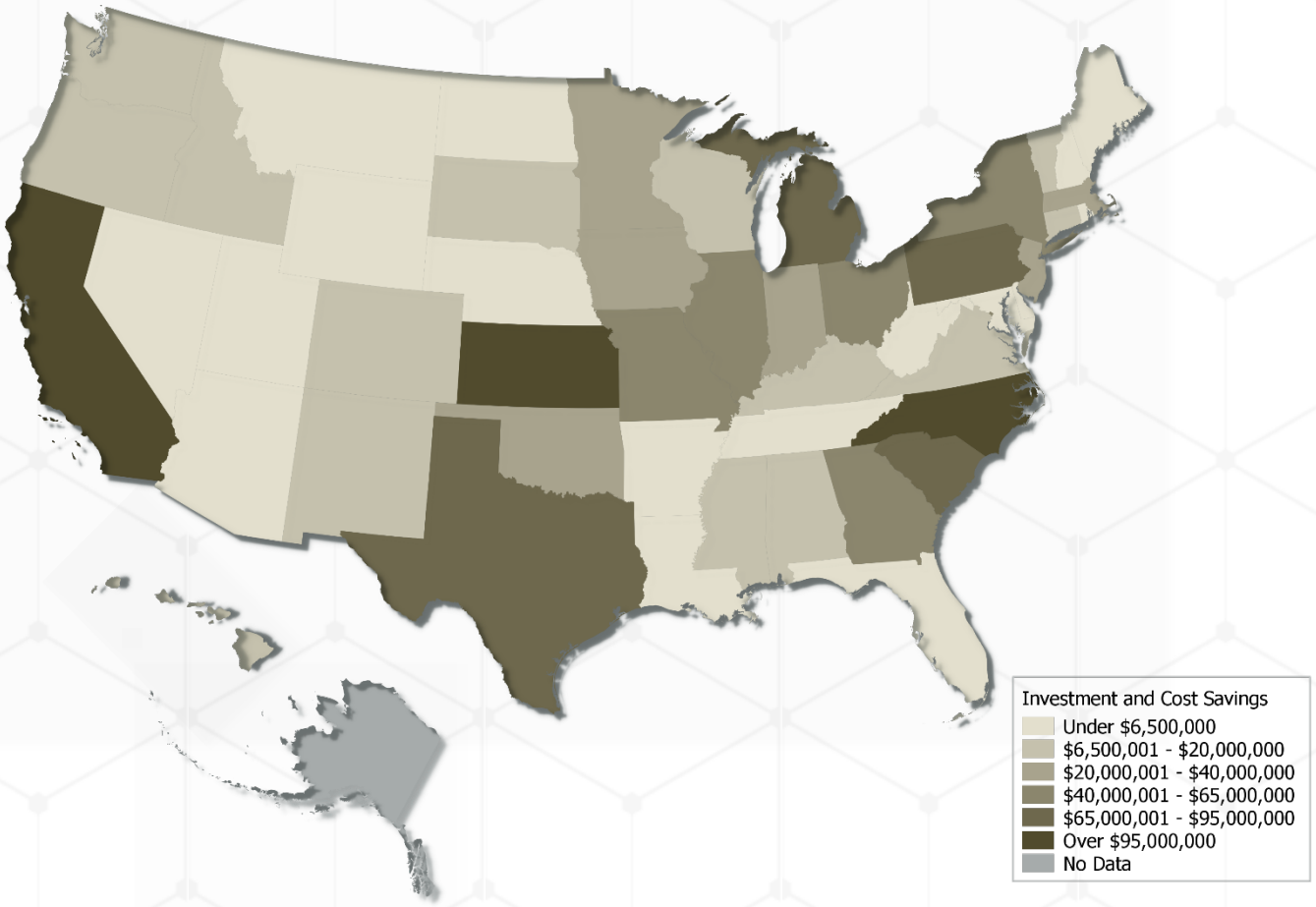
States with Most Investment Savings

1.	Kansas	$90,391,500
2.	California	$68,611,242
3.	Dist. of Colombia	$49,500,000
4.	Michigan	$29,291,031
5.	Texas	$27,381,500

Investment savings were applied in REMI as reduced production costs.

Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Total Investment and Cost Savings



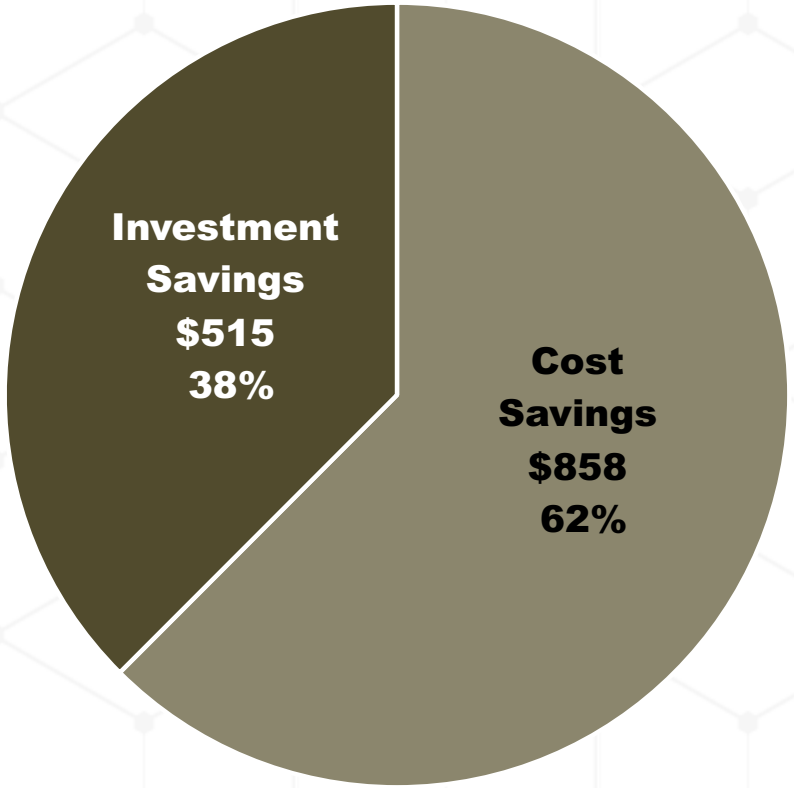
States with Highest Total Savings

1.	North Carolina	$191,023,970
2.	Kansas	$132,184,310
3.	California	$107,649,798
4.	Pennsylvania	$76,092,825
5.	South Carolina	$67,086,093

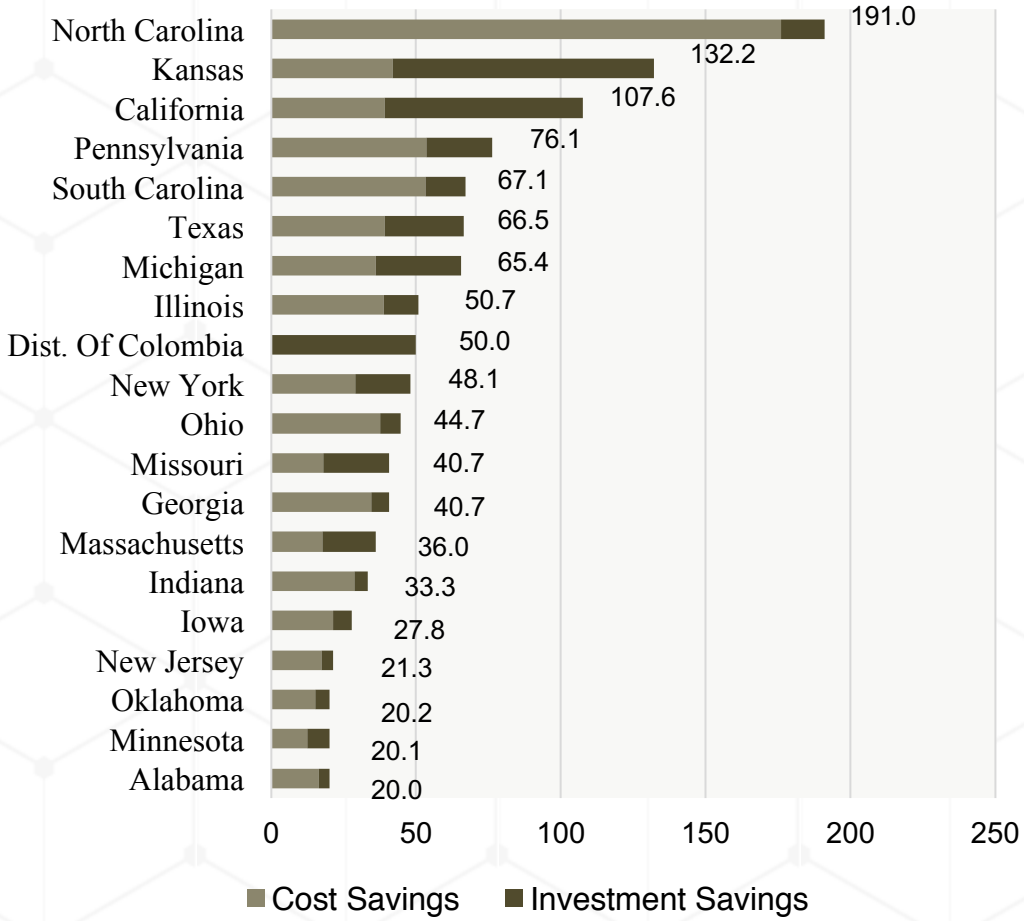
Source: Manufacturing Extension Partnership and W.E. Upjohn Institute

Cost Savings vs. Investment Savings

Total Cost Savings vs. Total Investment Savings
(in millions)



Top States and Territories for Total Savings
(in millions)

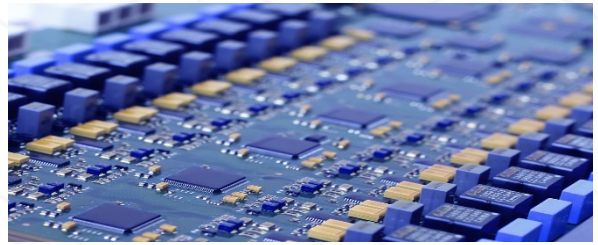


Source: Manufacturing Extension Partnership and W.E. Upjohn Institute









MEP Economic Impact Analysis

ECONOMIC OUTCOME DEFINITIONS

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.

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).

Economic Outcome Definitions

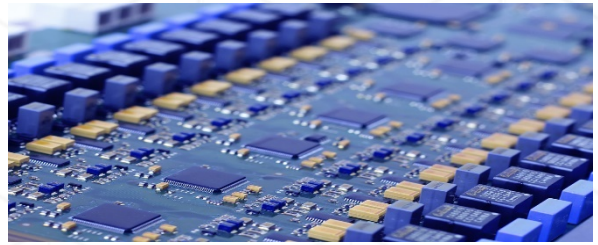
Returns to the U.S. Treasury

- 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.









MEP Economic Impact Analysis

SUMMARY AND OCCUPATION ANALYSIS

Summary

The W.E. Upjohn Institute was asked to estimate the aggregate impact of the centers that are part of the Manufacturing Extension Partnership (MEP), an agency that serves primarily the manufacturing sector in "growing and improving" businesses. As per its website, "MEP Centers and partners have developed a wide range of services and initiatives to enable manufacturers to identify opportunities that will accelerate and strengthen growth and competitiveness in the global marketplace."

As a means to better understand the effect that the MEP Centers have on the economy, the NIST MEP administers a survey to the clients to gain insights on how the companies have benefited through increased sales, employment, and investment as well as through lower production costs. When the survey was administered in federal fiscal 2016, slightly more than 6,500 companies responded. The responses were aggregated and used as inputs into an economic impact model developed by Regional Economic Models, Inc. (REMI) to estimate the collective impacts from the centers on the U.S. economy.

Using REMI, three forecasts were run to estimate the impacts when compared to the initial baseline forecast. The first forecast used industry variable that don't allow for firms to be in competition with each other and so assume that all new output is exported out of the country. While this assumption is unrealistic when applied to the national economy, it does provide

Summary

Interesting insights into an export-based economy. The results show (see the next table) that more than 575,000 jobs would be created, GDP would increase by $63 billion and using personal income tax as a base, there would be a nearly 36:1 return to the Treasury based on the FY 2016 MEP budget of $130 million.

Using firm variables in REMI offer a more reasonable approach and outcomes. In this forecast, firms do compete and when one has success through changes in productivity and costs, they may “crowd out” their competitors. The results of this forecast are the net effects of firms winning and losing. The results for this forecast estimate that the effects of MEP on the national economy are slight more than 142,000 jobs, $15.4 billion additional GDP, and a return of 8.7:1 to the U.S. Treasury.

It is likely that all of a firms growth and savings is not fully attributable to MEP center activities. The final forecast tests the sensitivity to that consideration. It asks, “How much of the changes to the firms must be attributable to MEP activities?” In this case, the return on investment (ROI) is set at 1:1, with personal income tax collection equal to MEP’s FY 2016 budget of $130 million. That puts the needed level of MEP attribution to about 11.5 percent, and yields 16,532 jobs and nearly $1.8 billion in GDP.

MEP center activities and the companies with whom the centers work provide spillovers into the larger and non-manufacturing economy. While more than 27,000 net jobs are in the manufacturing section, diverse industries such as construction, retail trade, and health care all saw

Summary

job gains. Similarly, while production and material-handling occupations show significant gains in employment, a diverse set of occupations ranging from management to sales and related with office and administrative support, and to construction and extraction occupations, all showed significant gains in net new jobs.

Forecast	Jobs	GDP	Output	Personal Income	Returns to Treasury	ROI Return on Investment
Unconstrained Model Using Industry Variables	575,870	$63.04*	$130.15*	$34.64*	$4.66*	35.8:1
Constrained Model Using Firm Variables	142,381	$15.40*	$29.89*	$8.44*	$1.13*	8.7:1
11.5% Solution Using Firm Variables	16,532	$1.79*	$3.46*	$.98*	$.132*	1:1

*Dollars in billions

Detailed Industry Analysis

Jobs Created or Retained by Industry	
Sector	**2016**
Forestry, Fishing, and Related Activities	388
Mining	1,652
Utilities	385
Construction	15,812
Manufacturing	27,468
Wholesale Trade	5,741
Retail Trade	15,291
Transportation and Warehousing	5,170
Information	2,124
Finance and Insurance	7,158
Real Estate and Rental and Leasing	4,973
Professional, Scientific, and Technical Services	8,524
Management of Companies and Enterprises	2,933
Administrative and Waste Management Services	8,973
Educational Services (private)	2,409
Health Care and Social Assistance	10,679
Arts, Entertainment, and Recreation	3,243
Accommodation and Food Services	6,453
Other Services, except Public Administration	8,745

The 142,000 jobs created or retained in the U.S. economy due to MEP activities are distributed widely across the various industries. The initial inclination may be to think that most of the jobs would be generated within manufacturing, since MEP Centers focus their services on manufacturing businesses and most of the direct employment effects are primarily in manufacturing. Ninety-five percent of the respondents to the survey are manufacturing firms. Yet, only 20 percent of the total number of jobs created or retained are in manufacturing. Thirty percent of MEP's impact on employment is in three non-manufacturing sectors: construction, retail trade, and health care and social assistance. This makes sense when one thinks of the indirect and induced effects of direct job creation or retention on worker purchases in retail and health care. The other 50 percent of MEP's impact on employment is spread among the remaining industries.

The implication of these results is that even though MEP focuses on the manufacturing effects, its overall effects benefit all sectors of the economy.

Employment Outcomes of Detailed Manufacturing Industries

Manufacturing	2016
Wood product manufacturing	707
Nonmetallic mineral product manufacturing	657
Primary metal manufacturing	1,293
Fabricated metal product manufacturing	3,241
Machinery manufacturing	3,144
Computer and electronic product manufacturing	2,343
Electrical equipment and appliance manufacturing	1,448
Motor vehicles, bodies and trailers, and parts manufacturing	1,469
Other transportation equipment manufacturing	3,365
Furniture and related product manufacturing	898
Miscellaneous manufacturing	1,414
Food manufacturing	1,826
Beverage and tobacco product manufacturing	151
Textile mills; Textile product mills	956
Apparel, leather and allied product manufacturing	549
Paper manufacturing	483
Printing and related support activities	389
Petroleum and coal products manufacturing	104
Chemical manufacturing	1,448
Plastics and rubber product manufacturing	1,581

As with the overall economy, the employment effects of MEP activities are spread throughout the manufacturing sector. While 30 percent of the respondents were in two manufacturing sectors—fabricated metals and machinery manufacturing – only 20 percent of the total employment effects on manufacturing were estimated to impact those two industries. In fact, the largest single industrial sector impacted by MEP activities was the food industry, with an estimated 14 percent of the total manufacturing employment impact. Consider that only 7 percent of the survey respondents identified their businesses as being in the food manufacturing industry. These results highlight the importance and widespread nature of supply chains and the overall impact of MEP activities on workers, as exhibited in higher consumer purchases.

Summary Occupations

Summary Occupations	2016
Management, business, and financial occupations	16,195
Computer, mathematical, architecture, and engineering occupations	7,750
Life, physical, and social science occupations	900
Community and social service occupations	1,134
Legal occupations	922
Education, training, and library occupations	3,253
Arts, design, entertainment, sports, and media occupations	2,170
Healthcare occupations	7,058
Protective service occupations	1,766
Food preparation and serving related occupations	6,638
Building and grounds cleaning and maintenance, personal care and service occupations	9,912
Sales and related, office and administrative support occupations	37,919
Farming, fishing, and forestry occupations	321
Construction and extraction occupations	11,637
Installation, maintenance, and repair occupations	7,244
Production occupations	16,965
Transportation and material moving occupations	10,596

Using the national industry-occupation matrix, it is possible to transform the industry employment effects into occupation effects. The primary occupations in the manufacturing sector are production and transportation and material handling, which account for 27,000 or 19 percent of the total overall employment effect. The single occupation group with the largest estimated employment impact is sales and related office and administrative support. This occupation group accounts for 27 percent of the total effect. Management, business, and financial occupations rival the largest impacted manufacturing occupation, which attests to the widespread effects of MEP-generated activities.

Top 20 Detailed Occupations

Detailed Occupations	
Construction trades workers	9,185
Retail sales workers	8,703
Information and record clerks	5,426
Material moving workers	5,078
Business operations specialists	4,835
Metal workers and plastic workers	4,617
Motor vehicle operators	4,331
Other installation, maintenance, and repair occupations	4,196
Other production occupations	4,191
Other office and administrative support workers	4,174
Computer occupations	3,937
Secretaries and administrative assistants	3,873
Assemblers and fabricators	3,847
Material recording, scheduling, dispatching, and distributing workers	3,834
Food and beverage serving workers	3,738
Financial clerks	3,519
Building cleaning and pest control workers	3,457
Financial specialists	3,249
Top executives	2,958
Health diagnosing and treating practitioners	2,639

The table to the left lists more detailed occupations than what was displayed in the previous slide. In this table, the top 20 occupations are shown with respect to MEP-generated employment impacts.

While some of these occupations are in the goods producing sector, they are also across a range of skills from retail and food service workers to executives and financial specialists.

This suggests that MEP impacts stretch across a spectrum of workers that demand a range of skills and offer a range of incomes. This portfolio creates an opportunity for a range of workers, including a first job as well as the potential for permanent employment in jobs with career ladders.

Production Occupations & Materials Handling Occupations

Production & Materials Handling Occupations	2016
Supervisors of production workers	1,164
Assemblers and fabricators	3,847
Food processing workers	847
Metal workers and plastic workers	4,617
Printing workers	244
Textile, apparel, and furnishings workers	1,288
Woodworkers	499
Plant and system operators	270
Other production occupations	4,191
Supervisors of transportation and material moving workers	430
Air transportation workers	164
Motor vehicle operators	4,331
Rail transportation workers	113
Water transportation workers	58
Other transportation workers	421
Material moving workers	5,078

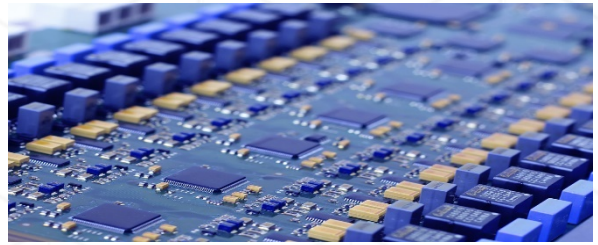
Slightly more than 60 percent of jobs in this combined group of production occupations and materials handling occupations are in more detailed production occupations. Occupations accounting for most of the jobs among production workers include assemblers and fabricators, metal and plastic workers, and “other” production workers.

Among the materials handling occupations, motor vehicle operators and material moving workers represent most of the employment. For these occupations, the former tend to be offsite moving goods and people while the latter tend to be onsite.









MEP Economic Impact Analysis

THE STATE OF MANUFACTURING IN THE U.S.

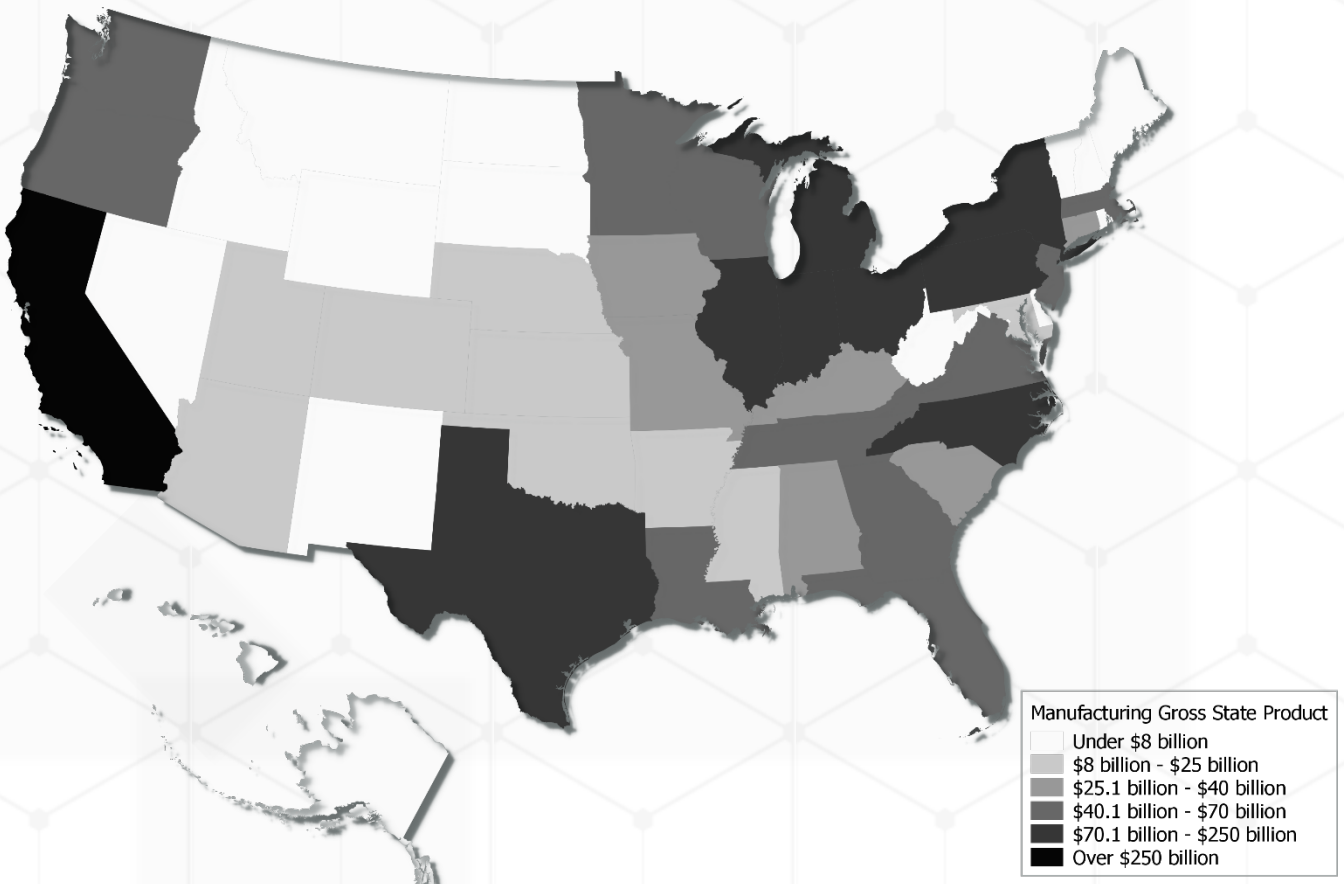
State of U.S. Manufacturing

Since manufacturing firms account for most of the clients of MEP Centers, this section provides background information on the state of manufacturing in the United States and various states. Manufacturing employment as a percentage of total employment has shrunk to slightly over 8.5 percent of total nonfarm employment in recent years. Yet, manufacturing's percentage of GDP is 12.0 percent. Both percentages continue to decline over time. In 1990, for example, manufacturing employment accounted for 16.4 percent of the total and manufacturing accounted for 17 percent of GDP.

Manufacturing's share of employment and output varies widely by state. As shown in the accompanying graph, the manufacturing's share of total employment among states varies from 14 percent (Indiana) to nearly 0 percent (District of Columbia). Similarly, manufacturing's share of GDP swings from 30 percent (Indiana) to 0

percent (District of Columbia). The two largest manufacturing states—California and Texas—are only average in terms of their employment and output shares. The slides in this section highlight manufacturing in various states.

Manufacturing Gross State Product



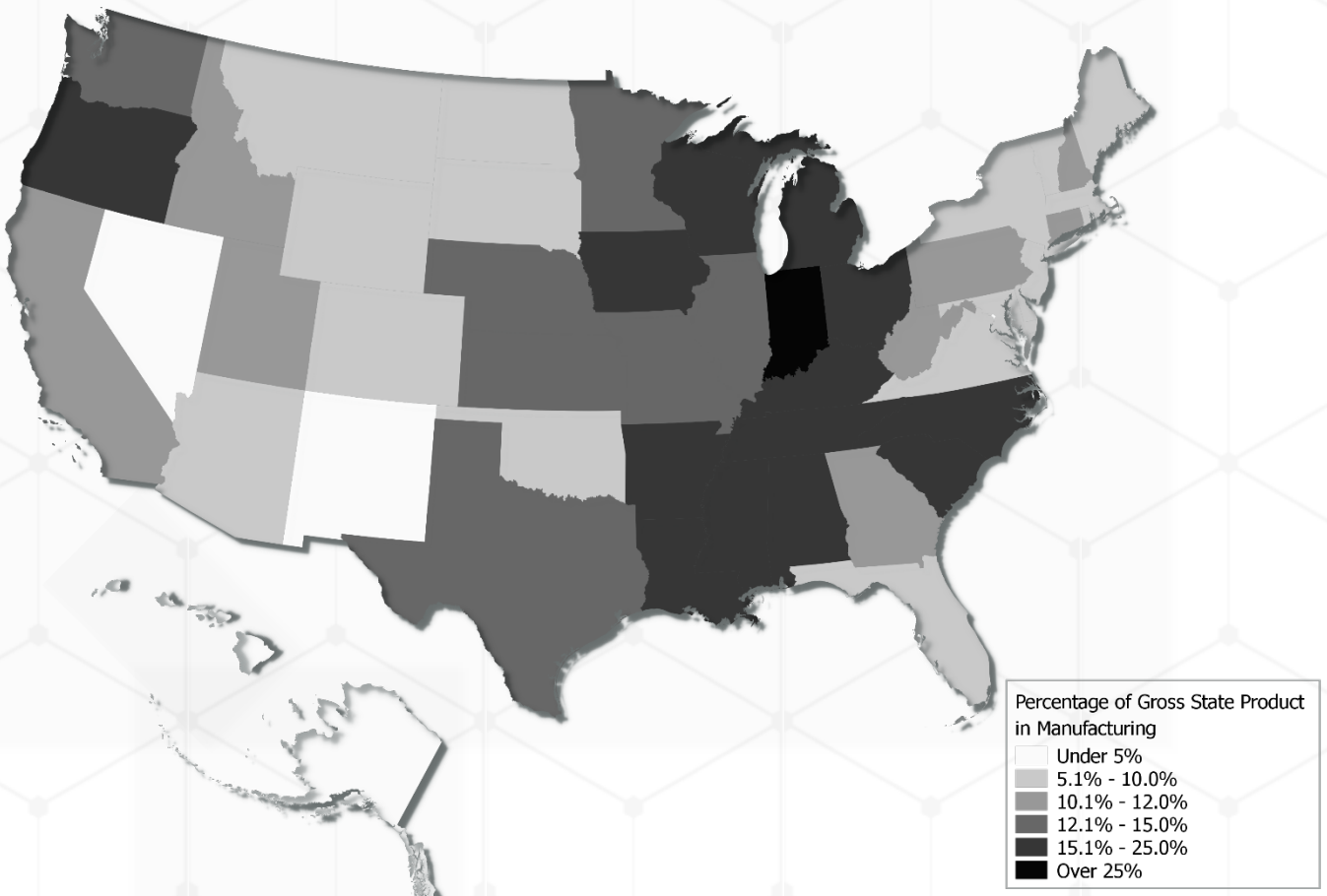
The Great Lakes region, along with North Carolina, California, and Texas, dominate the total value of gross state product (GSP) generated in the United States.

States with Most Manufacturing GSP

1.	California	$277,634,000,000
2.	Texas	$237,082,000,000
3.	Ohio	$109,476,000,000
4.	Indiana	$100,908,000,000
5.	Illinois	$99,514,000,000

Source: Bureau of Economic Analysis: Annual Gross Domestic Product by State, 2015

Percentage of GSP in Manufacturing

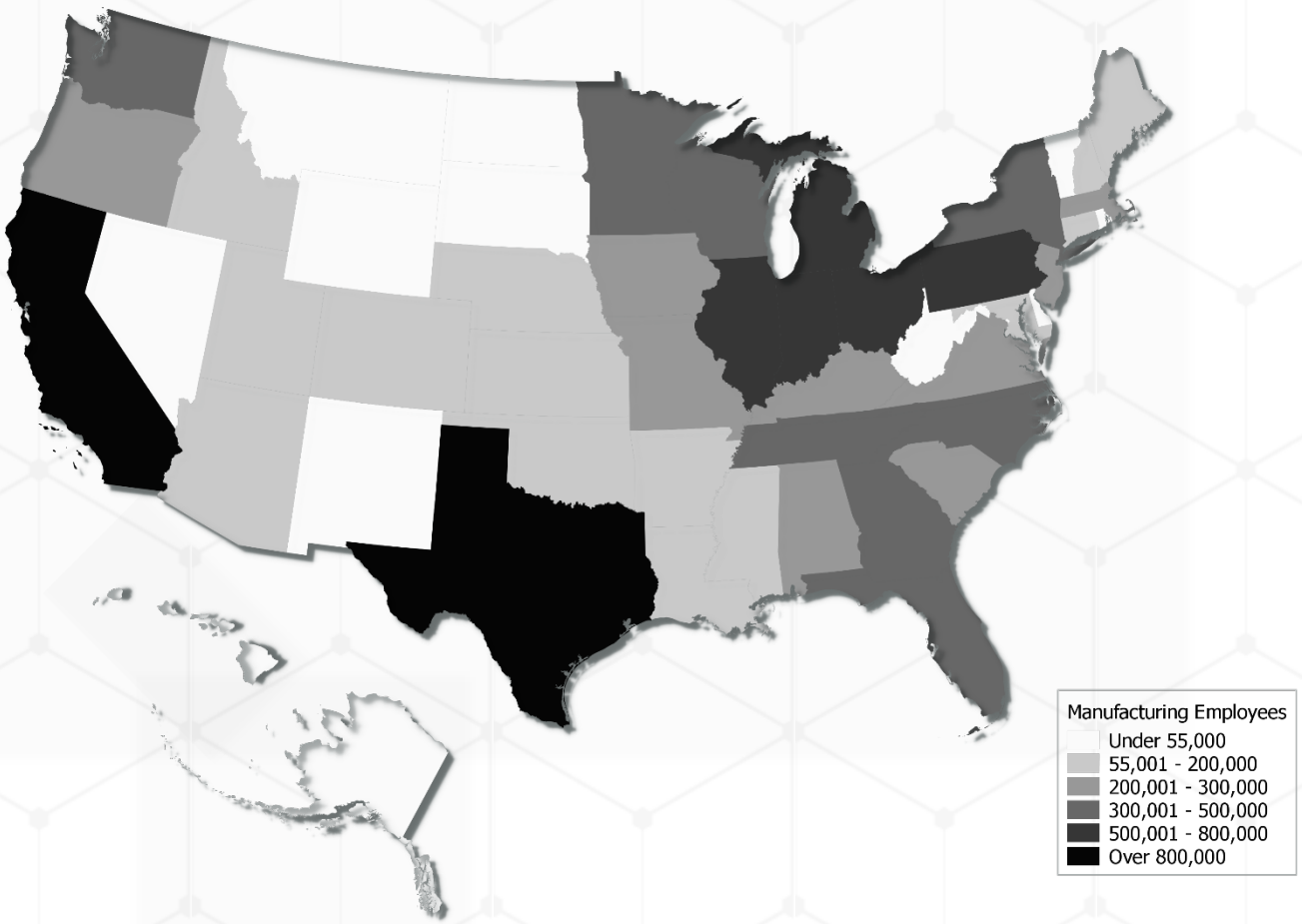


The map changes with a shift from size to share. While manufacturing continues to be strong in the heartland, the South has a high share of gross state product in manufacturing, as does Oregon.

States with Highest % of GSP in Manufacturing		
1.	Indiana	30.03%
2.	Oregon	22.85%
3.	Louisiana	21.90%
4.	North Carolina	19.81%
5.	Kentucky	19.78%

Source: Bureau of Economic Analysis: Annual Gross Domestic Product by State, 2015

Employment in Manufacturing



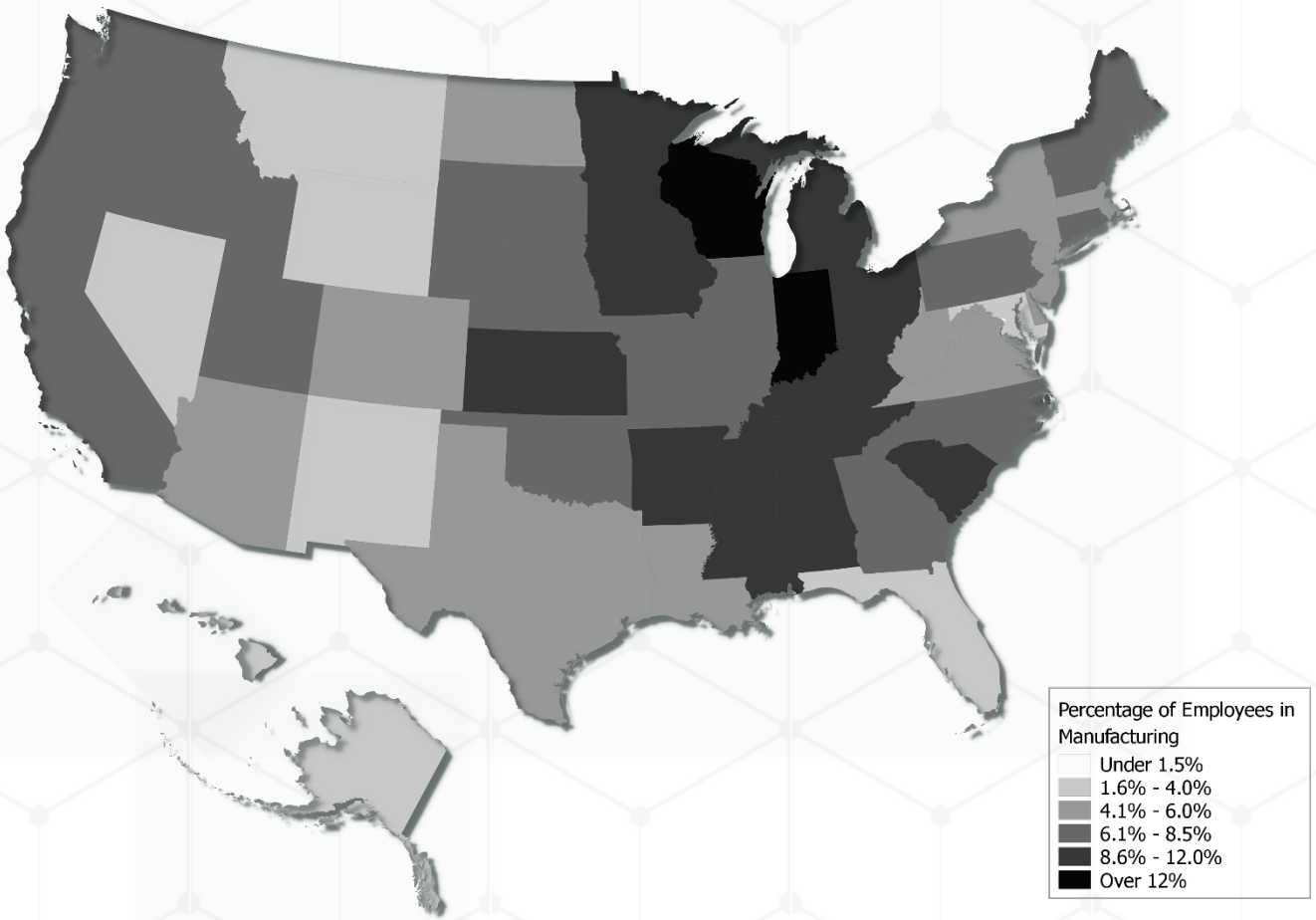
When employment is compared to GSP, Texas and California continue to dominate but a smaller group of Great Lakes states have a strong showing. These include Illinois, Michigan, Indiana, Ohio, and Pennsylvania.

States with Most Employment in Manufacturing

1.	California	1,402,133
2.	Texas	953,778
3.	Ohio	715,200
4.	Michigan	612,097
5.	Illinois	603,153

Source: Bureau of Economic Analysis: Full-Time and Part-Time Wage and Salary Employment By Industry, 2015

Percentage of Employees in Manufacturing



When total share of employment is considered, the heartland and the south stand out. The next chart shows the correlation between share of employment and share of GSP.

States with Highest % of Employees in Manufacturing

1.	Indiana	14.03%
2.	Wisconsin	13.33%
3.	Michigan	11.09%
4.	Iowa	10.81%
5.	Ohio	10.39%

Source: Bureau of Economic Analysis: Full-Time and Part-Time Wage and Salary Employment By Industry, 2015