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The National-Level Economic Impact of the Manufacturing Extension Partnership (MEP): Estimates for Fiscal Year 2018

Jim Robey
W.E. Upjohn Institute for Employment Research, jim.robey@upjohn.org

Randall W. Eberts
W.E. Upjohn Institute for Employment Research, eberts@upjohn.org

Brian Pittelko
W.E. Upjohn Institute for Employment Research

Claudette Robey
W.E. Upjohn Institute for Employment Research, robey@upjohn.org

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Authors

Jim Robey, *W.E. Upjohn Institute for Employment Research*
Randall W. Eberts, *W.E. Upjohn Institute for Employment Research*
Brian Pittelko, *W.E. Upjohn Institute for Employment Research*
Claudette Robey, *W.E. Upjohn Institute for Employment Research*

Upjohn Author(s) ORCID Identifier

https://orcid.org/0000-0002-4668-2567

https://orcid.org/0000-0002-9711-5466

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

MEP • MANUFACTURING EXTENSION PARTNERSHIP

The National-Level Economic Impact of the Manufacturing Extension Partnership (MEP): Estimates For Fiscal Year 2018

W.E. Upjohn Institute for Employment Research
300 South Westnedge Avenue
Kalamazoo, MI 49007
www.Upjohn.org

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MEP Economic Impact Analysis:

Estimates of Fiscal Year 2018

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 and FY17 with survey results from FY18. The Upjohn Institute used the same methodology for the FY18 impact estimates as it used for the previous 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. The study takes the self-reported outcomes of MEP clients at face value, without attempting to validate the reported outcomes.

Three scenarios are presented when estimating the impact of the 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 FY18 ($140 million).

Study Overview (continued)

As discussed later in this report, as much as we tried to replicate the methodology and procedures in the FY16 and FY17 study to estimate the impact of MEP in FY18, there were unavoidable differences. The major concern was the higher response rate to the survey in FY18 compared to FY16 and FY17. Although the number of clients selected for the survey remained relatively the same between the three years, there was a 10% increase in the number of responses from FY17 to FY18 – from 7,228 to 7,986. The actual response rate went from 80.9% in FY17 to 83.9% in FY18. 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.

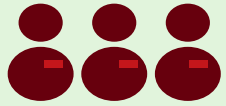
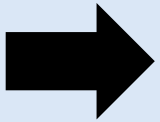
Differences in reported outcomes and estimated net impacts could also be affected by the difference in industry mix of the MEP clients, since REMI estimates separate multipliers for each industry group. Another issue that could affect the estimates was that the REMI model was updated for 2019, the year we conducted the analysis for FY18, and includes somewhat different macroeconomic trends than were embedded in the 2018 model, which was used to analyze the FY17 survey data. The values in Table 1 are from the surveys and show the differences between FY16, FY17, and FY18.

Study Overview (continued)

Table 1: Differences in Survey Impacts, FY18 vs. FY 16 and FY17.

Category	FY16	FY17	FY18	FY16 to FY17 % Change	FY17 to FY18 % Change
Total Jobs	86,541	100,721	121,412	16.4	20.5
Created	19,653	24,210	26,486	23.2	9.4
Retained	66,888	76,511	94,926	14.4	24.1
Total Sales	$9.33b	$12.6b	$15.9b	35.0	26.2
Increased sales	$2.33b	$3.5b	$3.8b	50.2	8.6
Retained sales	$7.0b	$9.1b	$12.0b	30.0	31.9
Cost Savings	$857m	$1.04b	$976m	21.4	-6.2
Investment Savings	$514m	$703m	$724M	32.8	30
Total Investment	$3.5b	$3.5b	$4.0b	0.0	14.3
Products & Process	$1.07b	$1.07b	$1.08b	0.0	0.9
Plant & Equipment	$1.83b	$1.86b	$2.32b	1.64	24.7
Systems & Software Information	$134m	$178m	$206m	32.8	5.7
Workforce Practices	$210m	$199m	$202m	-5.2	1.5
Other	$227m	$233m	$214m	2.6	-8.2

Study Overview: Estimates of Impacts

Forecast	 Jobs	 GDP	 Output	 Personal Income	 Returns to Treasury	ROI Return on Investment
Unconstrained Model Using Industry Variables	843,889	$103.16*	$203.38*	$54.51*	$7.19*	51.4:1
Constrained Model Using Firm Variables	236,802	$24.9*	$46.6*	$15.0*	$2.02*	14.4:1
6.9% of Reported Impact	16,427	$1.62*	$3.04*	$1.04*	$0.140*	1:1

MEP Economic Impact Analysis:

Estimates of Fiscal Year 2018

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 2017 through Q3 2018. 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 9,518 clients from across the country were surveyed. MEP Centers are located in every state and in 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 35 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 captures both employment and sales outcomes, 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 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, is 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,

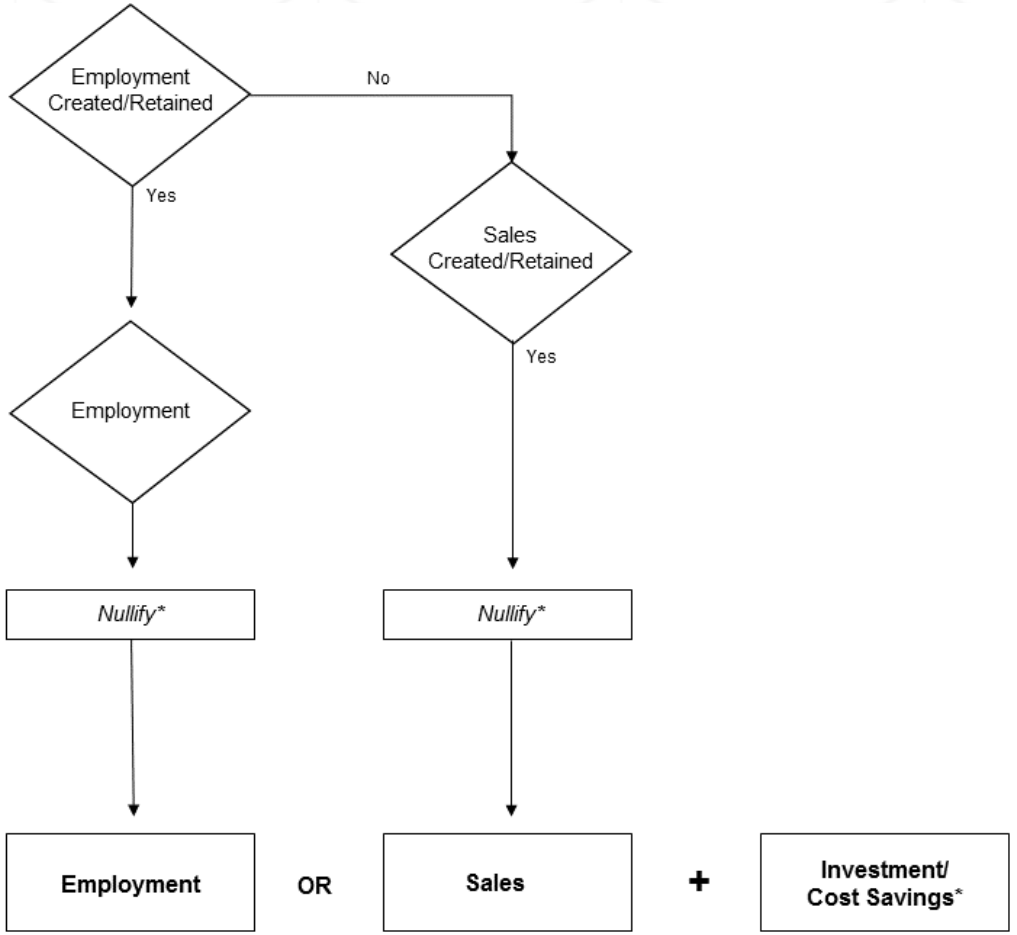


Figure 1: Upjohn's Decision Tree for Using Survey Data

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 2018

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

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% (other investments) to 52.7% (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% of the respondents indicated a positive employment effect**.** Forty-eight percent indicated a positive combined sales effect. About 42% of those surveyed responded "yes" to both the employment and the sales questions, and only 36% 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 totals are reported in the following slides in this section.

Survey Responses (continued)

Table 2: Survey Responses for FY18.

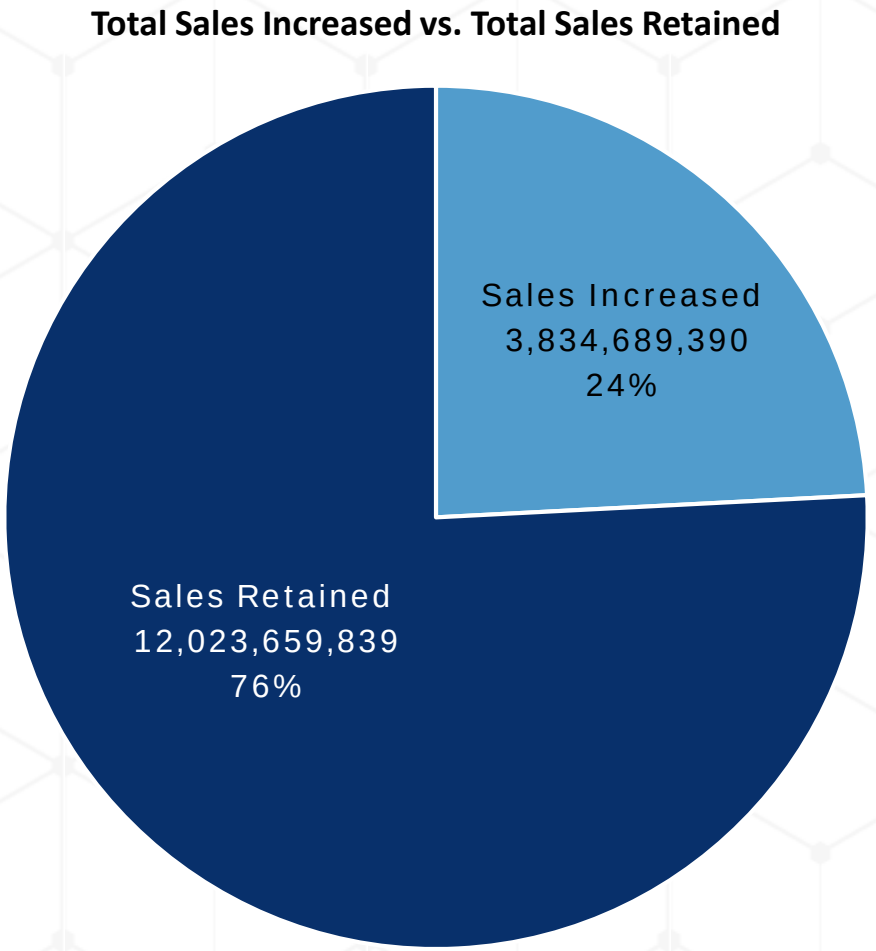
Data Element (variable)	Number Who Indicated MEP Affected a Positive Response
Number of jobs created	3,369
Number of jobs retained	3,828
Increase in sales	2,956
Retained sales	3,353
Cost savings	4,120
Investment in plant and equipment	3,605
Investment in products and processes	3,459
Investment in information systems	2,566
Investment in workforce training	4,443
Other investments	1,465
Unnecessary investments	2,986
Total Responses	7,986

A Summary of Center Activities: Q4 2017 to Q3 2018

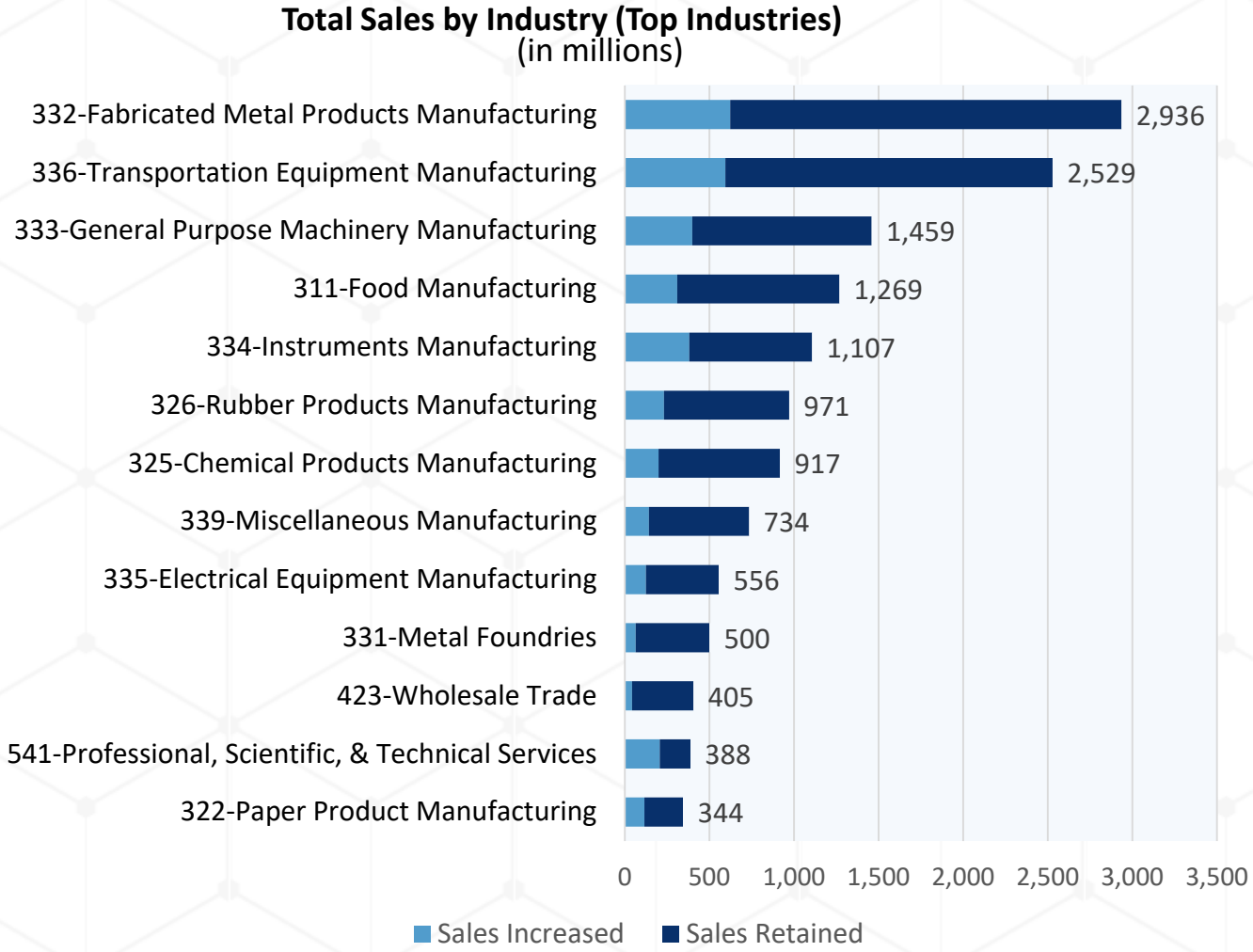
Sales:	**+$15.9b**
o Increased:	$3.8b
o Retained:	$12.0b
Jobs:	**+121,412**
o Created:	26,486
o Retained:	94,926
Cost Savings:	**+$976m**
Investment Savings:	**+$724m**

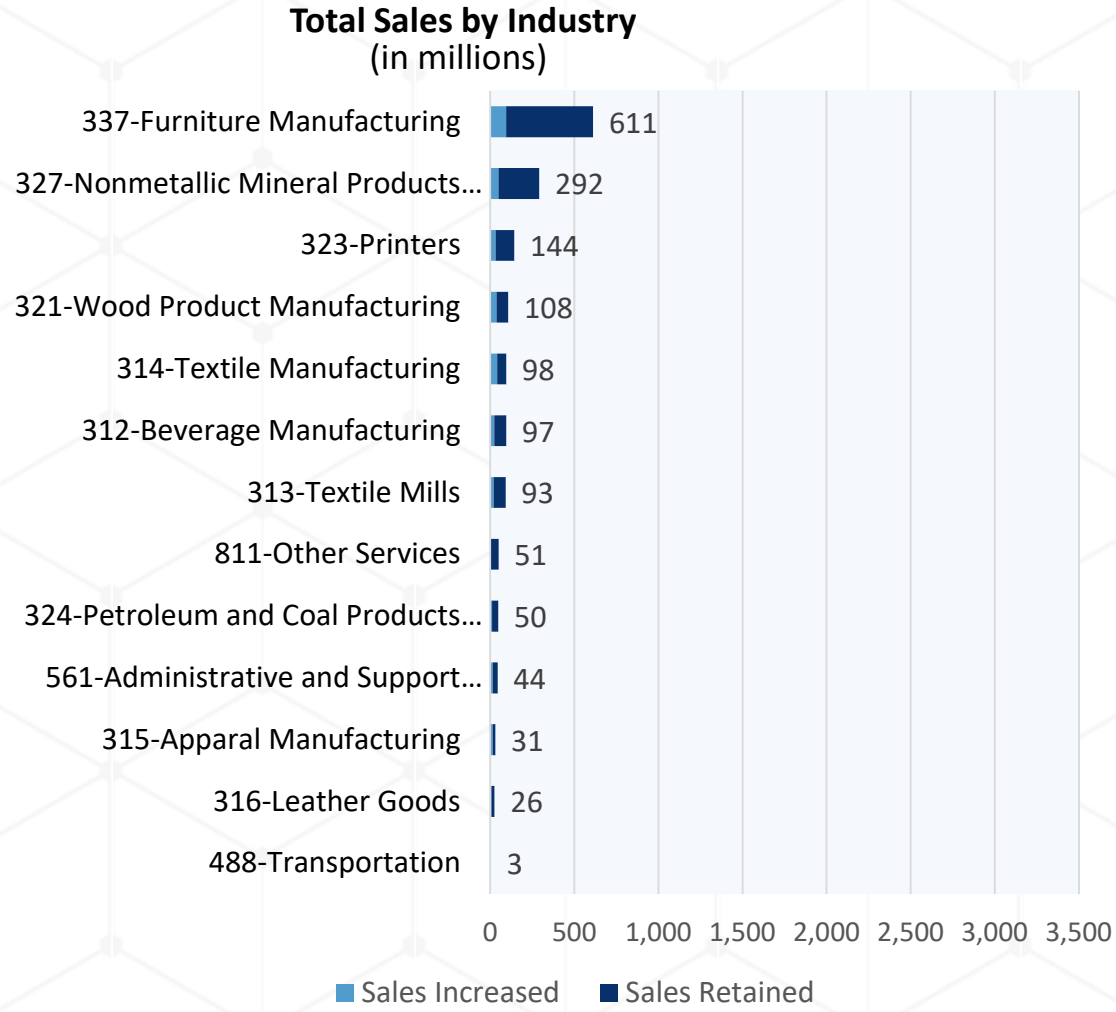
Total investment:	**+$4.0b**
o Products & Process:	$1.08b
o Plant & Equipment:	$2.32b
o Systems & Software:	$206m
o Workforce Practices & Employee Skills	$202m
o Other Areas of Business:	$214m

Overview of Total Sales

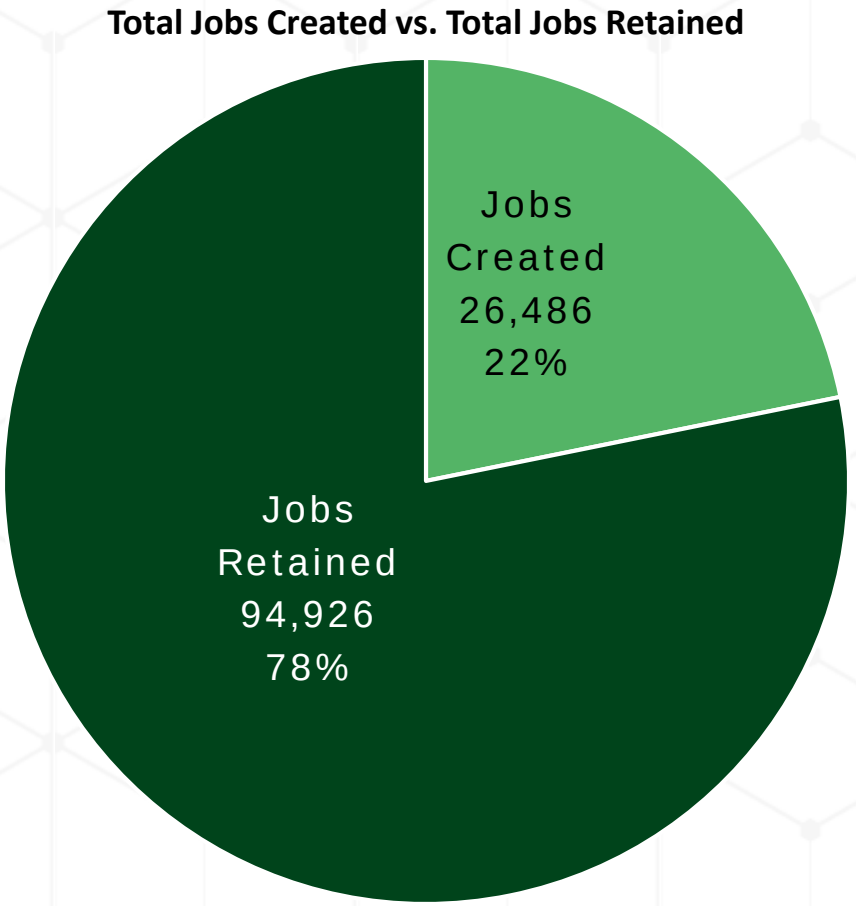


Total Sales by Industry

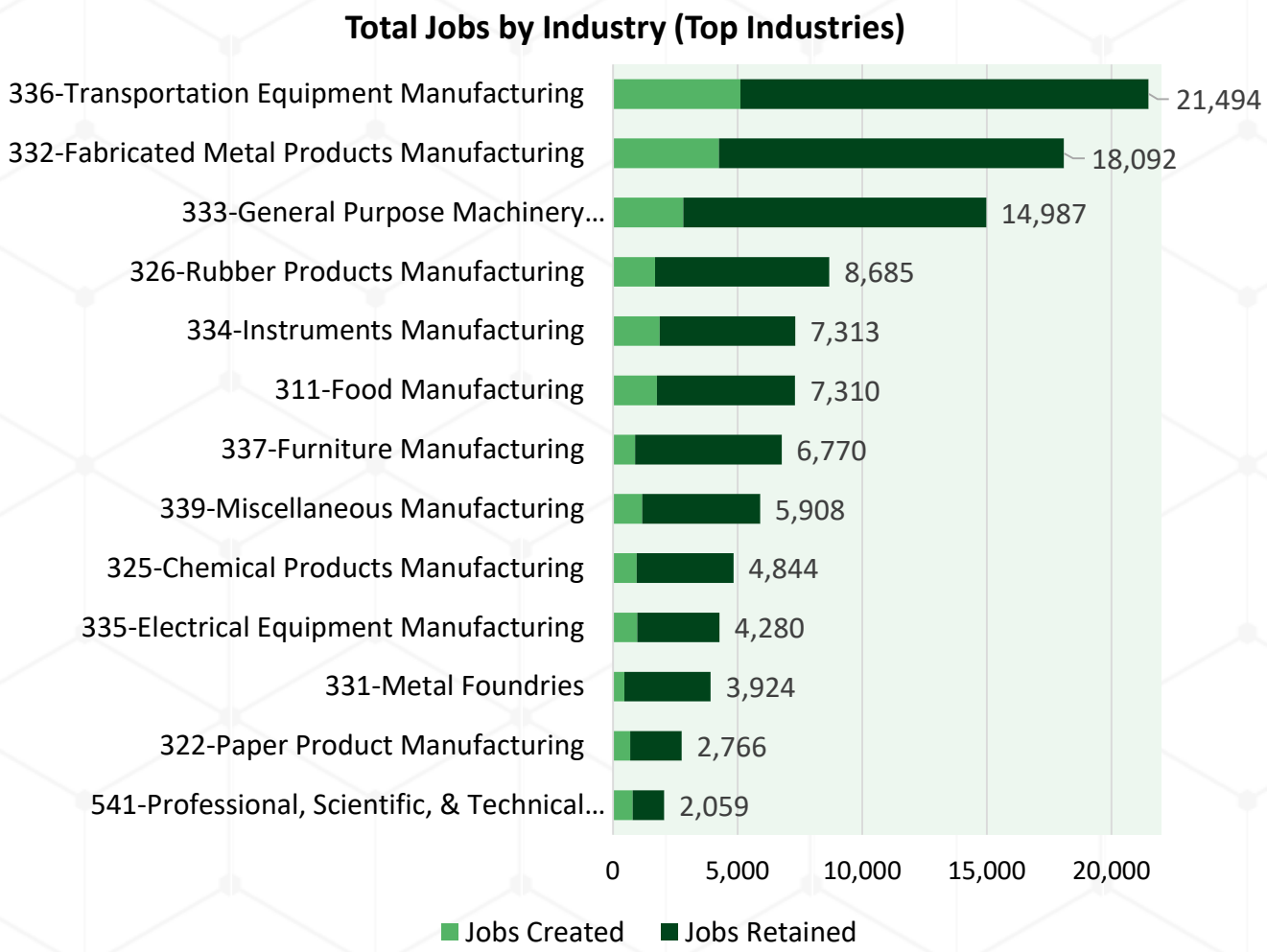


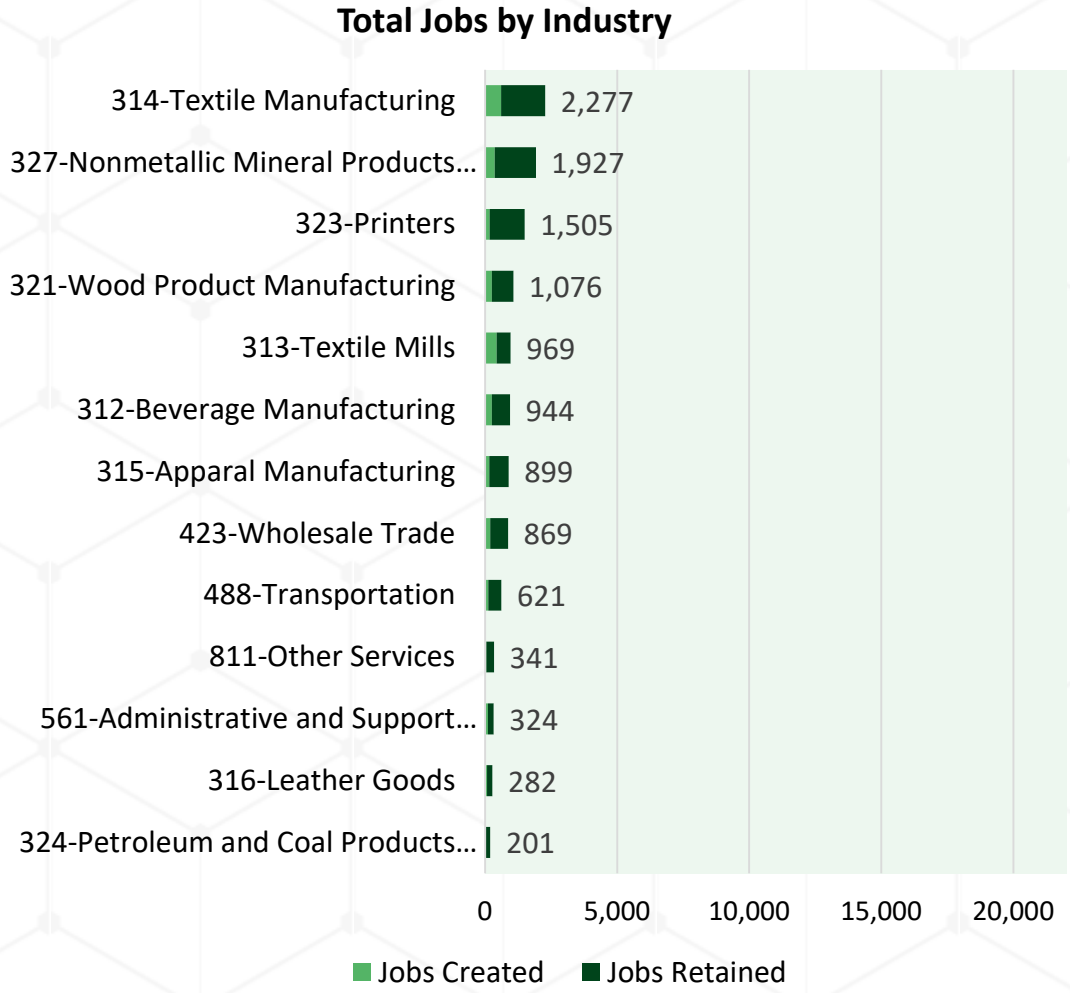


Overview of Total Jobs

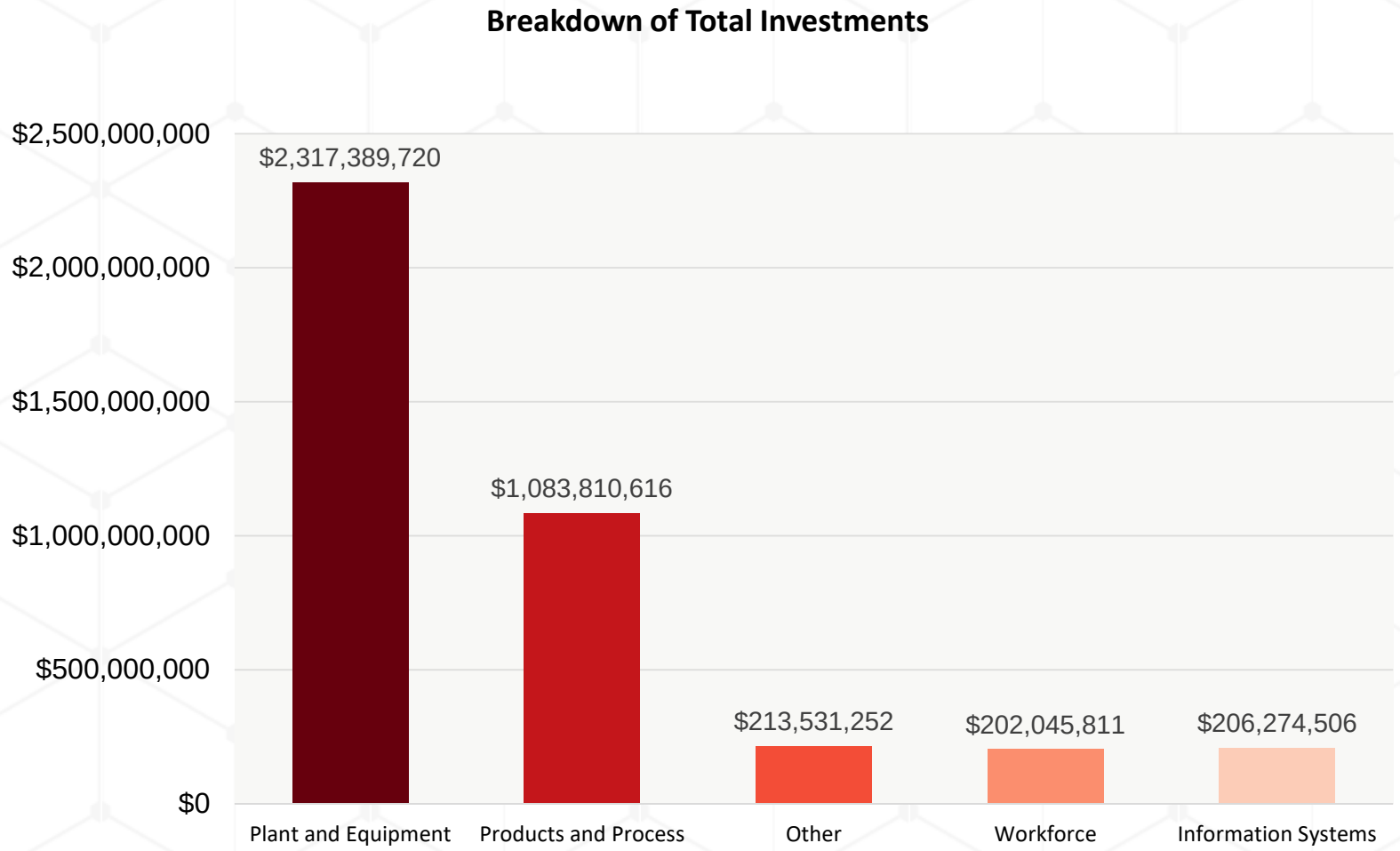


Total Jobs by Industry

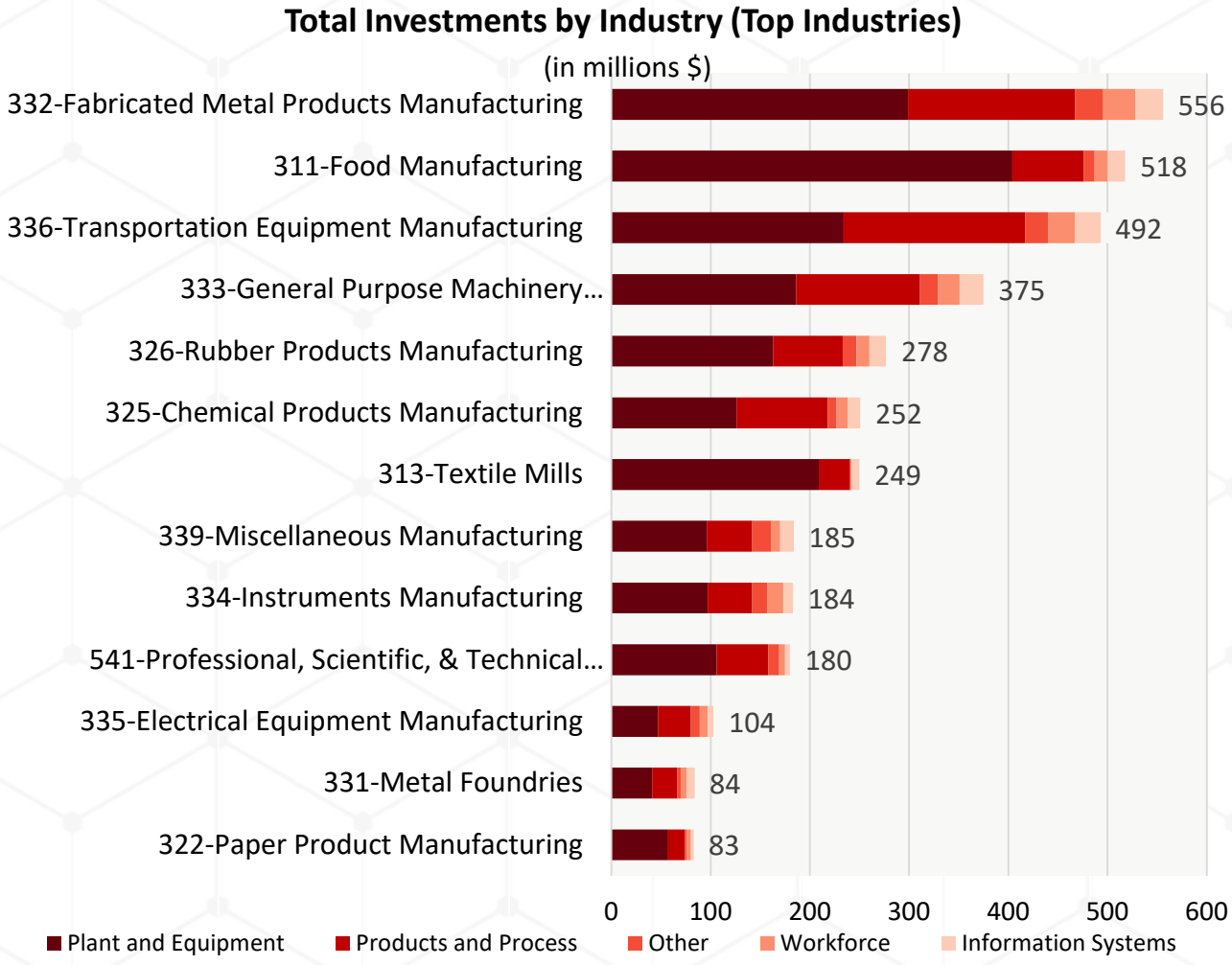


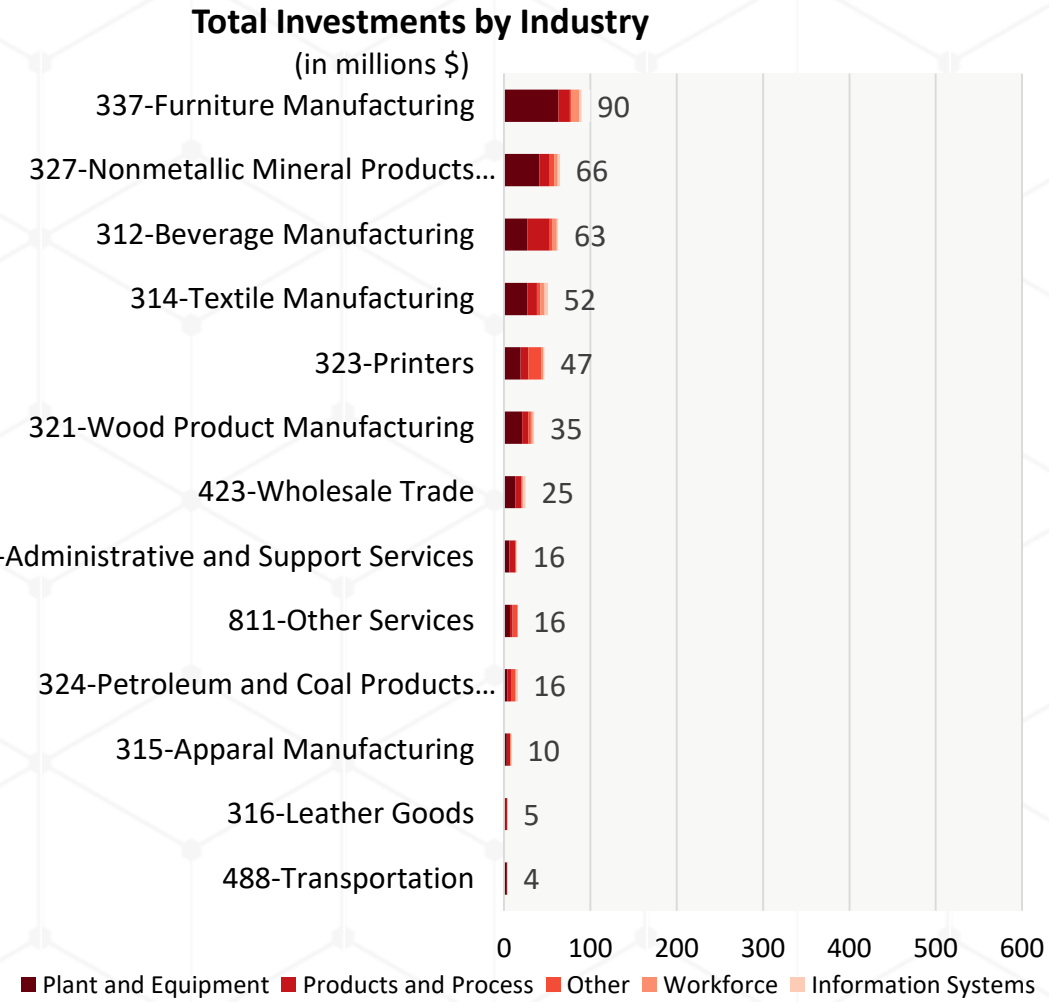


Overview of Total Investments

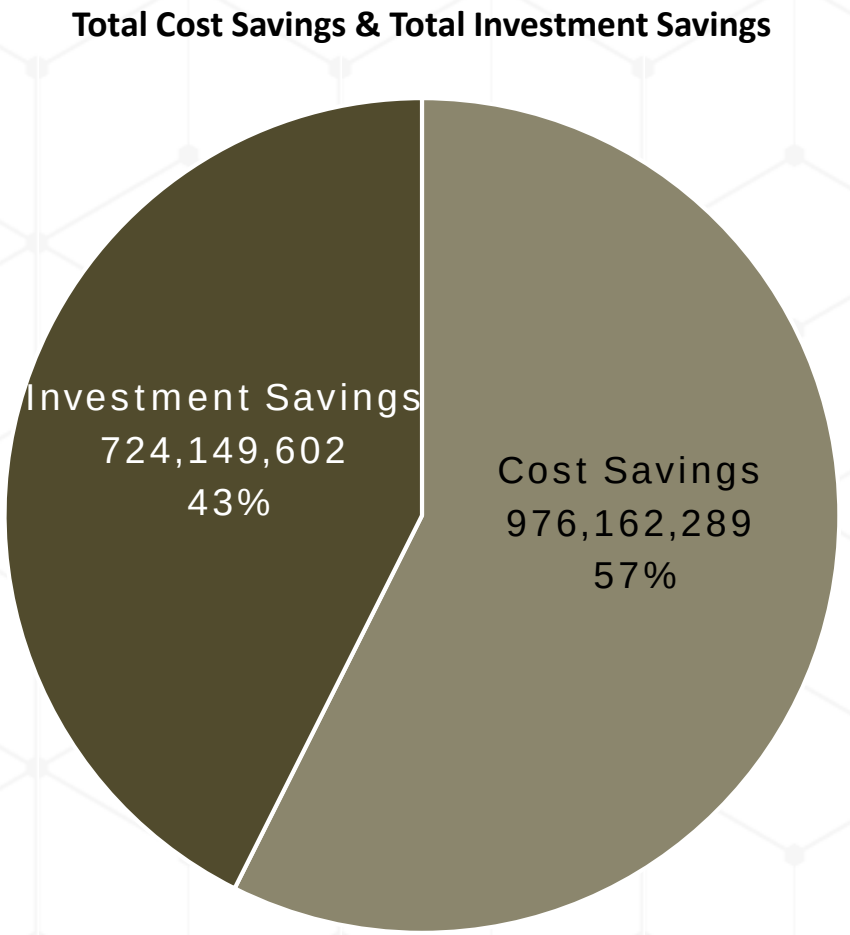


Total Investments by Industry

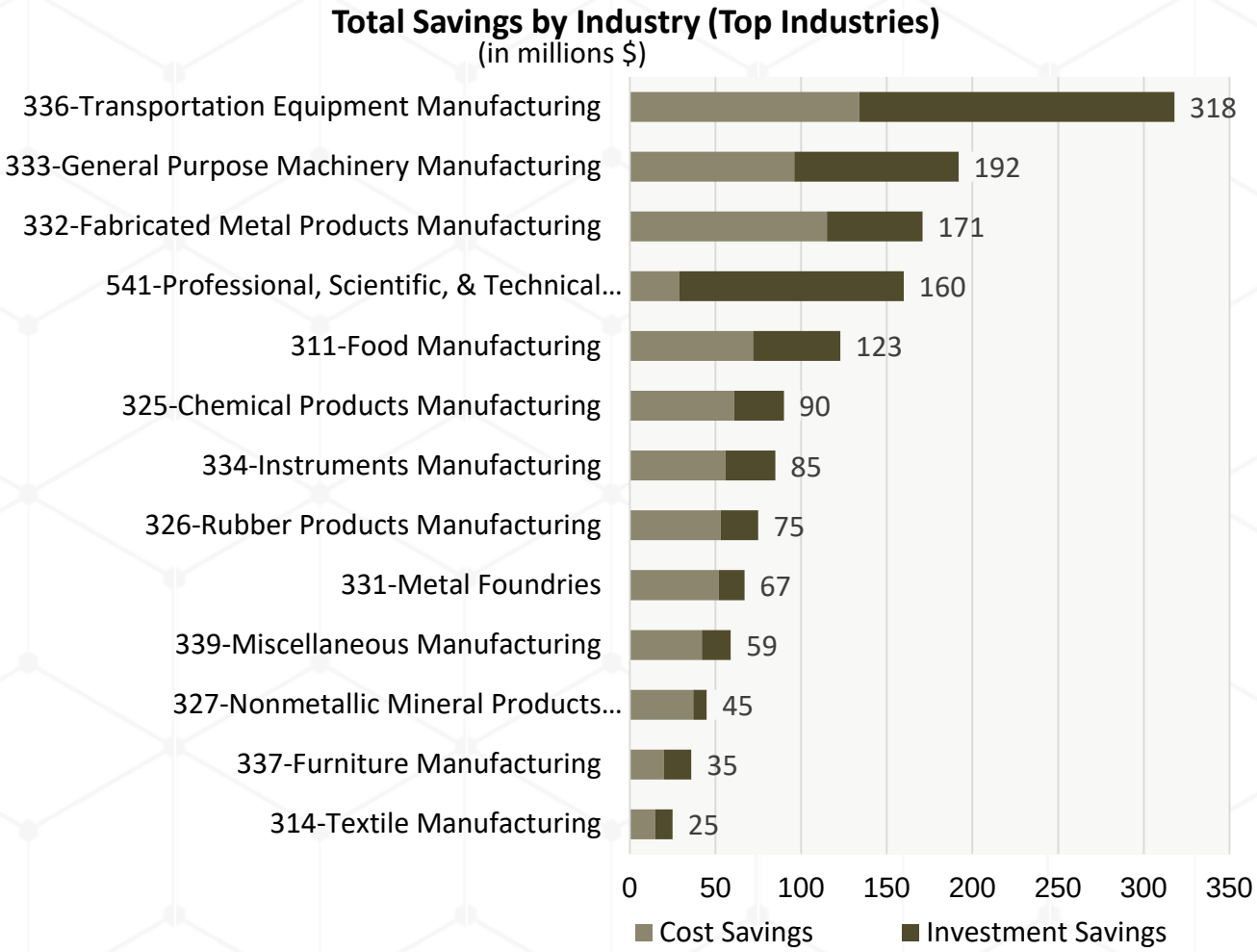


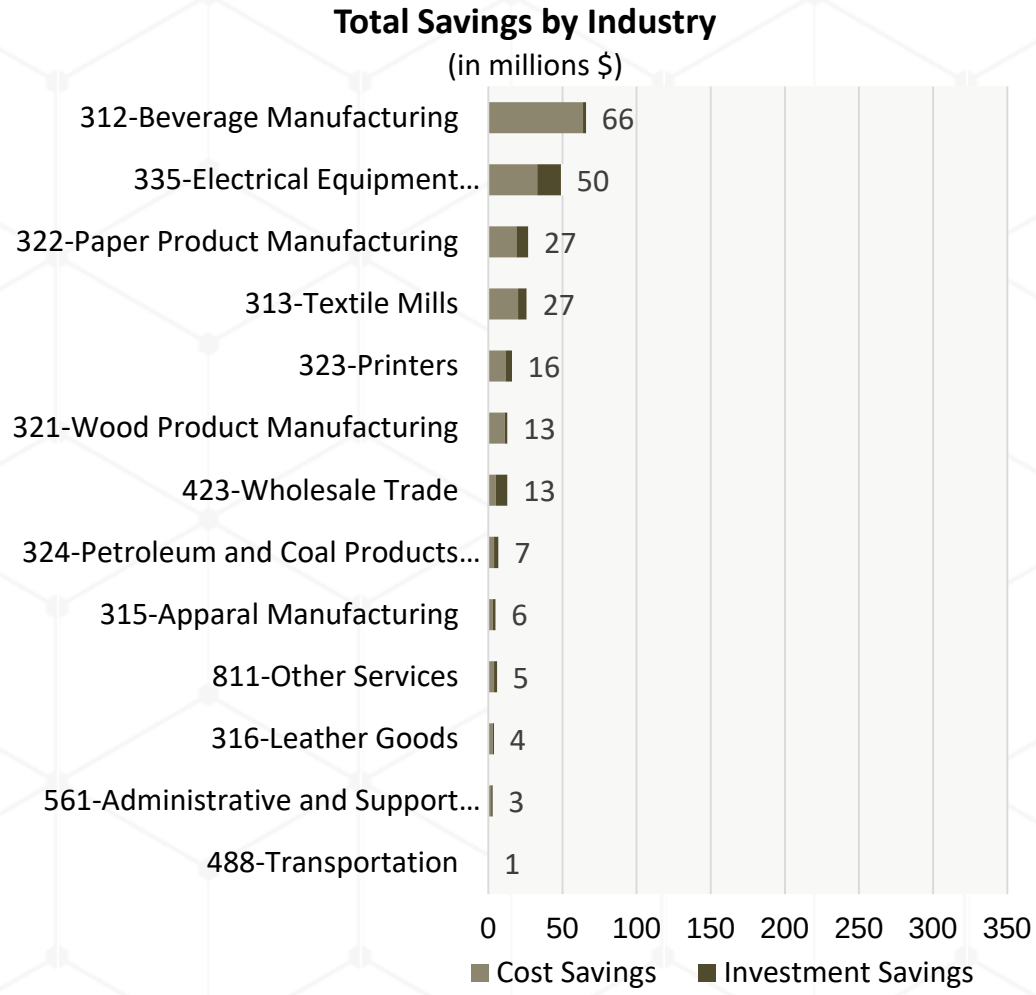


Cost Savings and Investment Savings

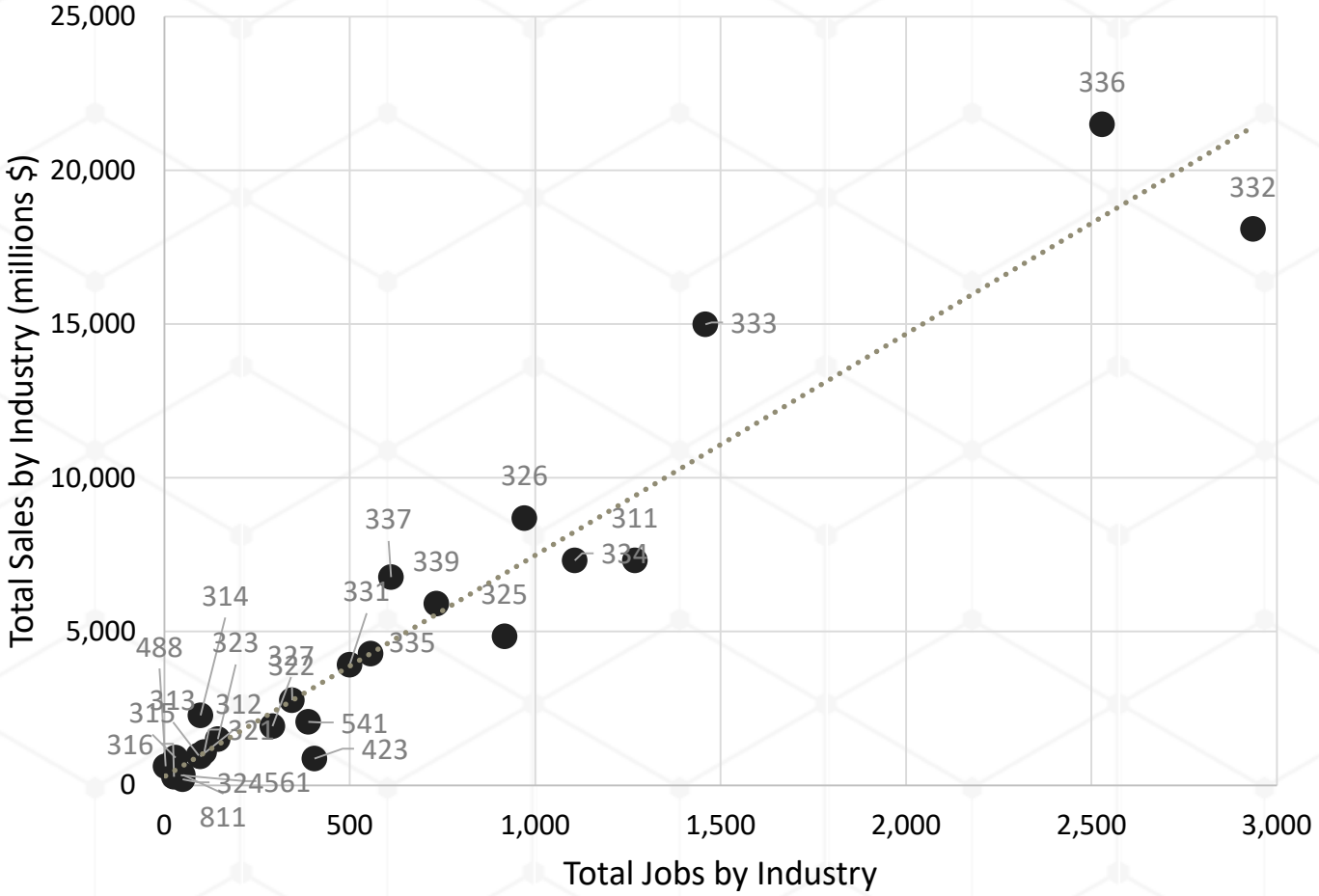


Total Savings by Industry



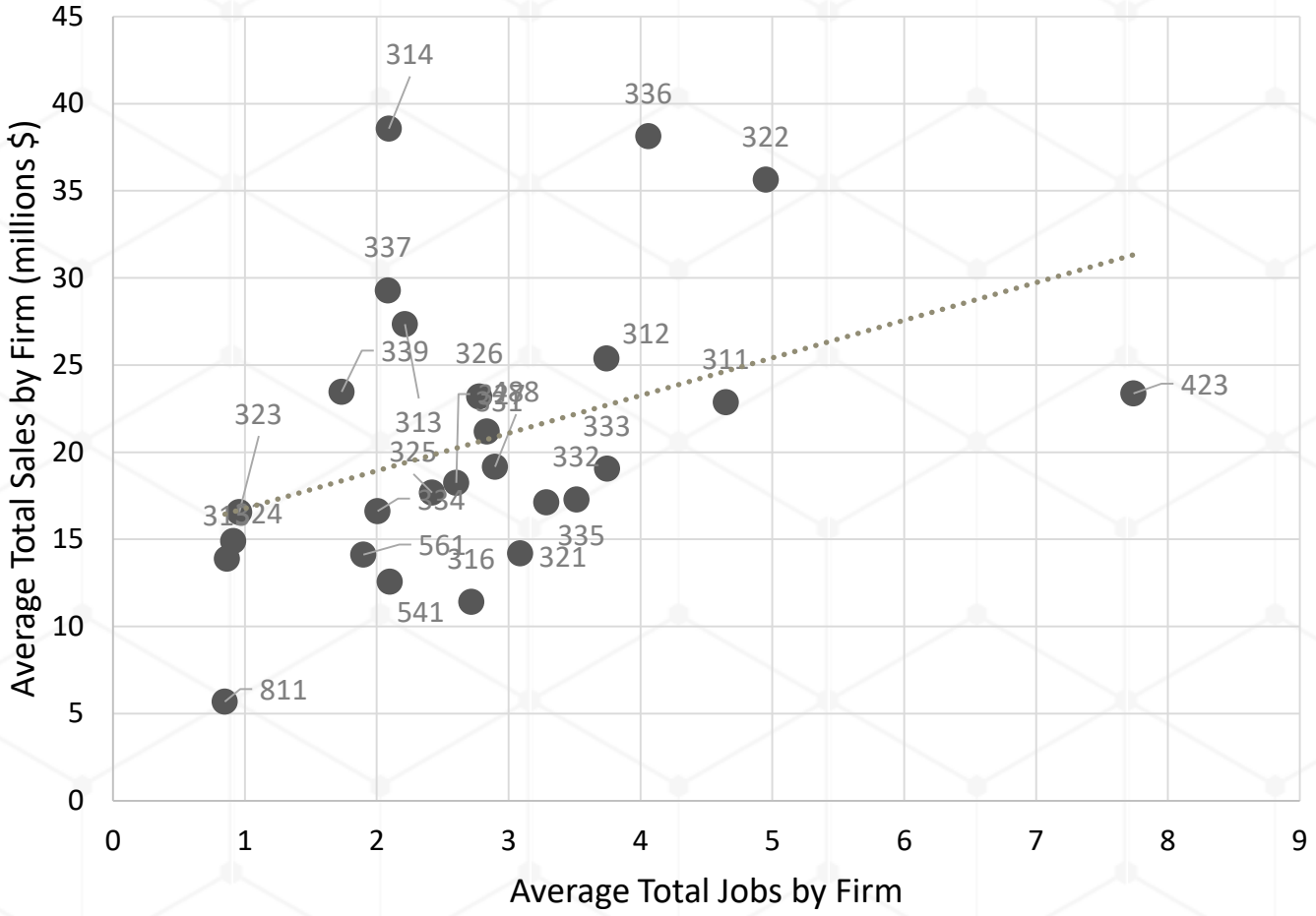


Total Sales and Total Jobs by Industry



NAICS-Industry	NAICS-Industry
311-Food Manufacturing	331-Metal Foundries
312-Beverage Manufacturing	332-Fabricated Metal Products Manufacturing
313-Textile Mills	333-General Purpose Machinery Manufacturing
314-Textile Manufacturing	334-Instruments Manufacturing
315-Apparel 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 & Coal Products Manufacturing	488-Transportation
325-Chemical Products Manufacturing	541-Professional, Scientific, & Technical Services
326-Rubber Products Manufacturing	561-Administrative & Support Services
327-Nonmetallic Mineral Products Manufacturing	811-Other Services

Total Sales and Total Jobs by Firm



NAICS-Industry	NAICS-Industry
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314-Textile Manufacturing	334-Instruments Manufacturing
315-Apparel 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 & Coal Products Manufacturing	488-Transportation
325-Chemical Products Manufacturing	541-Professional, Scientific, & Technical Services
326-Rubber Products Manufacturing	561-Administrative & Support Services
327-Nonmetallic Mineral Products Manufacturing	811-Other Services

MEP Economic Impact Analysis:

Estimates of Fiscal Year 2018

THE CHANGE FROM 2017 VS 2018

Estimating FY18 Using FY17 Response Rates

The impacts estimated for FY18 are higher than for FY17. 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 that could affect the higher estimates for FY18: a difference in the mix of industries served by the centers and the difference in the response rate to the survey.

With respect to the industry mix, REMI estimates dynamically a set of multipliers for each industry; thus the "spillover" effects to both indirect and induced jobs will vary by industry. In comparing the two periods, 4,039 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 FY17 only and those clients who were included in FY18 only.

The number of clients selected for survey in FY18 was higher than FY17, at 9,518 and 8,920 respectively. Similarly the response rate to the survey was in higher in FY18 (83.1% and 80.1%, respectively). As with the description of the difference in industry composition, we also divided the clients from FY17 and FY18 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 FY17, and 3) the group in which clients responded to the survey only in FY18. We found that the response rate of clients who responded in both years was lower in FY18 than FY17 (85% down from 88%) while the response rate for those FY18 survey respondents was much higher, 83% compared to 73% in FY17 only.

Estimating FY18 Using FY17 Response Rates (continued)

We also found that those who responded to the survey in general were more likely to respond positively to the “jobs creation” question in FY18 than in FY17, 35% versus 31%, respectively.

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 or retained between FY17 and FY18 increased by 21%, while the response rate increased overall by 4%.

Our approach to estimating the number of jobs created in FY18 without the increase in response rate would be to reduce the number of respondents in FY18 to that in FY17 and multiply that number by the number of jobs created per respondent.

We counted fully all the jobs created and retained by respondents in both years. We then discounted the jobs created and retained by firms that responded in FY18 only to that of FY17, and added that to the jobs created and retained by firms that responded in both years. This adjustment brings the total jobs created and retained down to 112,921 from 121,412.

While using all survey responses provided an estimated impact of 236,802 total jobs, controlling for comparable response rates reduces the impact estimates by about 7% to 220,231.

Estimating FY18 Using FY17 Response Rates (continued)

Fewer responses also reduced estimates of gross domestic product (GDP) from almost $25 billion to about $23 billion, output from $46.6 billion to $43.3 billion, personal income from $15.04 billion to $13.99 billion, and returns to the Treasury from $2.01 billion to $1.88 billion. Even with reduced responses and the associated impacts to inputs, the ratio of the return on the investment of $140 million was at 13.4:1.

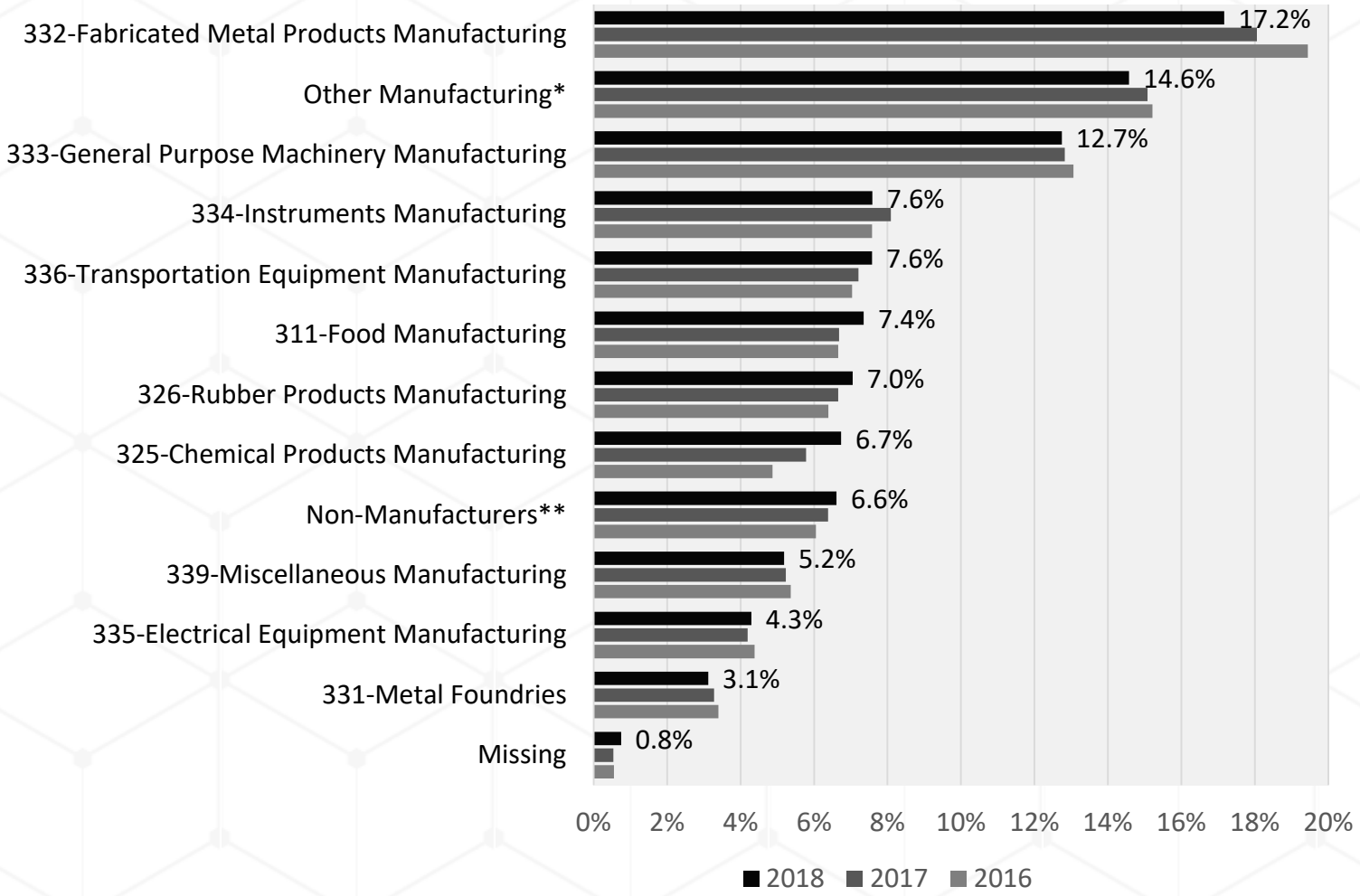
Average Number Indicated MEP Affected a Positive Response: Change from 2016 to 2018

Data Element (variable)	Positive Response (2016)	(%)	Positive Response (2017)	(%)	Difference FY16 to FY17	Positive Response (2018)	(%)	Difference FY17 to FY18
Number of jobs created	2,406	37.0%	2,789	38.6%	1.6	3,369	42.2%	3.6
Number of jobs retained	2,881	44.3%	3,339	46.2%	1.9	3,828	47.9%	1.7
Increase in sales	2,088	32.1%	2,421	33.5%	1.4	2,956	37.0%	3.5
Retained sales	2,242	34.5%	2,739	37.9%	3.4	3,353	42.0%	4.1
Cost savings	3,217	49.4%	3,600	49.8%	0.4	4,120	51.6%	1.8
Investment in plant and equipment	2,748	42.2%	3,096	42.8%	0.6	3,605	45.1%	2.3
Invest in products and processes	2,442	37.5%	2,900	40.1%	2.6	3,459	43.3%	3.2
Investment in information system	1,853	28.5%	2,174	30.1%	1.6	2,566	32.1%	2.0
Investment in workforce training	3,315	50.9%	3,812	52.7%	1.8	4,443	55.6%	2.9
Other investments	1,116	17.2%	1,378	19.1%	1.9	1,465	18.3	-0.8
Unnecessary investments	2,272	34.9%	2,472	34.2%	-0.7	2,986	37.4%	3.2
Total Responses	6,507		7,228			7,986		

FY17 Study Findings, Controlling for Change in Response Rates

Forecast	Jobs	GDP	Output	Personal Income	Returns to Treasury	ROI Return on Investment
FY17 Findings Using Firm Variables	219,148	$22.01*	$40.34*	$13.76*	$1.86*	14.5:1
FY18 All Responses Using Firm Variables	236,802	$24.9*	$46.6*	$15.04*	$2.01*	14.4:1
FY18 with FY17 Response Rates Using Firm Variables	220,231	$23.17*	$43.35*	$13.99*	$1.88*	13.4:1

Industry Mix

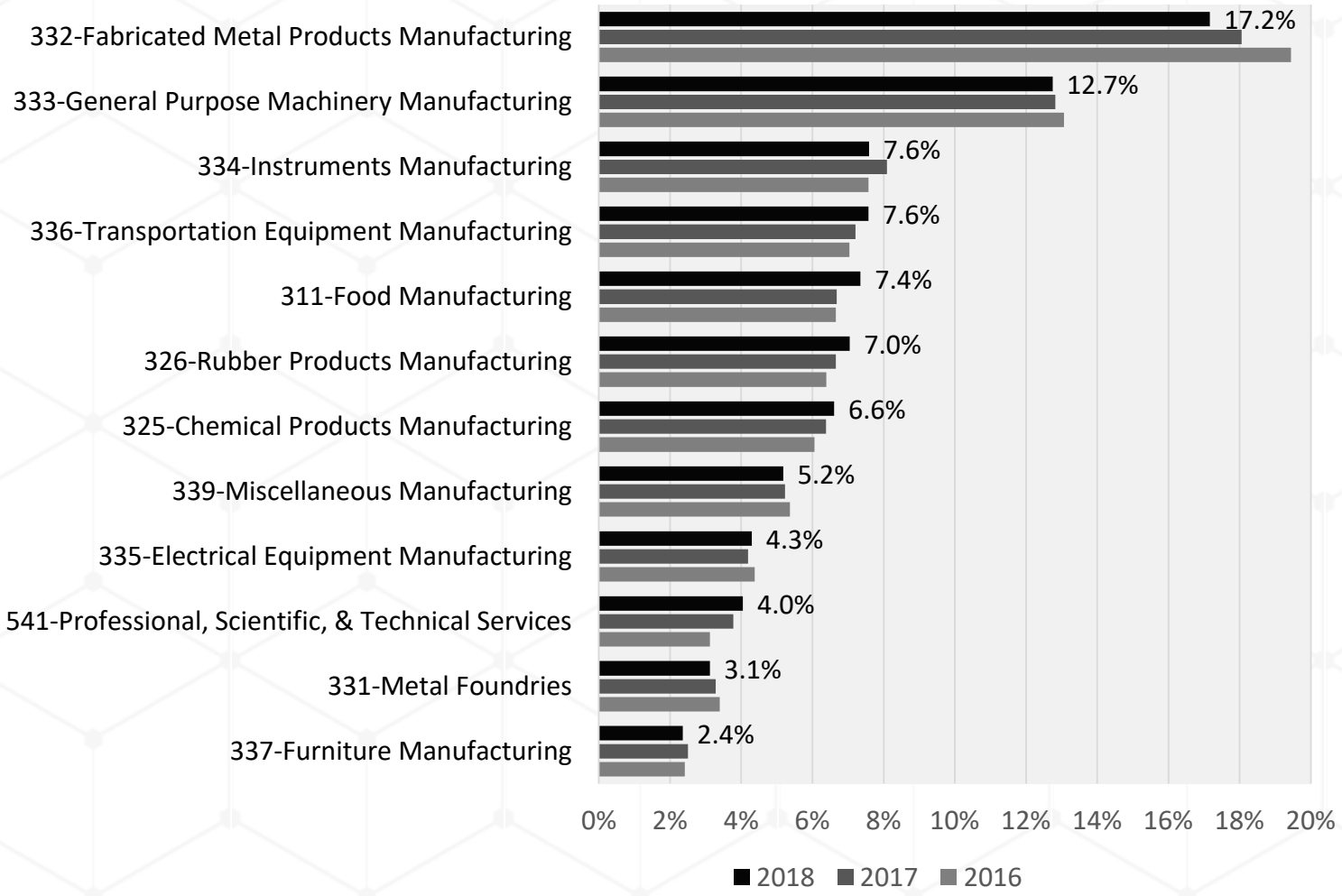


Total Respondents

Industry	2016	2017	2017
332-Fabricated Metal Products Manufacturing	1,265	1,305	1,371
Other Manufacturing*	990	1090	1164
333-General Purpose Machinery Manufacturing	850	927	1,018
334-Instruments Manufacturing	493	585	606
336-Transportation Equipment Manufacturing	458	521	605
311-Food Manufacturing	433	483	587
326-Rubber Products Manufacturing	416	481	563
325-Chemical Products Manufacturing	394	461	528
Non-Manufacturers**	317	418	538
339-Miscellaneous Manufacturing	349	378	414
335-Electrical Equipment Manufacturing	285	303	343
331-Metal Foundries	221	237	249
Missing	36	39	60

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

Industry Mix (continued)



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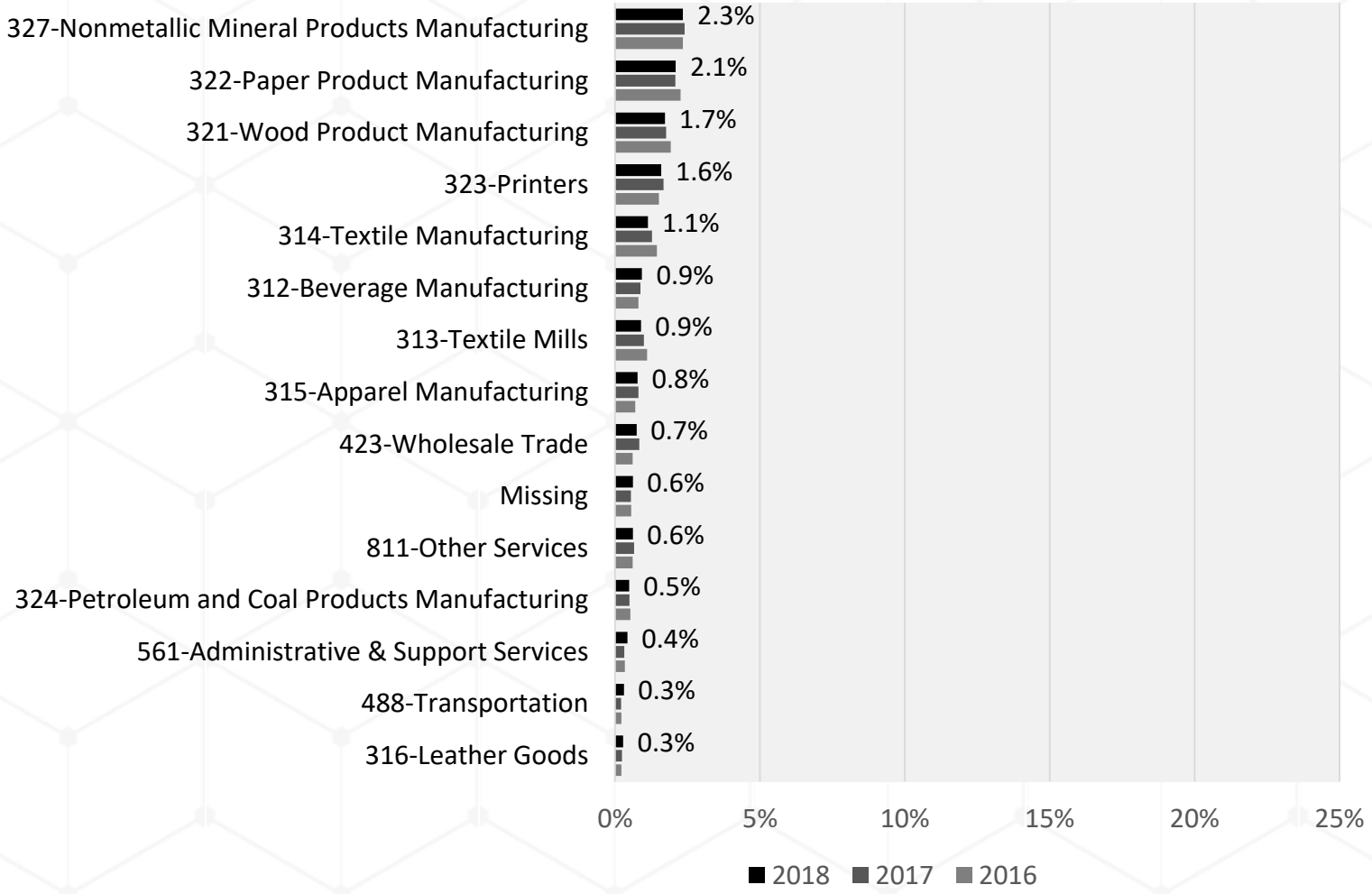
325-Chemical Products Manufacturing	394	461	528
339-Miscellaneous Manufacturing	349	378	414
335-Electrical Equipment Manufacturing	285	303	343
541-Professional, Scientific, & Technical Services	203	273	323
331-Metal Foundries	221	237	249
337-Furniture Manufacturing	157	181	188

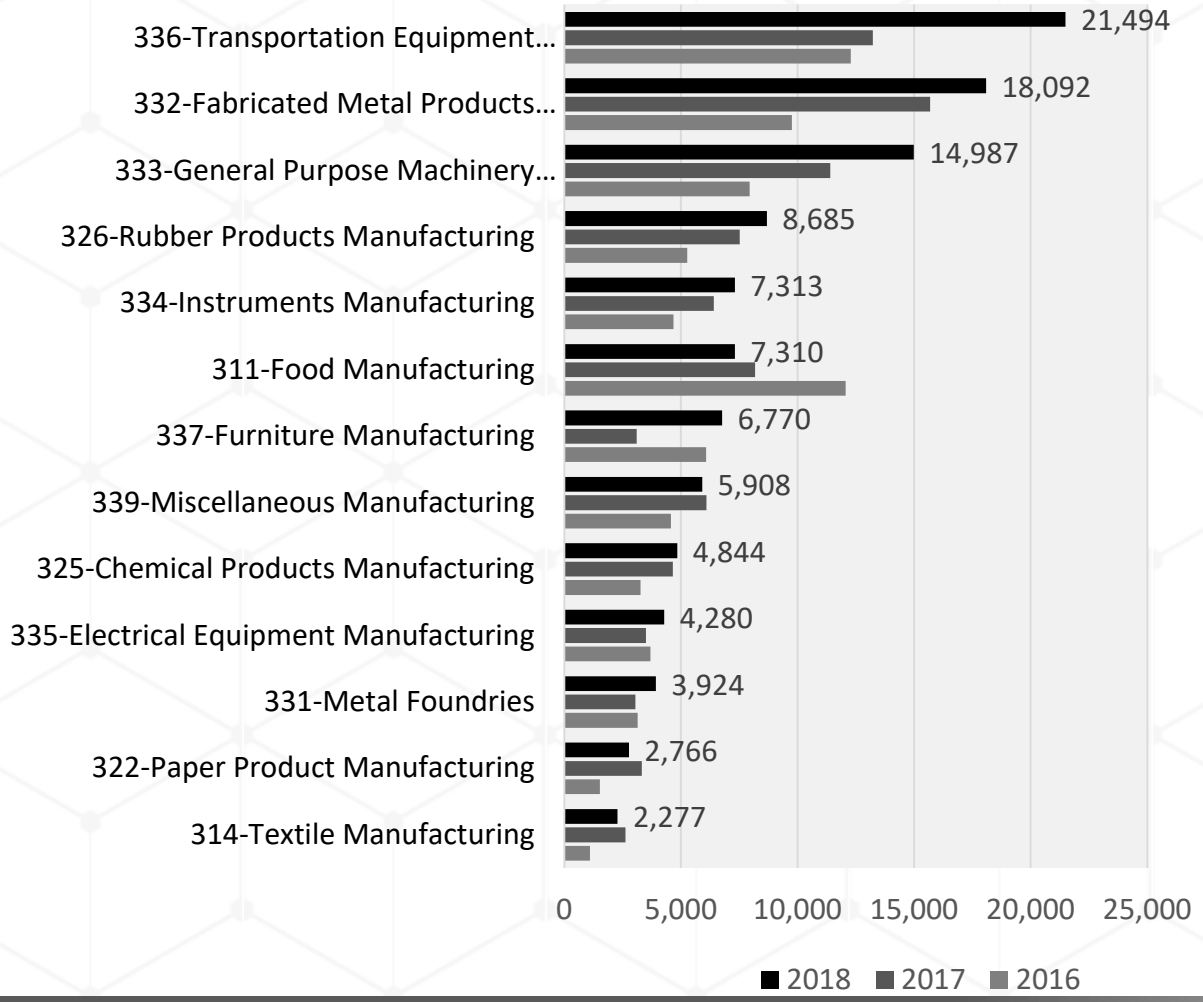
Industry Mix (continued)

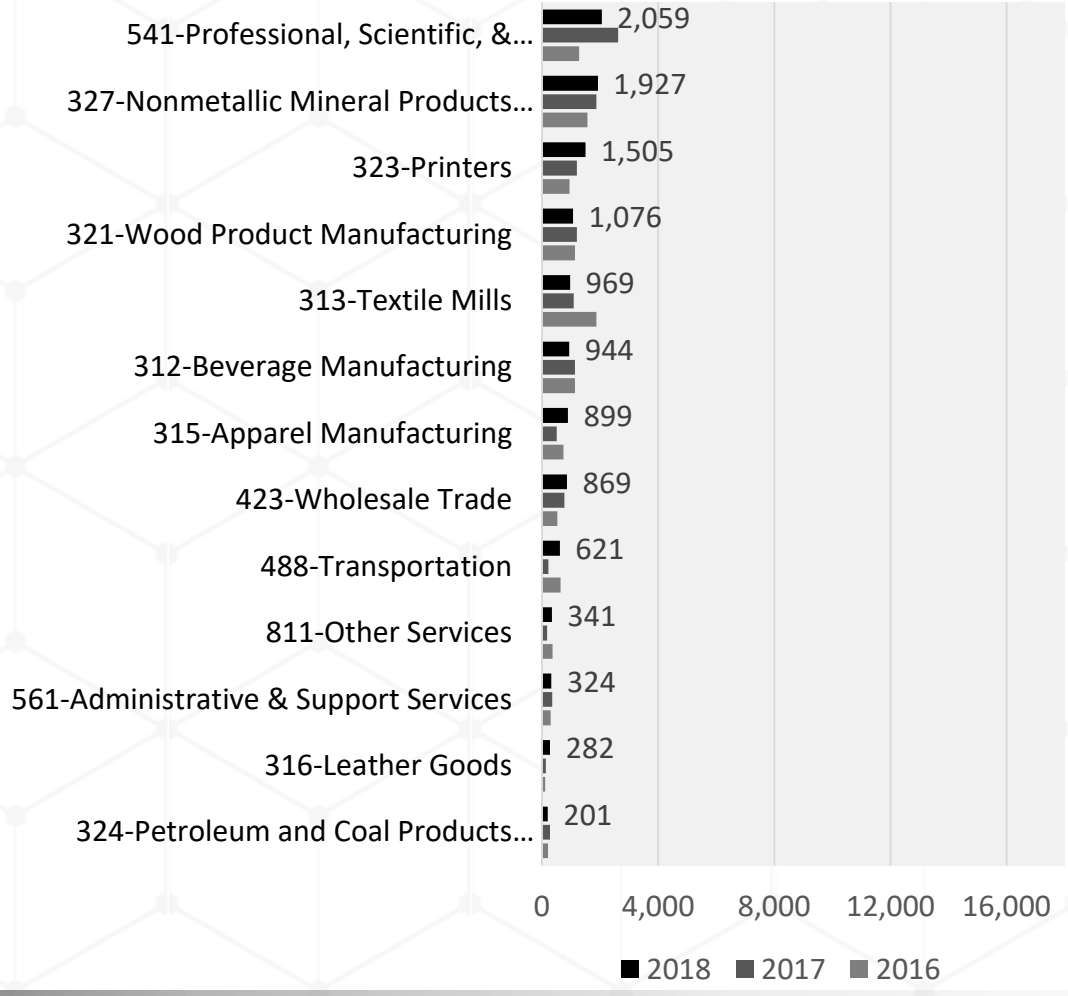


Total Respondents

Industry	2016	2017	2018
327-Nonmetallic Mineral Products Manufacturing	152	173	187
322-Paper Product Manufacturing	147	150	167
321-Wood Product Manufacturing	125	127	137
323-Printers	98	121	127
314-Textile Manufacturing	94	92	90
312-Beverage Manufacturing	52	63	74
313-Textile Mills	72	72	71
315-Apparel Manufacturing	45	58	62
423-Wholesale Trade	39	60	59
811-Other Services	39	47	49
Missing	36	39	49
324-Petroleum and Coal Products Manufacturing	34	36	39
561-Administrative & Support Services	22	23	34
488-Transportation	14	15	24
316-Leather Goods	14	17	22

Total Jobs per Industry





MEP Economic Impact Analysis:

Estimates of Fiscal Year 2018

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., Senior Researcher; Carlesa Beatty, Brian Pittelko, and Claudette Robey.

For additional information or questions, contact Jim Robey at 269-385-0450 or jrobey@Upjohn.org. Additional information and research on the Upjohn Institute is available at www.Upjohn.org.

MEP Economic Impact Analysis:

Estimates of Fiscal Year 2018

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 2018 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. In tax year 2018, the tables were published for categories single, married filing separately, married filing jointly, and head of household. For purposes of this study, the “head of household” tax rate was applied to estimates of average income.

Appendix II: NAICS Codes

NAICS-Industry	NAICS-Industry
311-Food Manufacturing	331-Metal Foundries
312-Beverage Manufacturing	332-Fabricated Metal Products Manufacturing
313-Textile Mills	333-General Purpose Machinery Manufacturing
314-Textile Manufacturing	334-Instruments Manufacturing
315-Apparel 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 & Coal Products Manufacturing	488-Transportation
325-Chemical Products Manufacturing	541-Professional, Scientific, & Technical Services
326-Rubber Products Manufacturing	561-Administrative & Support Services
327-Nonmetallic Mineral Products Manufacturing	811-Other Services