7-20-2020

The Economic Impact of the Manufacturing Extension Partnership (MEP), 2018

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

Kathleen Bolter
W.E. Upjohn Institute for Employment Research

The Economic Impact of the Manufacturing Extension Partnership (MEP) in Michigan: Estimates for the Michigan Manufacturing Technology Center in Fiscal Year 2018

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

February 19, 2019

MICHIGAN MANUFACTURING TECHNOLOGY CENTER
MANUFACTURE SMARTER

MEP • MANUFACTURING EXTENSION PARTNERSHIP





MMTC Economic Impact Analysis

EXECUTIVE SUMMARY

Study Overview

The Michigan Manufacturing Technology Center (MMTC) is the state of Michigan's center for the Hollings Manufacturing Extension Partnership (MEP), which is part of the National Institute of Standards and Technology (NIST). MMTC engaged the W.E. Upjohn Institute for Employment Research to conduct an analysis of the overall effect of MMTC projects on the state of Michigan's economy. MEP centers assist 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, MMTC clients are surveyed 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 MMTC 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 MMTC on Michigan's economy, and is then combined with the client-reported outcomes from other state MEP centers to estimate the impact to the U.S. economy. Using the REMI model developed for the Upjohn Institute and

Study Overview

configured specifically for the state of Michigan, this study estimates the indirect and induced effects of the reported increase in jobs, sales, cost savings, and investments by MMTC clients.

Two scenarios are presented in this study. 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. The use of *industry* variables in REMI assumes that all production is exported out of the study region. In this case, the assumption is that the output from MMTC clients would be consumed outside of the state of Michigan. 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 time. However, the likelihood that a significant portion of firm output would be exported out of the state is reasonable. In two prior Upjohn Institute studies of the aggregate impacts of all MEP centers on the macro economy, the use of REMI's industry variables was cautioned, as it was more likely that a much smaller share of domestic production would be exported out of the country than out of a state. This scenario, using a more unconstrained set of variables, is included to serve as an upper bound on the estimates of impacts.

The second scenario provides a set of estimates and

Study Overview

potentially a more accurate, yet conservative, assumption that competition among firms reduces the outcomes as a result of competition. In the second scenario, using REMI's *firm* variables, it is not assumed that all output is exported and that some firms with more productive approaches will "crowd out" other less-productive firms. In this case, the impacts, while net positive, are offset by losses in sales and employment in those firms that are crowded out. The results of the analysis are displayed on the next slides.

Estimates of Impacts & ROI

Forecast	Jobs	GDP	Output	Personal Income	Returns to Michigan
Unconstrained Model Using Industry Variables	35,863	$3.968	$11.477	$2.332	$.071
Constrained Model Using Firm Variables	29,054	$3.166	$8.951	$1.884	$.057

		Constrained Model	Unconstrained Model
Source of MMTC Funding	Investment in MMTC	Return Per Dollar	Return Per Dollar
State of Michigan	$2,150,000	$26.64	$32.97
NIST/MEP	$4,229,000	$13.54	$16.76
Combined State/MEP	$6,379,000	$8.98	$11.11

*Dollars in billions

A Summary of Center Activities

Q4 2017 to Q3 2018

Sales:	**+$1.8b**
o Increased:	$0.25b
o Retained:	$1.6b
Jobs:	**+10,651**
o Created:	1,259
o Retained:	9,392
Cost Savings:	**+$62.1m**
Investment savings:	**+$19.6m**

Total Investment:	**+$195.7m**
o Products & Process:	$64.7m
o Plant & Equipment:	$98.4m
o Systems & Software:	$15.1m
o Workforce Practices & Employee Skills:	$9.0m
o Other Areas of Business:	$8.6m





MMTC Economic Impact Analysis

MODELLING THE NET IMPACT OF MMTC ACTIVITIES

Modelling the Net Impact

As Upjohn was not able to validate the accuracy of the outcomes given in the client self-reported surveys, we present some caveats when interpreting the results. These caveats are similar to estimating the net impact on the local economy of a company that reports its plans to expand its employment by an anticipated number of workers. In estimating the net impact of such an exogenous shock to a local economy, the company's plans are accepted at face value.

To be consistent with the methodology applied to the MEP / NIST 2017 and 2018 net impact analyses, Upjohn followed a guide created by Mark Ehlen and M. Hayden Brown (2000) entitled, "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 state economy.

Decisions Regarding Data Elements

Although the MMTC client survey includes both employment and sales, both can, with caveats, be used in the REMI model at the same time without double counting the effects of the outcomes associated with MMTC activities. Either employment or sales should be used consistently when aggregating the responses. Contrary to the guide's suggestion, Upjohn chose to use the

Modelling the Net Impact

reported estimates of the number of jobs created or retained, when available, instead of sales. This decision was based on Upjohn's observation and assumption that businesses are better able to estimate the impact of MMTC 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 MMTC activities. Sales, on the other hand, are more volatile and depend on outside market factors, which are beyond a firm's control. When employment is not available from the surveys, however, 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 MMTC 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 MMTC/MEP activities and that these are consistent with what is needed to accommodate

Modelling the Net Impact

increased sales and additional personnel. Neither approach is completely satisfactory. We view the results from inputting the 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 for industry variables caused by changes in sales and employment, assuming that new jobs and sales use existing capital stocks. Within the MMTC/MEP survey, and as noted above, data on several types of production-related investments were collected and used in place of the assumed changes in capital stock. This change in methodology provides a more realistic view of impacts on the state 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.

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 that 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

Modelling the Net Impact

worse off" (2000, p. 39). They continue with " (R)elevant to state impacts, the sales increases that MEP clients report may only be 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.

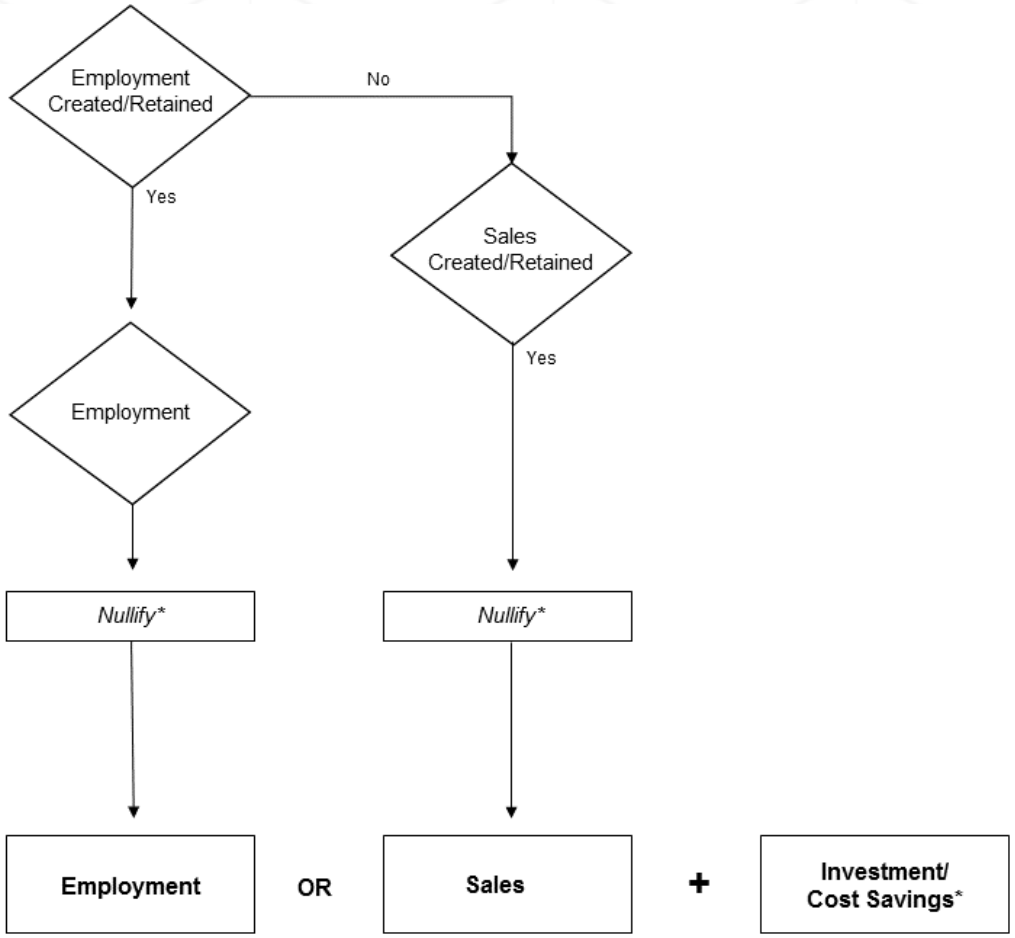


Figure 1: Upjohn's decision tree for using MEP survey data.

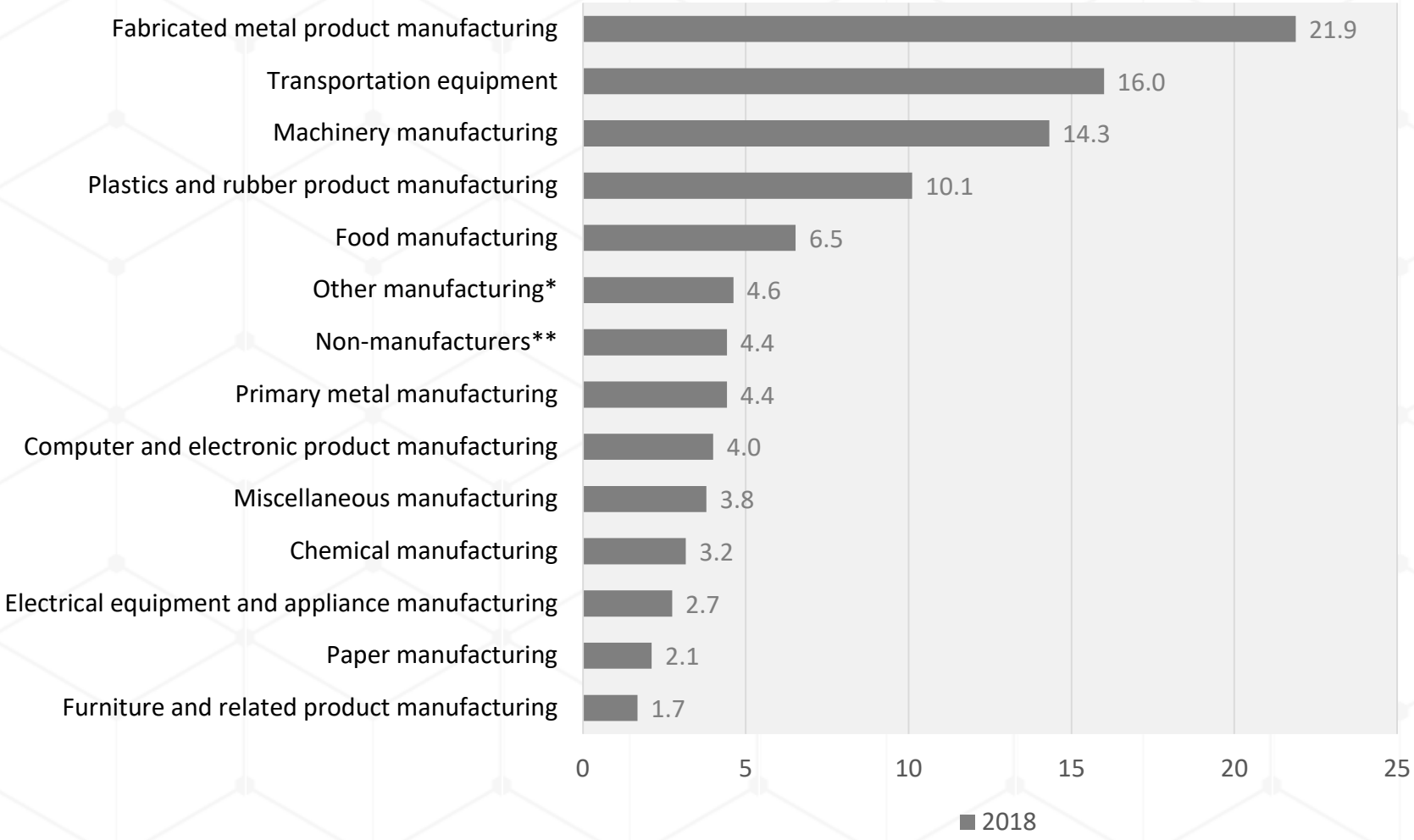




MMTC Economic Impact Analysis

SURVEY RESPONSES FROM MMTC CLIENTS

Industry Mix

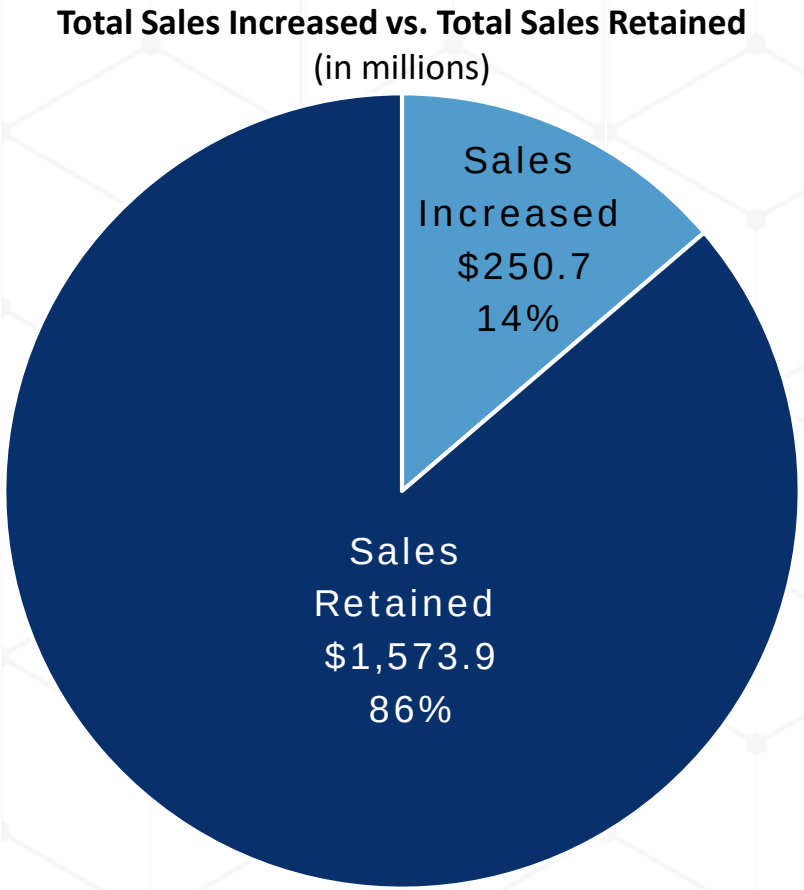


Total Respondents

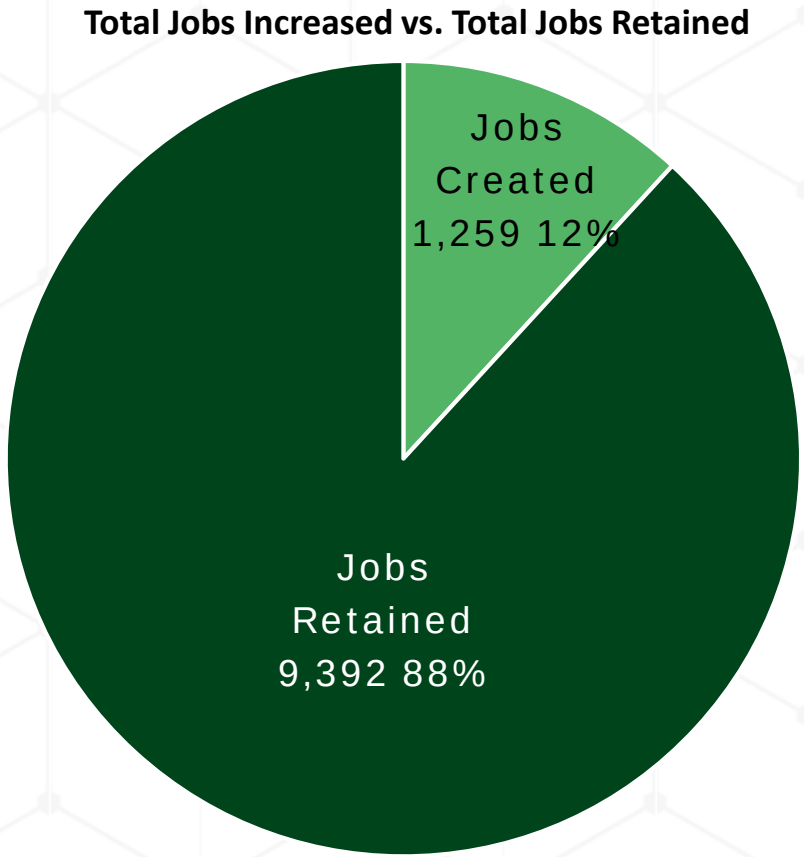
Industry	Firms	Percent
Fabricated metal product manufacturing	104	21.9
Transportation equipment	76	16.0
Machinery manufacturing	68	14.3
Plastics and rubber product manufacturing	48	10.1
Food manufacturing	31	6.5
Other manufacturing*	22	4.6
Primary metal manufacturing	21	4.4
Non-manufacturers**	21	4.4
Computer and electronic product manufacturing	19	4.0
Miscellaneous manufacturing	18	3.8
Chemical manufacturing	15	3.2
Electrical equipment and appliance manufacturing	13	2.7
Paper manufacturing	10	2.1

*-Includes NAICS: 312-316, 321, 323, 324, 327
**-Includes NAICS: 423, 541, 561, 811

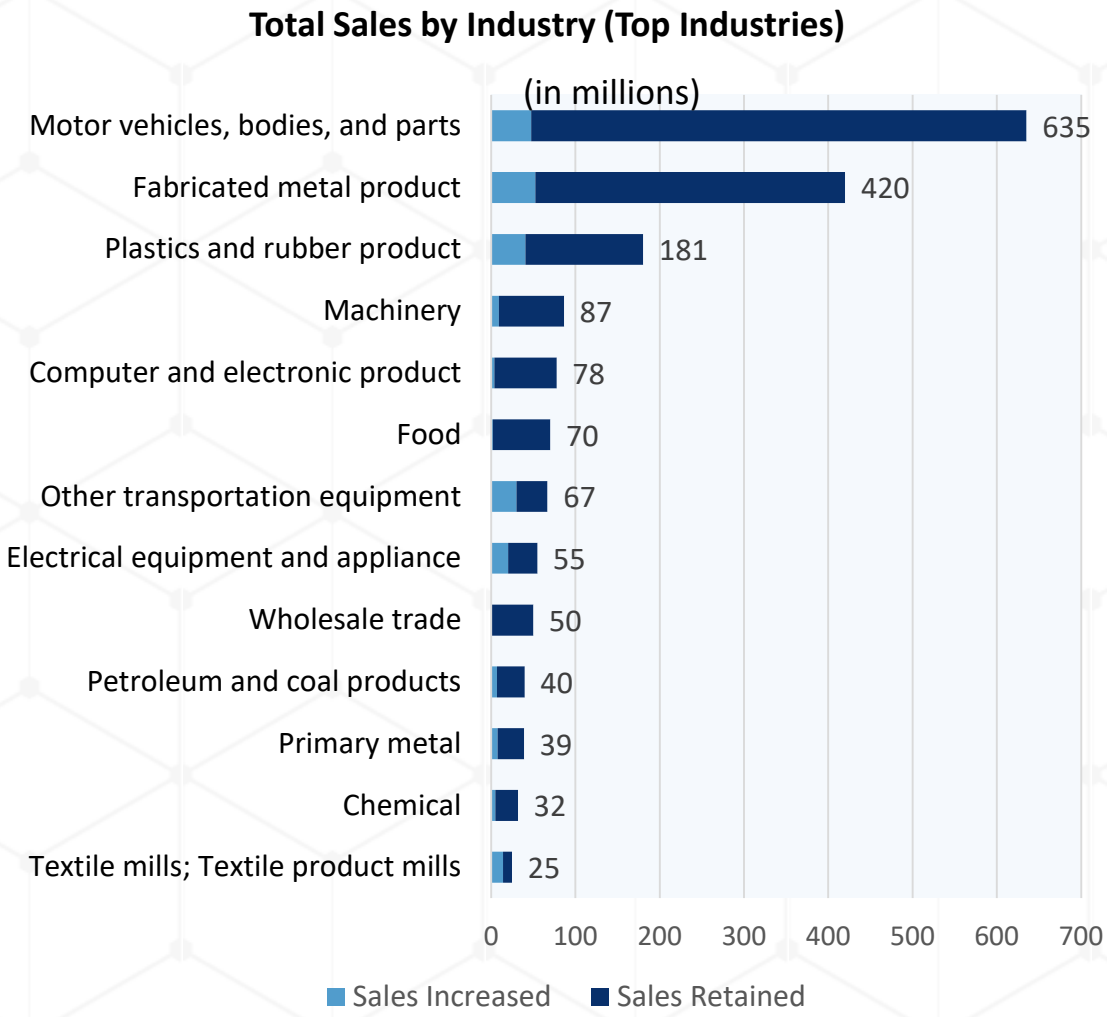
Overview of Total Sales

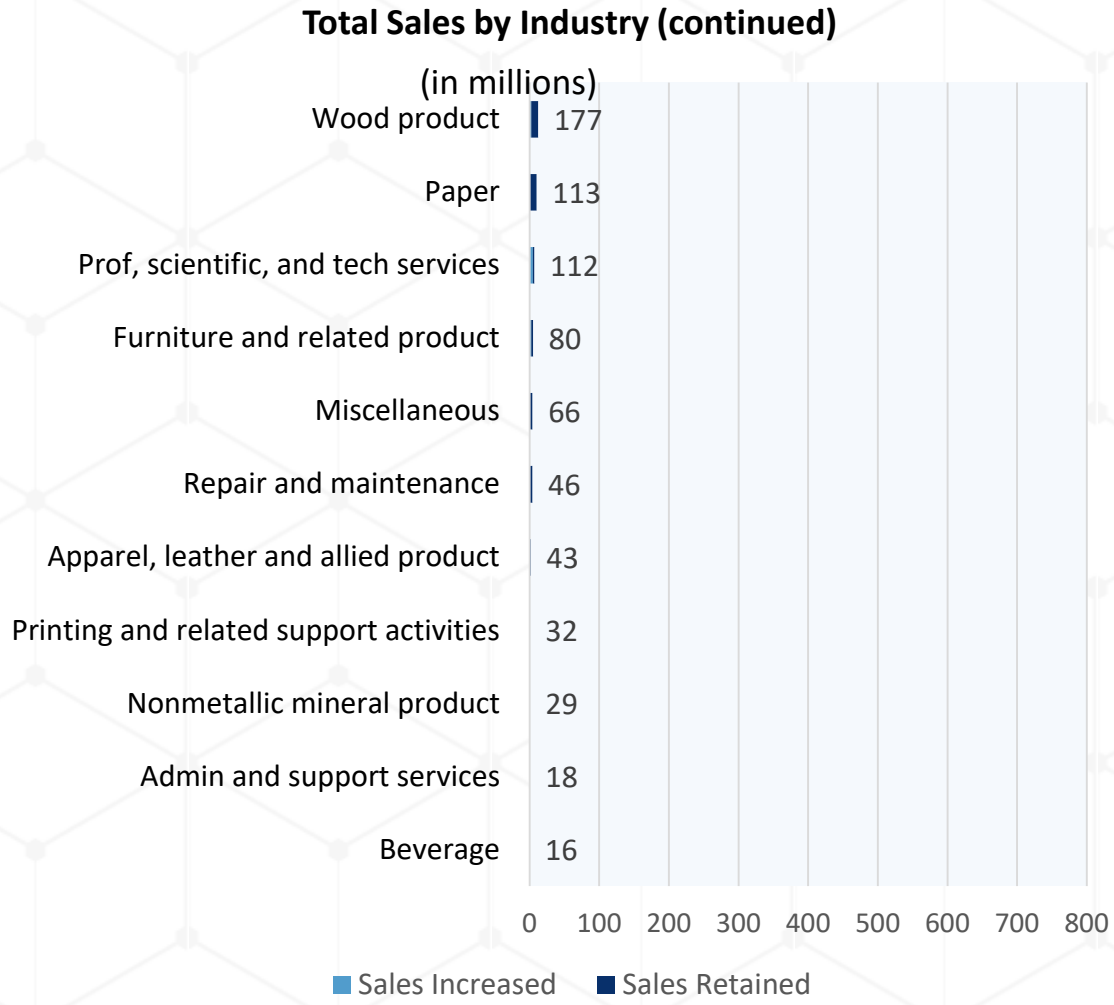


Overview of Total Jobs

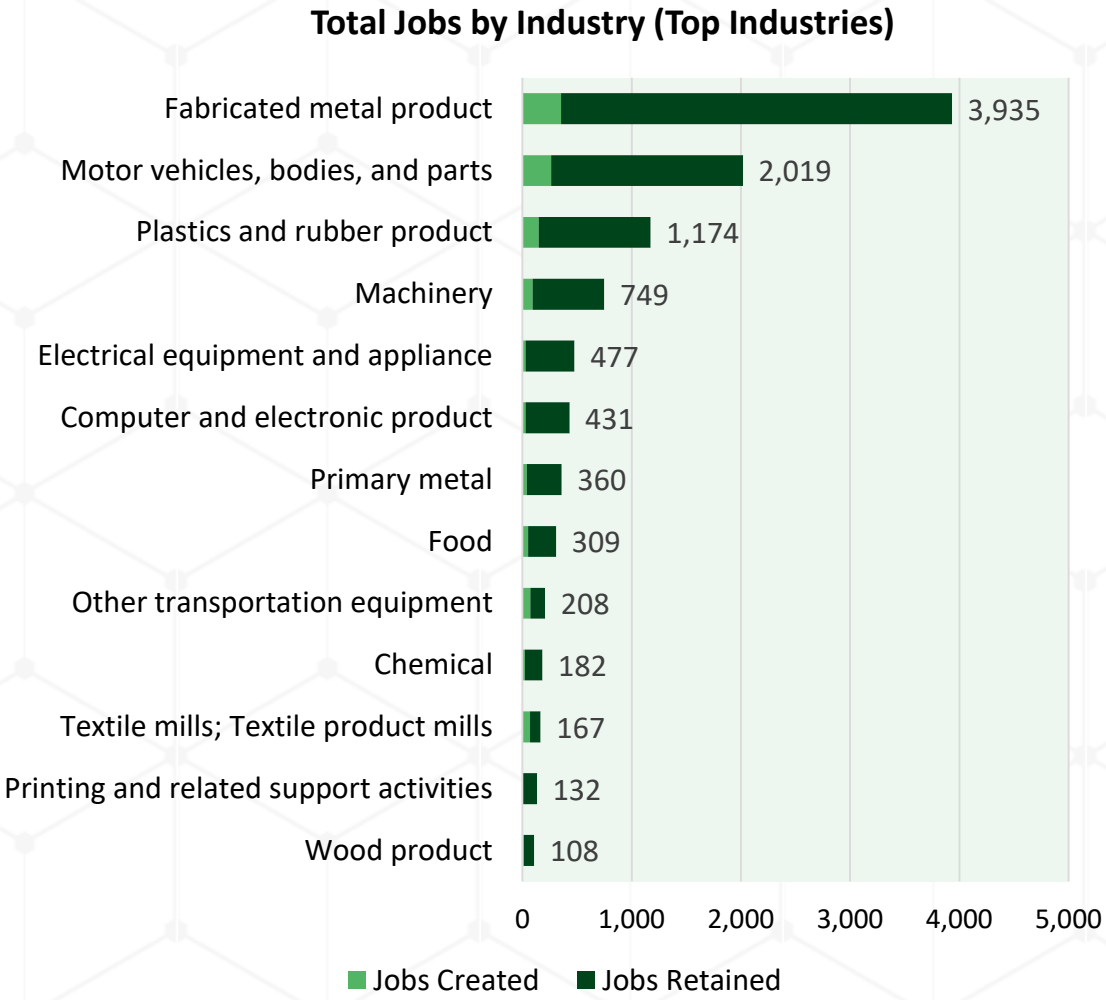


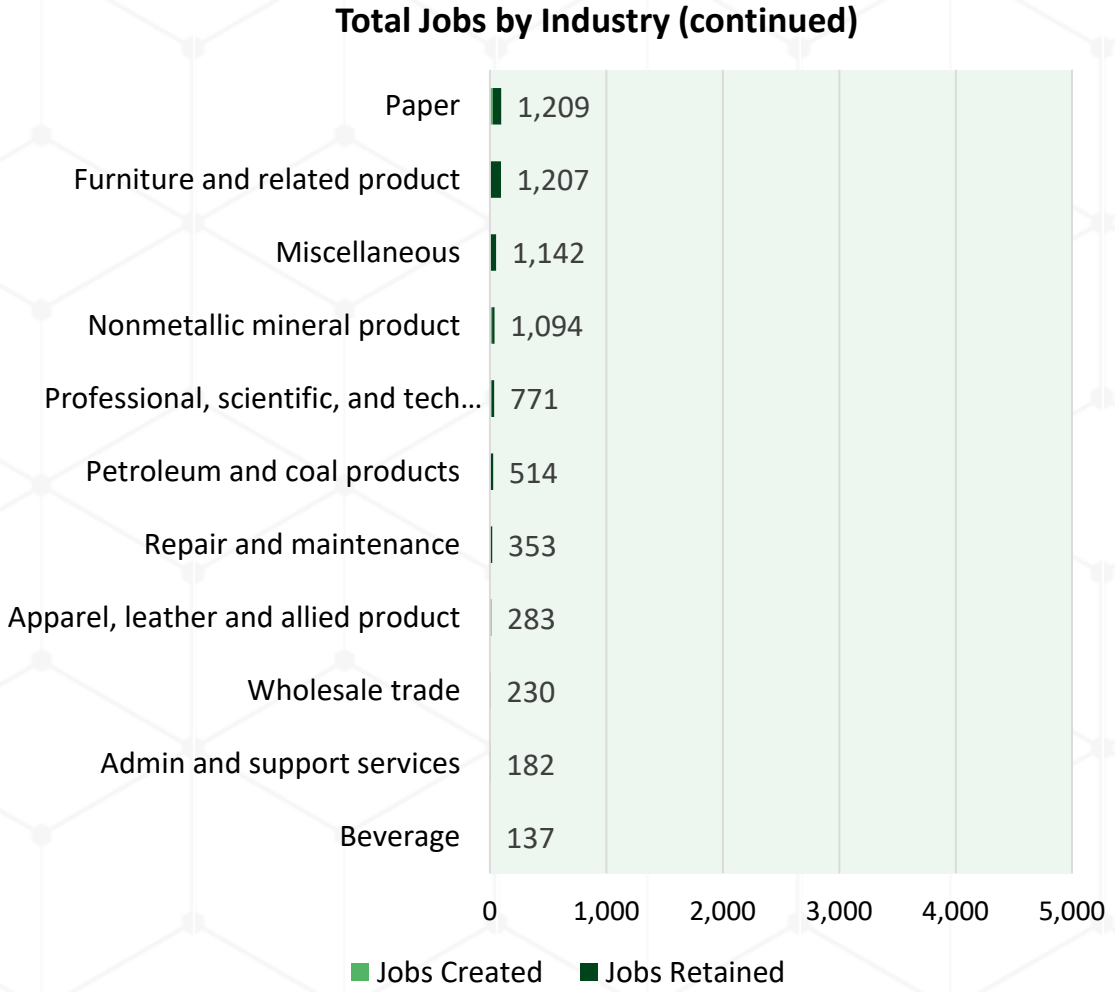
Total Sales by Industry



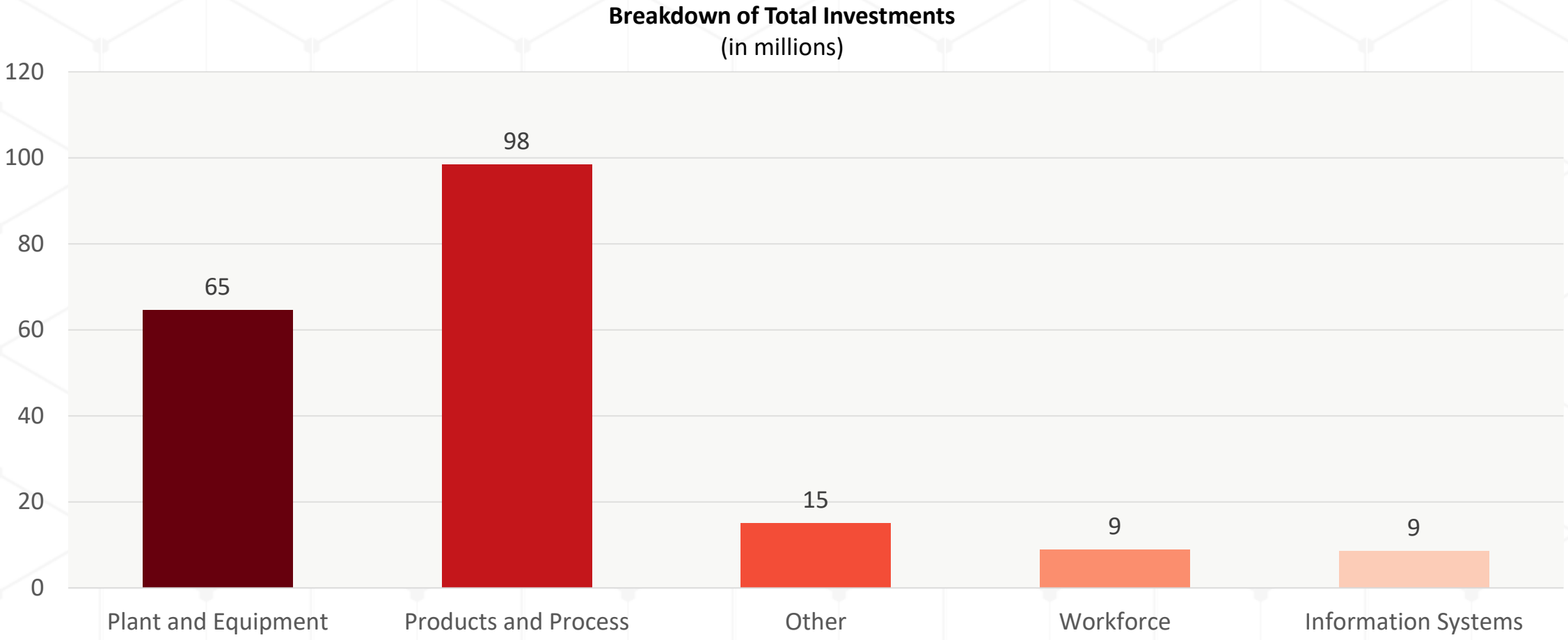


Total Jobs by Industry

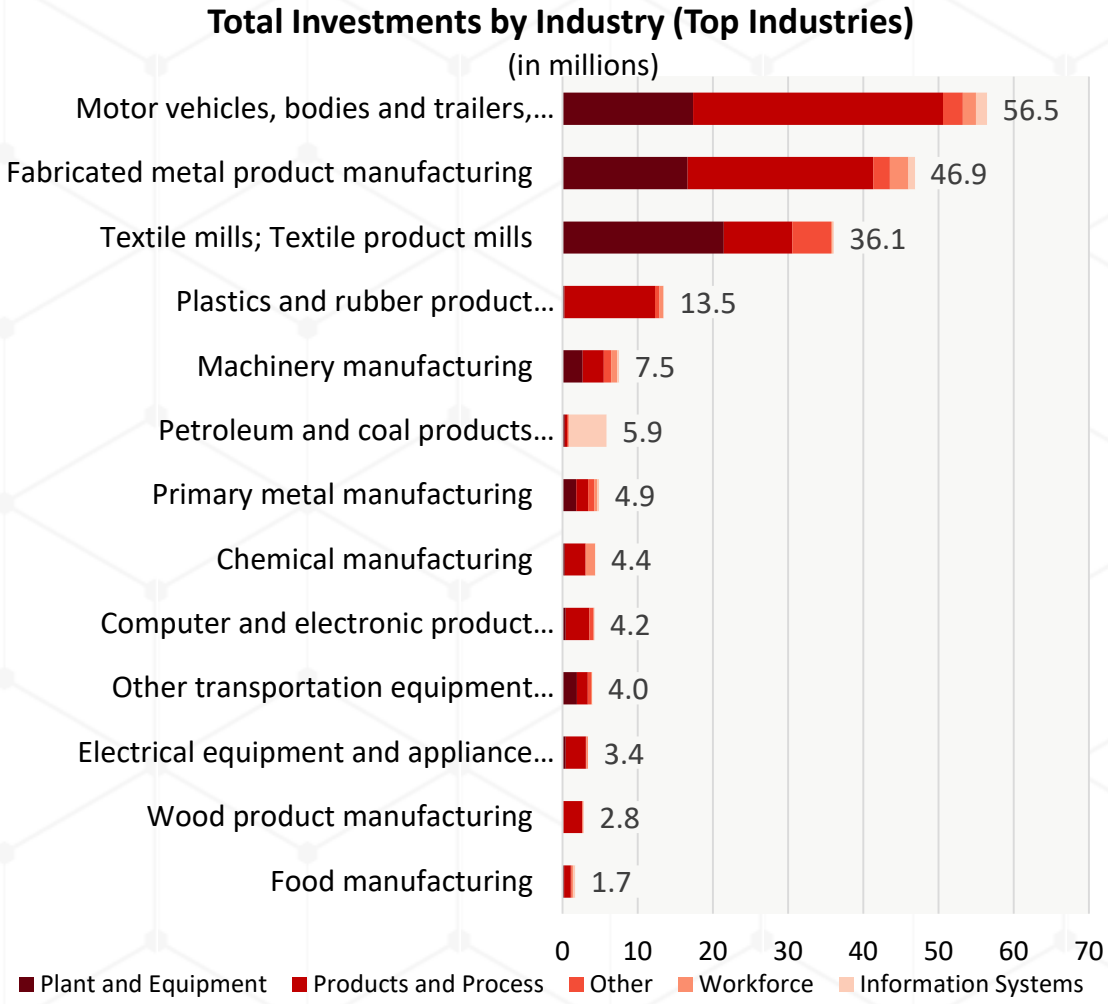


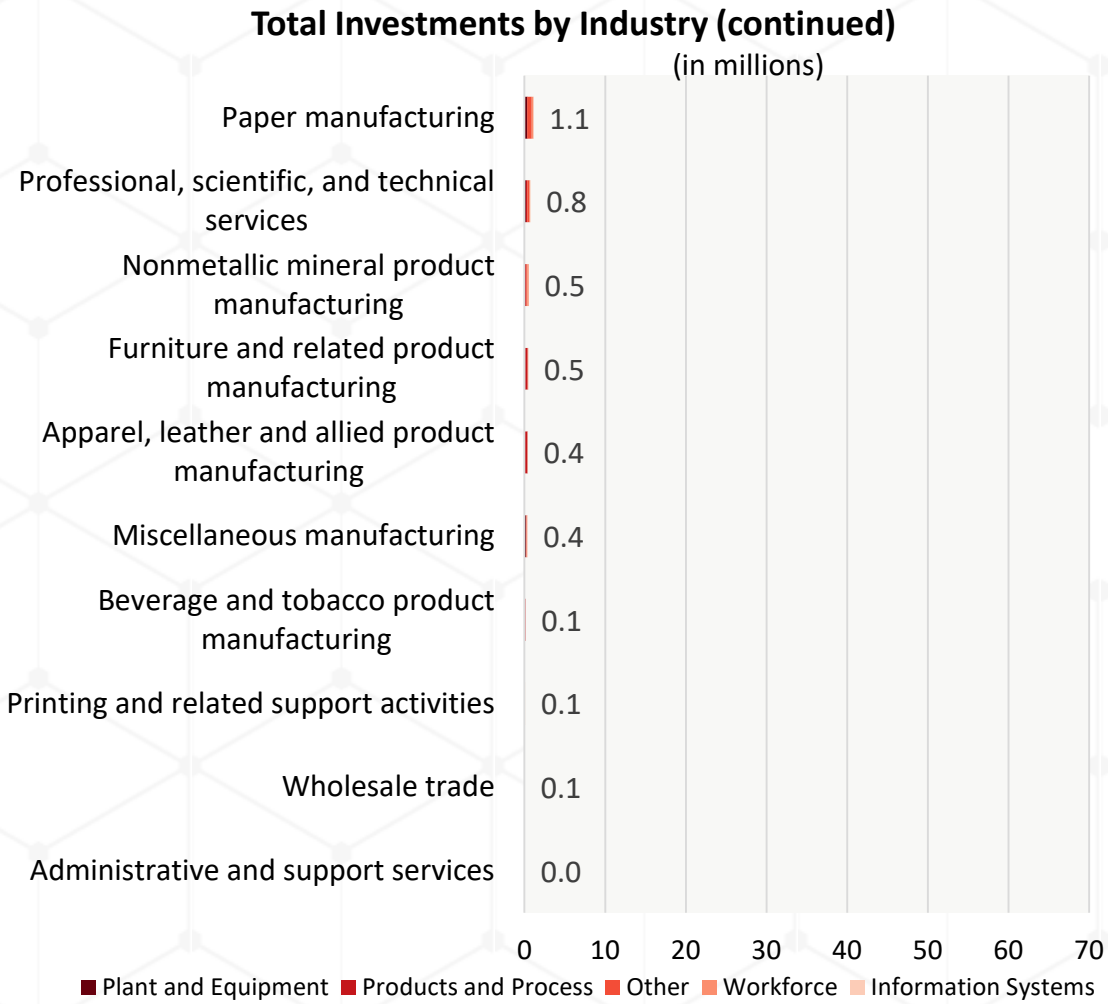


Overview of Total Investments

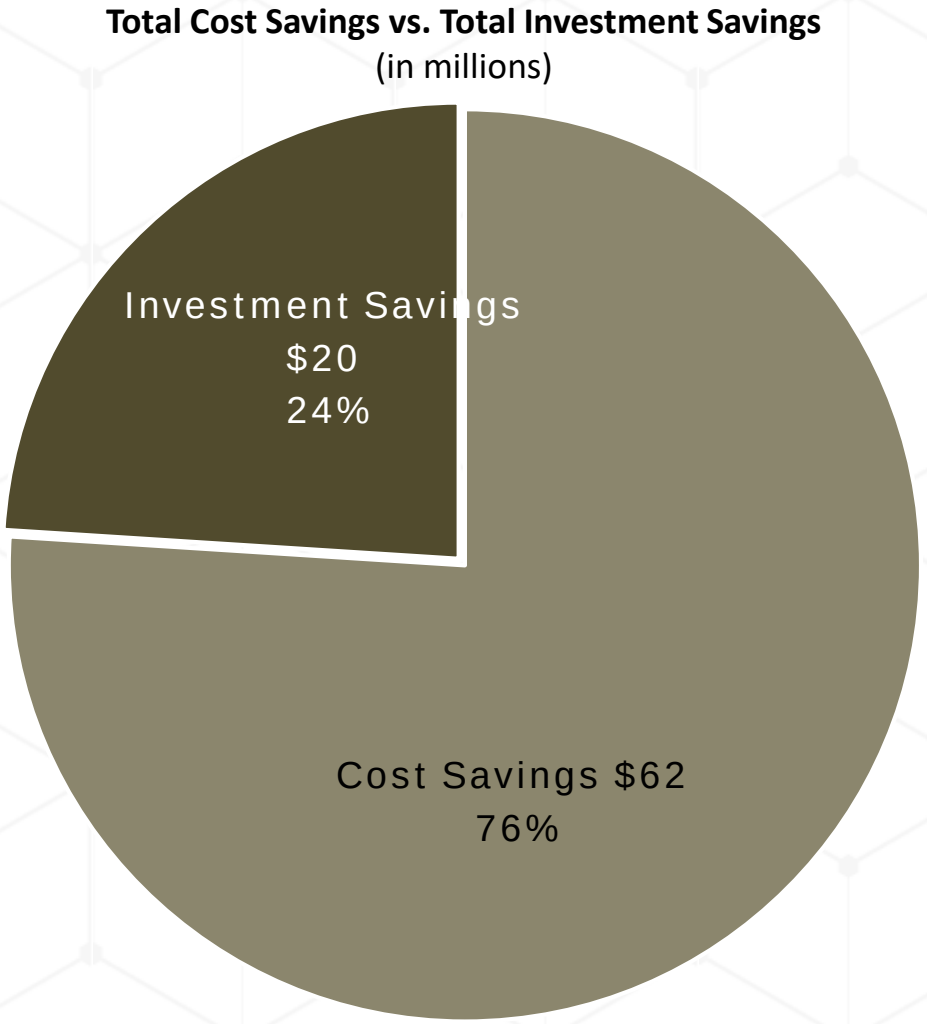


Total Investments by Industry

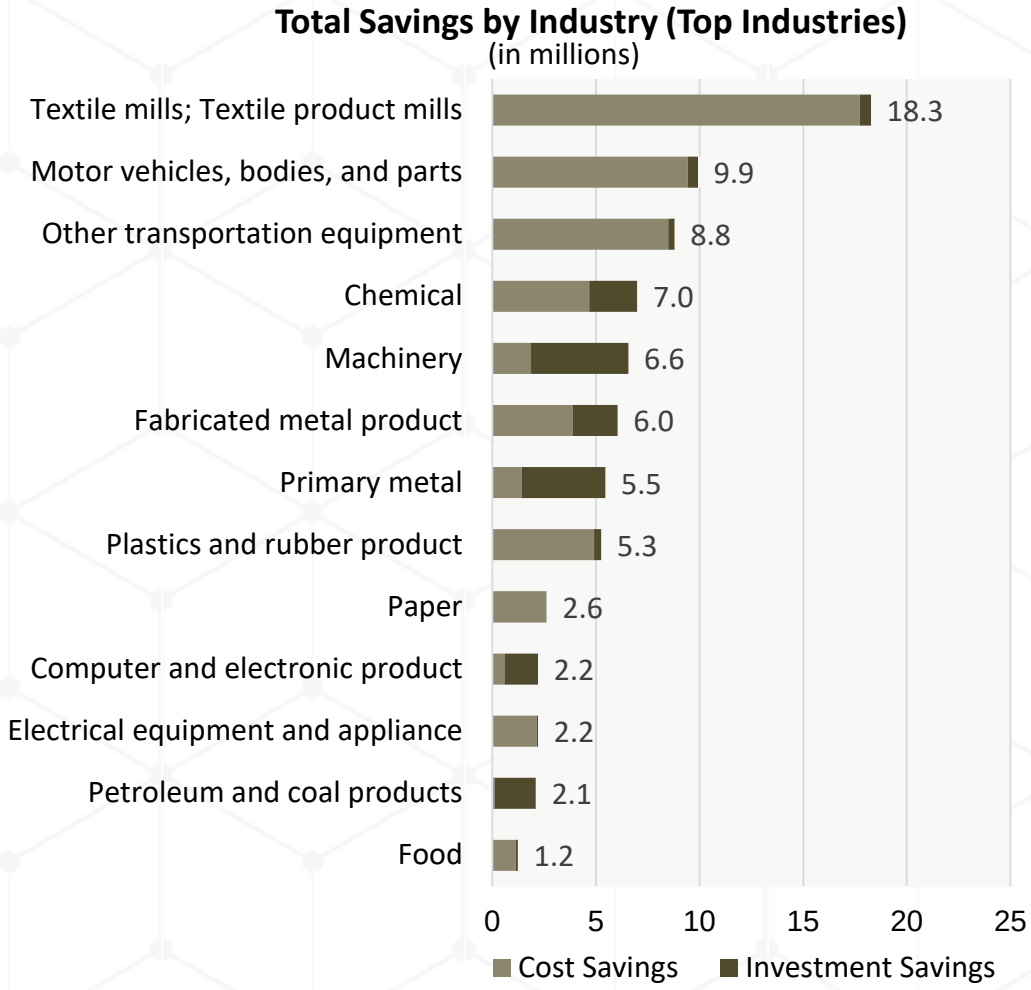


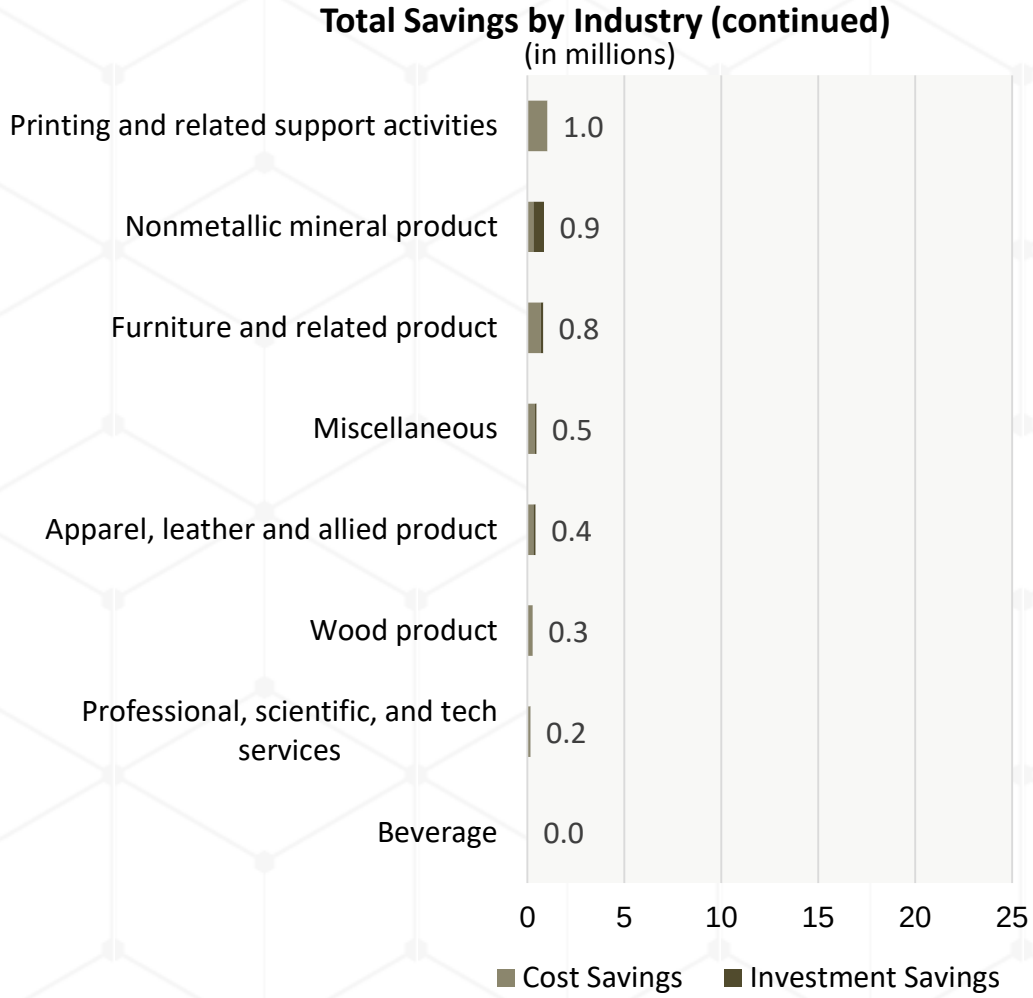


Cost Savings vs. Investment Savings



Total Savings by Industry









MMTC 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 MEP client survey responses as inputs. Each of the five variables are described in this section.

Jobs Created or Retained

These are 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. Also, these jobs are likely distributed across several 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.

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

Economic Outcome Definitions

the workers in the prior two elements

- Examples include education, dry cleaners, accountants, gas stations, lawyers, and grocers

Gross Domestic Product

Gross domestic product (GDP) is an economic measure of the value of goods and services produced within the United States.

It is the broadest measure of economic activity within a region or country. It consists of compensation of employees, taxes on production and imports, less subsidies, and grow operating surplus. It does not include intermediate inputs, so it is a measure of the value labor and capital contribute to production.

Income

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

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, thus it is similar to the sales reported by the individual MEP clients. For the purposes of the model, the sales and receipts are aggregated at the national level.

Returns to the Michigan Treasury

Returns to the Michigan Treasury are estimated using personal income for all additional workers (direct, indirect, and induced) who were employed as a result of MMTC client activities. The

Economic Outcome Definitions

University of Michigan's Research Seminar in Quantitative Economics (RSQE) provides fiscal estimates to the state treasurer across several measures. RSQE estimates that while the rate of tax on personal income is currently 4.25%, the effective tax rate, after deduction and exemptions, is 3.04%. In estimating returns on investment (ROI), the rate of 3.04% is applied to estimates of personal income from the REMI model to estimate state benefits. While it is acknowledged that there are other measures of state revenue that could be included in the ROI, only personal income was used as a means to provide comparability to the national MMTC study and its findings.





MMTC Economic Impact Analysis

APPENDIX

NAICS CODES

Code	Industry	Code	Industry
311	Food Mfg.	332	Fabricated Metal Product Mfg.
312	Beverage & Tobacco	333	Machinery Mfg.
313-314	Textile Mills	334	Computer & Electronic Product Mfg.
315-316	Apparel Mfg.; Leather & Allied Product Mfg.	335	Electrical Equipment, Appliance, & Component Mfg.
321	Wood Product Mfg.	3361-3363	Motor Vehicles, Bodies & Trailers, & Parts Mfg.
322	Paper Mfg.	3364-3369	Other Transportation Equipment Mfg.
323	Printing & Related Support Activities	337	Furniture & Related Product Mfg.
324	Petroleum & Coal Products Mfg.	339	Miscellaneous Mfg.
325	Chemical Mfg.	42	Wholesale Trade
326	Plastics & Rubber Products Mfg.	54	Professional, Scientific, & Technical Services
327	Nonmetallic Mineral Product Mfg.	561	Administrative & Support Services
331	Primary Metal Mfg.	811	Repair & Maintenance