# THE MANUFACTURING RESURGENCE:
## WHAT IT COULD MEAN FOR THE U.S. ECONOMY
## *A Forecast for 2025*

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MAPI

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# Foreword

MAPI and the Aspen Institute's Manufacturing and Society in the 21st Century program have partnered on this report to provide the framework for how U.S. policymakers can help create a real manufacturing resurgence in this country. But unless you're making product here, why should you care about the future of American manufacturing?

There are those who don't, including some notable academics. Columbia University Professor Jagdish Bhagwati attracted attention by calling the current focus on revitalizing the factory sector a "manufactures fetish." President Obama's former Council of Economic Advisers Chair, Christina Romer, made headlines when she pronounced, "A persuasive case for a manufacturing policy remains to be made." And in a column headlined "Manufacturing Illusions," Robert Reich noted, "The fundamental problem isn't the decline of American manufacturing, and reviving manufacturing won't solve it."

With all due respect, they're wrong. Our broad challenge, at its most fundamental level, is a sustainable increase in society's standard of living. To ensure (or produce) a rise in living standards, a nation—or more precisely, its citizens and businesses—must create new wealth. As other nations (developing and developed alike) have found, manufacturing is still the greatest wealth-creating tool we have. Here's why:

- Manufacturing stimulates economic growth through a higher multiplier effect than other sectors. Every dollar of final sales for manufactured products generates $1.48 in economic activity in other parts of society.
- Manufacturing raises living standards because it's a leader in productivity. Over the past quarter-century, manufacturing has consistently experienced higher labor productivity rates than the overall nonfarm business sector—double the rate in the 1990s, and roughly 50 percent higher between 2000 and 2010.
- Manufacturing creates new wealth because it's a leader in exports. More than half the dollars earned from U.S. exports stem from manufactured goods. With manufactures representing 75 percent of global trade, this country's best bet to balance its trade accounts is through making more products here—for export and to replace imports.
- Manufacturing adds value to our economy because it's a leader in R&D investment and, ultimately, in driving innovation. Manufacturers are responsible for three-fourths of private sector R&D investment, and according to the National Science Foundation, are far more innovative than the business community as a whole.

Even given the overwhelming evidence that manufacturing matters, there are those who still opine that production can move overseas because Americans will generate sufficient wealth through *ideas*, that is, innovation. Harvard's Gary Pisano and Willy Shih successfully challenge this notion in their recent book *Producing Prosperity*: *Why America Needs a Manufacturing Renaissance*.

First, when production goes overseas, innovation often follows. In many cases, designers and engineers must be in proximity to the process to ensure the steady flow of ideas. In those industries, wherever production takes place, R&D investment and innovation will inevitably follow, as has occurred with consumer electronics. Thus we lose not only our nation's innovation capabilities, but the knowledge and network spillovers that benefit the broader economy.

Second, when production goes overseas, any ecosystem surrounding it here deteriorates. Large local and regional economic benefits are achieved through the establishment of "industrial commons," the term Pisano and Shih coined for those close-knit networks of manufacturers, suppliers, researchers, designers, and investors spread throughout our country. When a manufacturer picks up stakes, the commons can collapse like a house of cards. Investments dry up, jobs are lost, and the community stagnates. As Fred Zimmerman and Dave Beal put it in their 2002 book *Manufacturing Works*, "Profitable manufacturers strengthen communities. The wages, benefits, and taxes they generate lead not only to prosperity and opportunity, but also to pride in community identity."[*]

That's why Americans should care about whether or not we experience a manufacturing resurgence in this country. This paper illuminates the drivers behind such a revitalization, and the policy changes needed to boost those drivers. To simulate the demand and supply variables that would promote manufacturing growth, and the associated economic benefits to the rest of society, we relied on economic modeling by the Interindustry Forecasting Project (Inforum) at the University of Maryland. Inforum's models combine an input-output structure with econometric equations, and can be used to answer "what if" questions on the impact across industries of fluctuation in the macroeconomic environment for manufacturers.

Inforum's bottom-up approach has several desirable properties. First, the model works like the actual economy, building the macroeconomic totals from details of industry activity, and enabling us to apply various policies and create a manufacturing revival scenario. Second, it describes how changes in manufacturing, such as increasing productivity or shifting international trade patterns, affect other sectors and overall economic output. Third, Inforum's model permits the incorporation of price inflation by industry, showing causes and effects of relative price changes by industry.

Given manufacturing's key role in creating wealth, and the detailed analysis contained in this paper of the drivers needed to ensure a manufacturing resurgence, U.S. policymakers have a blueprint here for economic expansion and increased living standards for generations to come.

*Stephen Gold*
*President and Chief Executive Officer*
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[*] Fred Zimmerman and David Beal, *Manufacturing Works: The Vital Link Between Production and Prosperity* (Chicago: Dearborn Financial Publishing, 2002), p. 47.

# Executive Summary

The Aspen Institute's program on Manufacturing and Society in the 21st Century and MAPI commissioned an econometric forecast to determine how the U.S. economy would change if it were to achieve the manufacturing resurgence which has been widely touted in recent years. The importance of such a resurgence is that it very well could lead to higher growth over time, higher standards of living, and a reduction or reversal of the chronic balance of payments deficit which is shifting resources outside the country. Achieving this result, the modeling shows, requires certain policy choices which are not radically different from current trends. The University of Maryland's Interindustry Forecasting Project (Inforum) was commissioned to make projections based on a target of moving manufacturing's share of GDP back to the level last seen in 1998 (around 15 percent), before the "dot-com" recession and the Great Recession. Various scenarios were also tested to determine what economic trends could power such a change. Finally, policy levers which could support the trend were outlined.

Results were projected to 2025. With the right policies in place, the manufacturing share of value added in the resurgence scenario grew to 15.8 percent of GDP, compared to 11.6 percent in 2012 and 11.1 percent in 2025 under a "business as usual" baseline forecast. Under the resurgence scenario, real manufacturing output is over $1.5 trillion higher than in the baseline scenario, and overall GDP grows by a similar magnitude. To achieve such a growth path, investment in equipment and software is 12.1 percent higher in 2025 relative to the baseline, and the mining sector (driven by the natural gas boom) gains 1 percent of GDP (over $300 billion in output). Other major sectors of the economy are necessarily smaller under the resurgence scenario. Personal consumption expenditures, notably, are over 3.2 percent lower in the resurgence scenario, signaling a shift in the economy toward investment and goods production for export and away from domestic consumption. Due to higher productivity in services, in turn partially powered by gains derived from new manufacturing processes and products, the services sector loses some relative share of total GDP. Government services also loses about 2.2 percent of its share of GDP. Services and government do not decline in real terms, but grow more slowly than manufacturing.

Two other significant changes under the resurgence scenario are the creation of about 3.7 million new jobs directly in manufacturing, when compared to the baseline, and a reversal of the trade deficit in manufacturing. Direct employment in manufacturing rises to a level of over 16.3 million jobs, compared to 12.3 million in 2012 and about 17.6 million in 1998. Exports grow significantly faster than imports in the resurgence scenario, reaching a positive trade balance by 2024. Exports grow at an annual rate of 8.1 percent in our resurgence scenario, while imports grow at 2.5 percent. Growth in exports is driven by energy-intensive industries, such as chemicals, plastics, fabricated metals, and steel; and capital goods, such as computers, engines, turbines, and power equipment, aerospace equipment, and industrial products. Semiconductors and pharmaceuticals also grow faster than average exports.

Major policy directions which could support achievement of the resurgence scenario are:

- **Trade Policy**: complete more trade-opening agreements, such as the current negotiations with Asia and Europe; combat "competitive currency devaluations"; and work to achieve global macroeconomic stability.
- **Energy Policy**: sustain current energy boom in oil and gas production; improve electric grid to allow development of new sources of power generation, such as wind and solar; support more efficient use of energy through conservation efforts.
- **Regulatory Policy**: reduce overlapping and layered regulations through regulatory forbearance, elimination of duplicative regulations, and more rigorous review of costs and impacts of new regulations; and use trade negotiations to reduce costs of and impediments to trade by converging or harmonizing regulations.
- **Manufacturing Labor Force**: improve K-12 performance, including science, technology, engineering, and mathematics (STEM) education; develop nationally recognized skills certification programs and certificates; expand and improve apprenticeship and vocational education programs; encourage entry of non-traditional demographic groups to manufacturing positions and skills; reduce barriers to entry in professional fields related to manufacturing; and reform immigration to support permanent work status for skilled workers, engineers, and research personnel.
- **Tax Policy**: Reduce corporate taxes to OECD average levels; adopt territorial tax regimes; expand and improve R&E tax credit and investment expensing options; and exercise care in any tax reform not to burden "pass-through" firms with new tax obligations on top of the personal income tax increases adopted in 2013.
- **Basic and Applied Research**: Expand federal support for basic and applied research applied research in fields important to manufacturing, i.e., engineering, mathematics, and physical sciences.

# The Manufacturing Resurgence: What It Could Mean for the U.S. Economy
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## Introduction

In recent years, especially as the United States has begun to recover from the Great Recession, a good deal of interest has turned to the role of manufacturing in contributing to growth, innovation, economic expansion, and increases in the standard of living in the United States. This is perhaps at least in part due to persistent weakness in some other major sectors of the economy that previously drove growth, especially construction and finance. It also results from the recognition that manufacturing is indeed steadily growing faster than the overall economy. The president in his 2013 State of the Union Message explicitly referenced manufacturing seven times in the context of outlining initiatives designed to strengthen this sector of the U.S. economy. His remarks build on considerable academic, government, think tank, and business school research in the last few years,[1] tending to explain how the manufacturing sector is a key to growth and innovation in both advanced and developing economies.

Not all the commentary is uniform in projecting a bright future for U.S. manufacturing, but enough of it is to warrant a systematic analysis of the impact of a resurgence in U.S. manufacturing. And that is the purpose of this paper, which takes a generally favorable view of the current trends. It projects the future evolution of this sector, and both the macroeconomic and structural impacts into the medium term, that is, until 2025. None of the papers cited earlier actually provide a detailed forecast of what the overall U.S. economy and the manufacturing sector would look like if the manufacturing resurgence unfolds in the growth paths they assume.

[1] Some of the more important studies are (in no particular order): President's Council of Advisors on Science and Technology "Report to the President on Capturing Domestic Competitive Advantage in Advanced Manufacturing" (Washington, DC: Executive Office of the President, 2012); Robert Atkinson and Stephen Ezell, *Innovation Economics: The Race for Global Advantage* (New York: Yale University Press, 2012); Ricardo Hausmann, Cesar Hildalgo, *et al.*, *The Atlas of Economic Complexity: Mapping Paths to Prosperity* (Cambridge: Harvard University and Massachusetts Institute of Technology, 2011); Craig Giffi, John Moavenzadeh, *et al.,* "The Future of Manufacturing: Opportunities to Drive Economic Growth" (Geneva: World Economic Forum, 2012); Susan Helper, Timothy Krueger and Howard Wial, "Why Does Manufacturing Matter? Which Manufacturing Matters?" (Washington, DC: The Brookings Institution, 2012); James Manyika, *et al.*, "Manufacturing the Future: The Next Era of Global Growth and Innovation" (Washington, DC: McKinsey Global Institute, 2012); Harold Sirkin, Justin Rose, and Michael Zinser, "The U.S. Manufacturing Renaissance: How Shifting Global Economics Are Creating the American Comeback" (Boston: Boston Consulting Group, 2012); Thomas J. Duesterberg, "Manufacturing: the Economy's Future," *Aspenia*, Vol. 57-58 (2012), pp. 42-50; Suzanne Berger, *et al.*, "Report of the MIT Taskforce on Innovation and Production" (Boston: MIT, 2013); Gary Pisano and Willy Shih, *Producing Prosperity: Why America Needs a Manufacturing Renaissance* (Boston: Harvard Press Books, 2012); and Michael Lind and Joshua Freedman, "Value Added: America's Manufacturing Future" (Washington, DC: New America Foundation, April 2012).

The projections are derived from the LIFT (Long-term Interindustry Forecasting Tool), a dynamic general equilibrium model of the U.S. economy developed and maintained at Inforum, a research center at the University of Maryland. The LIFT model is particularly well suited to this study because it embeds the structural detail of input-output analysis within the dynamic framework of a macroeconometric model, providing the context for assessing different paths of economic growth and development. It also contains ample historical and contemporary data on the individual sectors of the economy which facilitates detailed forecasts across manufacturing industries.

The objective of the modeling exercise was to develop an economic projection where the manufacturing value added proportion of GDP rises to around 15 percent by 2023, a ratio not observed since 1998. This scenario, called here the "Manufacturing Resurgence" (MR), would then be compared with a Baseline (BL) forecast where the manufacturing value added share would remain at the 2012 level, about 11.6 percent of GDP. Comparison between the MR and BL projections reveal the assumptions needed to reach the manufacturing value added target and the net benefits of more manufacturing-centric economic development.

A change of the manufacturing value added ratio of this magnitude implies fairly large changes to the demand and supply structures within the economy. The MR scenario was developed through an iterative modeling process to determine what mix of economic developments and public policy changes would be sufficient to achieve the 15 percent value added to GDP proportion. Manufacturing has been growing faster than the overall economy since the recovery began in 2009, but getting to the higher ratio requires some acceleration of the basic trends as explained in the following sections. We investigated four sources for providing the necessary boost to manufacturing value added:

1. Increase manufacturing exports and decrease manufacturing import shares across all manufactured commodities. These changes could be the result of better trade policy, or simply a flowering of the "pent-up" and recently improved competitiveness of the sector.
2. Reduce the rate of price increases and increase energy supplies relative to the BL, especially for natural gas. Robust energy supply will encourage moving more production onshore, especially for natural gas-intensive industries such as chemicals, plastics, fertilizers, food, and structural products. Capital investment will rise and net trade will be enhanced.
3. Reduce regulatory costs and corporate taxes to enable greater output, investment, and income across all sectors, especially manufacturing. In particular, lighter regulation provides a reduction of input requirements for administrative and waste management services.
4. Increase productivity growth in large service sectors, especially construction, medical care, trade, professional services, and finance. This assumption demonstrates that given a limited labor supply, manufacturing-led economic prosperity can only occur in an environment of better efficiency in service sectors. We assume that this efficiency increase is due in part to greater spillovers of manufacturing technology and techniques to be used in service sectors.

The LIFT modeling actually projects manufacturing's share of the economy to reach 15.8 percent on a value added basis by 2025. To be realistic, however, these changes had to occur within the fundamental capacity constraints of the economy. In particular, while GDP growth in the MR case could be larger than in the BL, enhanced production could not occur with a marked increase in domestic

inflation (because the Fed would squash it) or an unrealistic fall of the unemployment rate. Given the economic conditions of 2013, however, there is plenty of room for a manufacturing resurgence to stimulate firmer pricing and greater employment.

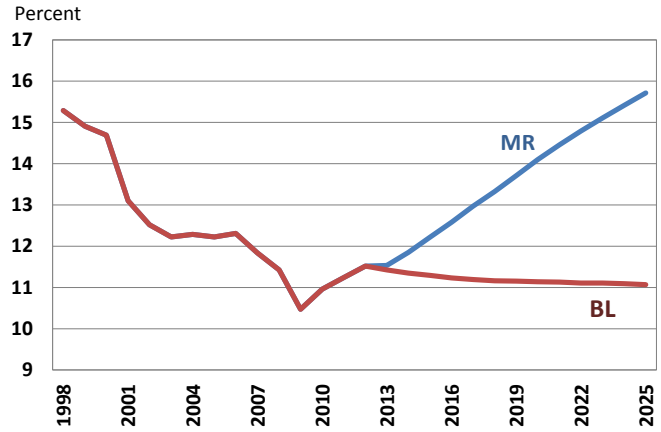
Another constraint involves the productive capacity of the manufacturing sector itself. The processes described above imply a much larger amount of capital formation within the manufacturing sector, compared to the baseline. This investment is attracted through greater sales opportunities and lower costs in the sector. Moreover, given that manufacturing is more capital-intensive than the rest of the economy, its greater share implies higher growth for capital investment for the economy as whole, at any given level of GDP growth. To reach the higher rates of capital formation, a lower profile for private consumption is also required.

## Basic Macroeconomic Results: Baseline and Manufacturing Resu

Figure 1 shows the general direction of value added in manufacturing as a proportion of GDP under the baseline (BL) and manufacturing resurgence (MR) scenarios.[2] Manufacturing's share fell from about 15 percent in 1998 to 11.6 percent in 2012. The new millennium was characterized by slow growth in the early part of the 2000s, a sharp downturn in the Great Recession, and an acceleration of manufacturing after 2009 at a rate considerably faster than overall GDP. The BL scenario generally assume a continuation of these trends of the new millennium, and manufacturing's share of the economy is basically constant at t

Figure 1

**Manufacturing Value Added Share of GDP**




Source: Inforum

In the MR alternative, manufacturing's share of GDP reaches 15.8 percent by 2025. A larger footprint for manufacturing generally has other macroeconomic benefits due to its higher wage scales, more complete benefits packages, higher jobs multiplier, better contributions to research and development, and higher labor productivity rates than the rest of the economy.[3]

Figure 2 shows the course of manufacturing employment over the same period. The sector lost about 6 million jobs over the first decade of the new century, even as total production

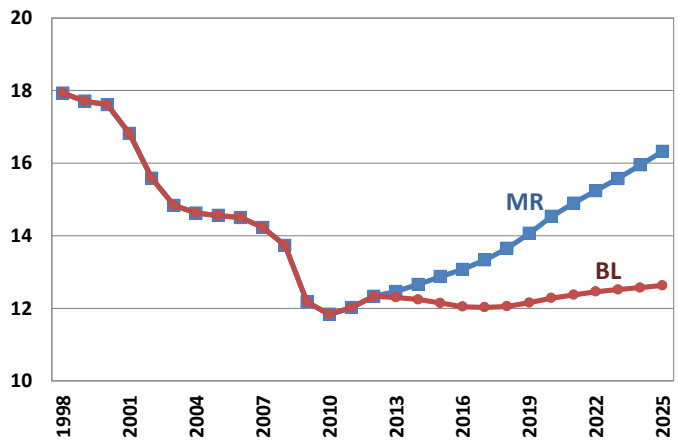
[2] Value added is the sum of wages, capital income (profits, rents, and interest), and net indirect taxes earned by any given industry. The sum of value added across sectors is equal to GDP.

[3] For some detail on these benefits, see the Manufacturers Alliance for Productivity and Innovation (MAPI) and the National Association of Manufacturers (NAM), *The Facts About Modern Manufacturing*, 2012 Edition, http://www.themanufacturinginstitute.org/Research/Facts-About-Manufacturing/Facts-2012.aspx.

Figure 2

**Manufacturing Employment**

(millions of workers)




Source: Inforum

nufacturing employment
lat in the BL, growing by
000 workers per year,
bout 317,000 per year in
r nearly 3.8 million jobs
ding the right mix of
s—including scientists
—is one challenge that
r the more optimistic
terialize.
nulation results shown in
allow us to trace this
the demand and supply
the economy. Table 1
mand side of the
2025, nominal GDP (i.e., unadjusted for inflation) in the MR scenario is 5.3 percent higher compared to the BL simulation. Consistent with the inflation constraint alluded to above, the GDP price deflator (index) is essentially unchanged between the scenarios, and real (inflation-adjusted) GDP in the MR alternative grows 5.6 percent higher than in the BL scenario. This is an additional one trillion dollars in 2005 prices, or $1.5 trillion in current dollars.

The higher output and improved performance characteristics under the MR scenario are not the result of huge differences in growth rates in comparison with baseline assumptions. The BL growth path is simply more modest than the robust expansion in the more optimistic scenario. Total real GDP, for instance, grows by an annual average of 2.6 percent in the BL, contrasted with around 3.0 percent in the MR. Nonetheless, this 0.4 percent annual increment adds up to over $1.5 trillion in added output by 2025.

Table 1 indicates that there is a notable difference in the demand composition of GDP, however. By 2025, total real consumption expenditures are 3.2 percent lower in the MR scenario, compared to the BL.[5] On the other hand, gross private fixed investment is enhanced by 6.3 percent, or by $200 billion in 2025. On the trade side, real exports are 20.9 percent larger, and real imports are 12.3 percent lower. These differences illustrate a needed rebalancing from the consumer- and government-centered economy of the past decade toward an investment-oriented and ultimately more internationally competitive economy.

Table 2 shows how these demand changes reverberate to boost manufacturing output and value added. In the MR scenario, increases in capital investment and manufacturing net exports pushes real gross output of manufacturing to a level 30.2 percent higher compared to the baseline. For many years, growth of manufacturing prices has lagged behind growth of the overall price level, due to fierce foreign competition. In the current exercise, we could not boost U.S. market share simply with even lower prices, because the industry could not then attract the

[4] Employment growth in the MR scenario averages a modest 2.2 percent per year.
[5] This results from slightly lower annual growth in personal consumption of 2.2 percent in the MR, relative to 2.4 percent in the BL.

Table 1
## Demand Side Simulation Results

| | 2012 | 2013 | 2015 | 2020 | 2025 | Average annual % change 2012-2025 |
|---|---|---|---|---|---|---|
| **Gross Domestic Product** | | | | | | |
| BL level, bil cu$ | 15738 | 16512 | 18274 | 22995 | 28774 | 4.6 |
| MR level, bil cu$ | | 16557 | 18533 | 23946 | 30288 | 5.0 |
| Difference from baseline, bil cu$ | | 45 | 259 | 951 | 1513 | |
| Percent difference from baseline | | 0.3 | 1.4 | 4.1 | 5.3 | |
| **GDP Deflator** | | | | | | |
| BL level, 2005 = 100 | 115.8 | 118.9 | 124.4 | 137.2 | 151.5 | 2.1 |
| MR level, 2005 = 100 | | 118.7 | 124.2 | 137.4 | 151.0 | 2.0 |
| Percent difference from baseline | | -0.1 | -0.2 | 0.1 | -0.3 | |
| **Real Gross Domestic Product** | | | | | | |
| BL level, bil 05$ | 13588 | 13889 | 14686 | 16763 | 18990 | 2.6 |
| MR level, bil 05$ | | 13945 | 14924 | 17432 | 20059 | 3.0 |
| Difference from baseline, bil 05$ | | 56 | 238 | 669 | 1068 | |
| Percent difference from baseline | | 0.4 | 1.6 | 4.0 | 5.6 | |
| **Personal Consumption Expenditures** | | | | | | |
| BL level, bil 05$ | 9601 | 9822 | 10432 | 11806 | 13199 | 2.4 |
| MR level, bil 05$ | | 9822 | 10410 | 11646 | 12775 | 2.2 |
| Difference from baseline, bil 05$ | | 0 | -22 | -160 | -424 | |
| Percent difference from baseline | | 0.0 | -0.2 | -1.4 | -3.2 | |
| **Gross Private Fixed Capital Formation** | | | | | | |
| BL level, bil 05$ | 1852 | 2019 | 2274 | 2788 | 3200 | 4.2 |
| MR level, bil 05$ | | 2045 | 2369 | 2967 | 3400 | 4.7 |
| Difference from baseline, bil 05$ | | 26 | 95 | 179 | 200 | |
| Percent difference from baseline | | 1.3 | 4.2 | 6.4 | 6.3 | |
| **Exports of Goods and Services** | | | | | | |
| BL level, bil 05$ | 1848 | 1904 | 2088 | 2724 | 3569 | 5.1 |
| MR level, bil 05$ | | 1937 | 2188 | 3090 | 4315 | 6.5 |
| Difference from baseline, bil 05$ | | 33 | 100 | 366 | 746 | |
| Percent difference from baseline | | 1.7 | 4.8 | 13.5 | 20.9 | |
| **Imports of Goods and Services** | | | | | | |
| BL level, bil 05$ | 2245 | 2330 | 2564 | 3084 | 3627 | 3.7 |
| MR level, bil 05$ | | 2334 | 2507 | 2842 | 3180 | 2.7 |
| Difference from baseline, bil 05$ | | 5 | -57 | -241 | -447 | |
| Percent difference from baseline | | 0.2 | -2.2 | -7.8 | -12.3 | |

Source: Inforum

capital and labor resources needed to sustain the expansion. On the other hand, due to the inflation constraint of the simulation exercise, manufacturing prices cannot be much greater in the MR alternative. By 2025 they are just 2.8 percent higher compared to the BL level. In other words, the gain in manufacturing market share is not coming about by cutting prices, profits and wages. Consequently, nominal manufacturing output is 33.9 percent greater. We see that to fuel this output increase, intermediate costs rise by substantially less, only 26.9 percent, reflecting the supply-side savings described below.

Table 2
**Supply Side Simulation Results**

| | 2012 | 2013 | 2015 | 2020 | 2025 | Average annual % change 2012-2025 |
|---|---|---|---|---|---|---|
| **Real manufacturing (duplicated) gross output** | | | | | | |
| BL level, bil 05$ | 4526 | 4584 | 4756 | 5408 | 6222 | 2.4 |
| MR level, bil 05$ | | 4662 | 5064 | 6435 | 8100 | 4.5 |
| Difference from baseline, bil 05$ | | 78 | 307 | 1027 | 1878 | |
| Percent difference from baseline | | 1.7 | 6.5 | 19.0 | 30.2 | |
| **Manufacturing prices** | | | | | | |
| BL level, 2005 = 100 | 127.1 | 129.6 | 136.7 | 150.1 | 164.9 | 2.0 |
| MR level, 2005 = 100 | | 129.1 | 137.0 | 153.0 | 169.6 | 2.2 |
| Percent difference from baseline | | -0.4 | 0.2 | 1.9 | 2.8 | |
| **Manufacturing (duplicated) gross output** | | | | | | |
| BL level, bil cu$ | 5753 | 5940 | 6502 | 8119 | 10261 | 4.5 |
| MR level, bil cu$ | | 6017 | 6939 | 9848 | 13735 | 6.7 |
| Difference from baseline, bil cu$ | | 77 | 436 | 1729 | 3474 | |
| Percent difference from baseline | | 1.3 | 6.7 | 21.3 | 33.9 | |
| **Intermediate purchases** | | | | | | |
| BL level, bil cu$ | 3939 | 4054 | 4438 | 5558 | 7076 | 4.5 |
| MR level, bil cu$ | | 4107 | 4674 | 6471 | 8977 | 6.3 |
| Difference from baseline, bil cu$ | | 54 | 236 | 913 | 1900 | |
| Percent difference from baseline | | 1.3 | 5.3 | 16.4 | 26.9 | |
| **Manufacturing value added** | | | | | | |
| BL level, bil cu$ | 1813 | 1886 | 2064 | 2562 | 3185 | 4.3 |
| MR level, bil cu$ | | 1909 | 2265 | 3377 | 4759 | 7.4 |
| Difference from baseline, bil cu$ | | 23 | 201 | 816 | 1574 | |
| Percent difference from baseline | | 1.2 | 9.7 | 31.8 | 49.4 | |
| **Manufacturing value added share** | | | | | | |
| BL share, % of GDP | 11.58 | 11.48 | 11.34 | 11.17 | 11.10 | -0.5 |
| ML share, % of GDP | | 11.59 | 12.27 | 14.15 | 15.76 | 4.2 |

Source: Inforum

The combination of significantly higher output volume, slightly higher prices, and markedly lower input costs means that the value added is enhanced substantially, by $1.5 trillion, or 49.4 percent, in the MR alternative relative to the BL scenario. This is essentially the same increment to current dollar GDP. The value added to nominal GDP ratio is shown in the final rows of Table 2. As shown above, under the MR simulation the manufacturing value added ratio reached 15.8 percent by 2025, compared to 11.1 percent in the BL scenario.

Table 3 shows the implication for employment, income, and the current (external) account. In the MR alternative overall employment is up significantly, especially in the near term. By 2020 there are 1.7 million more jobs compared to the baseline, but this increment subsides to about 0.5 million by 2025. Most of this long term increase is fueled with higher labor participation rates; the labor force expands by about 600 thousand persons by 2020 relative to the baseline. The near-term expansion is manifest through a significantly lower unemployment rate through the early twenties, but the rate converges to 5.3 percent by 2025. This trajectory, displayed in Figure 3, illustrates how the resurgence can relieve unemployment in the near term, where significant slack remains in any case. By 2025, however, the rates

Table 3

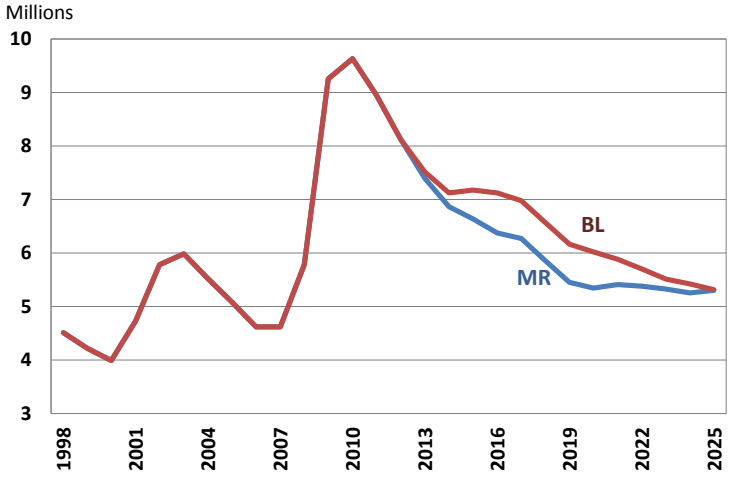
**Employment, Income, and Current Account**

| | 2012 | 2013 | 2015 | 2020 | 2025 | Average annual % change 2012-2025 |
|---|---|---|---|---|---|---|
| **Total Employment** | | | | | | |
| BL level, millions | 147.6 | 149.2 | 152.6 | 161.6 | 170.7 | 1.1 |
| MR level, millions | | 149.7 | 153.8 | 163.3 | 171.3 | 1.1 |
| Difference from baseline, millions | | 0.5 | 1.2 | 1.7 | 0.5 | |
| Percent difference from baseline | | 0.3 | 0.8 | 1.0 | 0.3 | |
| **Civilian Labor Force** | | | | | | |
| BL level, millions | 154.9 | 156.2 | 159.2 | 166.3 | 174.3 | 0.9 |
| MR level, millions | | 156.5 | 159.6 | 166.9 | 174.9 | 0.9 |
| Difference from baseline, millions | | 0.3 | 0.4 | 0.6 | 0.6 | |
| Percent difference from baseline | | 0.2 | 0.2 | 0.4 | 0.3 | |
| **Unemployment Rate** | | | | | | |
| BL rate % | 8.1 | 7.5 | 7.2 | 6.0 | 5.3 | -2.8 |
| MR rate, % | | 7.4 | 6.6 | 5.3 | 5.3 | -2.8 |
| Difference, % points | | -0.1 | -0.5 | -0.7 | 0.0 | |
| **Manufacturing employment (mill)** | | | | | | |
| BL level, millions | 12.3 | 12.3 | 12.1 | 12.3 | 12.6 | 0.2 |
| MR level, millions | | 12.5 | 12.9 | 14.5 | 16.3 | 2.2 |
| Difference from baseline, millions | | 0.2 | 0.7 | 2.2 | 3.7 | |
| Percent difference from baseline | | 1.3 | 6.0 | 18.3 | 29.2 | |
| **Manufacturing employment share** | | | | | | |
| BL rate % | 8.4 | 8.2 | 8.0 | 7.6 | 7.4 | -1.0 |
| MR rate, % | | 8.3 | 8.4 | 8.9 | 9.5 | 1.2 |
| Difference, in rate | | 0.1 | 0.4 | 1.3 | 2.1 | |
| **Real Personal Income** | | | | | | |
| BL level, bil 05$ | 11672 | 11757 | 12584 | 14785 | 16832 | 2.8 |
| MR level, bil 05$ | | 11803 | 12748 | 15087 | 17080 | 2.9 |
| Difference from baseline, bil 05$ | | 45.9 | 164.6 | 301.2 | 248.1 | |
| Percent difference from baseline | | 0.4 | 1.3 | 2.0 | 1.5 | |
| **Current Account Balance** | | | | | | |
| BL level, bil cu$ | -537 | -600 | -781 | -942 | -918 | -380.4 |
| MR level, bil cu$ | | -573 | -577 | -252 | 307 | 844.6 |
| Difference from baseline, bil cu$ | | 27 | 203 | 690 | 1225 | |

Source: Inforum

Figure 3

**Unemployment Rate**




Source: Inforum

emonstrating
with the unemployment
Total manufacturing
t is 3.7 million higher in
nario. Manufacturing
t as a proportion of total
t rises from its current
percent to 9.5 percent in
rnative by 2025.
important indicators
bottom-line tests for the
tive scenario. The first
nent to real personal
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e real income in the MR

alternative is 1.5 percent greater than the BL scenario. This is a moderate but solid increase. Second, the U.S. trade deficit is reversed in our MR scenario. From a 2025 deficit over $900 billion in the BL scenario, the current account is over $300 billion in surplus in the MR alternative. This turnaround of the current account demonstrates that the resurgence of manufacturing places the economy on a much more sustainable path to the future. Indeed, by 2025 there is a surplus on the current account, a surplus that will be used to reverse the foreign debt load otherwise overhanging the American economy.

Table 4
**VALUE ADDED BY INDUSTRY**
percent of GDP*

| | 1998 | 2012 | BL 2025 | MR 2025 |
|---|---|---|---|---|
| Agriculture, forestry, fishing | 1.1 | 1.1 | 1.0 | 1.0 |
| Mining | 1.0 | 1.9 | 2.9 | 2.9 |
| Construction | 4.4 | 3.7 | 4.4 | 4.0 |
| Manufacturing | 15.1 | 11.6 | 11.1 | 15.8 |
| Wholesale and retail trade | 13.8 | 12.2 | 11.4 | 10.8 |
| Transportation Services | 3.2 | 3.1 | 3.2 | 3.2 |
| Finance, insurance, real estate | 19.2 | 20.0 | 21.1 | 19.9 |
| Professional, business services | 10.6 | 12.0 | 12.2 | 11.9 |
| Education, health, social services | 6.9 | 8.6 | 9.6 | 8.7 |
| All government | 12.5 | 13.2 | 11.3 | 11.1 |

*Not all sectors are listed, totals do not add to 100
Source: Inforum

In order for manufacturing to regain its 1998 share of GDP, other sectors must necessarily lose some share. Table 4 lists some of the major changes, and gives a sense of the relative growth of different sectors—not all sectors are listed. In the MR scenario, manufacturing goes from 11.6 percent of GDP in 2012 to 15.8 percent in 2025, while the services-oriented sector, such as wholesale and retail trade; information, finance, insurance and real estate; education; health; and federal government all lose some share of GDP for a total of about 3.1 percent, relative to 2012. The larger education and health sectors slow their recent pace of growth so that their share is essentially flat, but significantly lower than in the BL. Government accounts for about 1.5 percent of the shift in shares of GDP, from somewhat elevated levels in 2012. All of these non-manufacturing sectors grow more slowly in terms of value added in the MR scenario than in the BL scenario. We will discuss this latter phenomenon below.

## Major Reasons for More Robust Growth in Manufacturing

The most important single reason for the manufacturing resurgence is the recapture of lost market share in both foreign and domestic markets for U.S.-domiciled firms (including U.S. affiliates of foreign multinationals). The second and related factor is an increase in capital investment, both in structures (factories) and equipment and software needed to produce the higher demand for U.S. manufactured goods Another important factor is the boom in energy production in the United States, which lowers

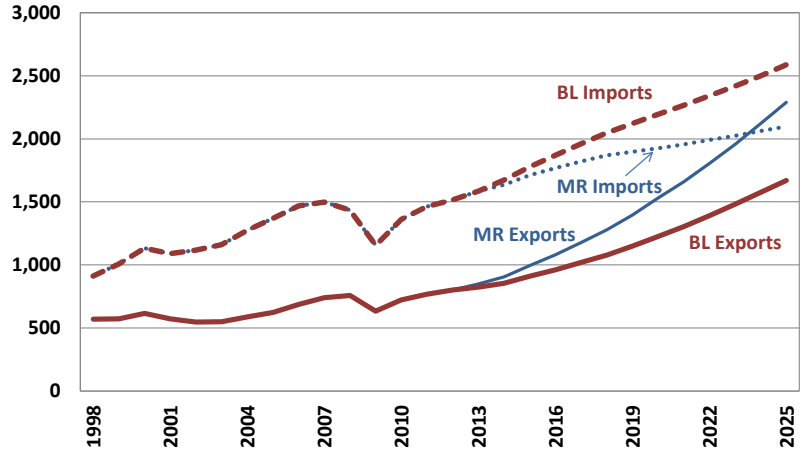
costs for both heat inputs and for raw materials that are transformed into products such as chemicals, fertilizers, and steel. The lighter hand of regulation assumed in the MR scenario contributes to reducing intermediate inputs as well. Consequently, unit input costs decline in the MR scenario, producing improved profit margins and freeing up more capital for investments. Finally, due to enhanced production and investment, millions of skilled jobs must shift in to manufacturing, both to fill new job creation and replace the unusually high level of retiring cohorts, all without creating wage inflation which triggers a negative response from the Federal Reserve.

Since the reversal of the international trade performance accounts for two-thirds or more of the improved performance under the MR scenario, I will start with the more detailed discussion of the rationale for the better export performance and for moderation in the growth of real imports. These forces combine to provide a meaningful trade surplus in manufactured goods by 2025. Figure 4 charts the growth of imports and exports of manufactured goods from 2000 to 2025.

Figure 4

**Boosting Real Manufacturing Demand: Exports and Imports**

(billions of 2005$)




Source: Inforum

## Rationale for Net Export Boom

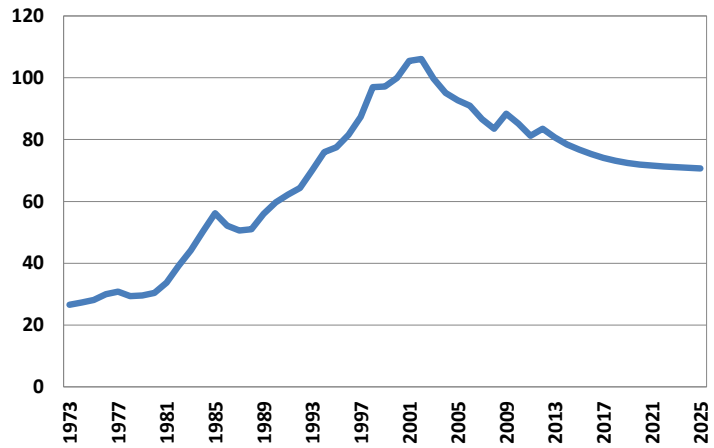
The United States has been losing domestic and foreign market share for several decades: why should we assume these trends will be reversed? There are many reasons for this optimistic assumption, and recent performance of U.S. exporters tends to support the argument, as manufactured goods exports have grown by about 39 percent (in current dollars) since the low point in 2009, or about 7.8 percent at an annual rate. Our MR scenario quickens export growth only to 8.1 percent annually. This is a good start in achieving President Obama's stated goal of doubling exports by 2015.

An obvious reason to look to export markets for growth is the higher growth rates and rapid expansion of purchasing power in developing economies. For example, at the recent Party Conference installing new Chinese President Xi Jiping, outgoing Premier Wen announced that the key to China's economic program in the future is to rebalance the economy by "enhancing people's ability to consume."[6] Much work remains to be done to gain access to markets in China, Brazil, Southeast Asia, India, and other growing areas (see below on trade policy), but it is indisputable that the most rapid growth in our

[6] See Bob Davis and Tom Orlik, "China Moves to Temper Growth," *The Wall Street Journal*, March 5, 2013, A1. China has adopted a "lower" target for growth, at 7.5 percent annually, and will try to lower some forms of investment, such as property, while boosting person consumption. There is obviously a political component to this shift as well.

time frame will come from the developing world. Evidence is also growing that the cost advantages enjoyed by foreign producers is diminishing and is likely to narrow even further. This is clear even relative to China, where wage rates are growing by double-digit figures every year. The Hackett Group argued in a recent study that the total cost advantage to manufacturing in China as compared to the United States has nearly reached the point where it is no longer compelling, an argument also supported by research by the Boston Consulting Group (BCG).[7] Reinforcing this trend is the growing recognition among U.S. multinationals that "intangible costs"—supply chain disruptions or dysfunctions, reliable access to inputs such as electricity and raw materials—and growing transportation costs add to the real bill for producing abroad. The disruptions occasioned by the Japanese tsunami, floods in Thailand, Hurricane Katrina, and the horrific blow of 9/11 reinforce the growing recognition of the true costs of

Figure 5
**Federal Reserve's Broad Currency Index**



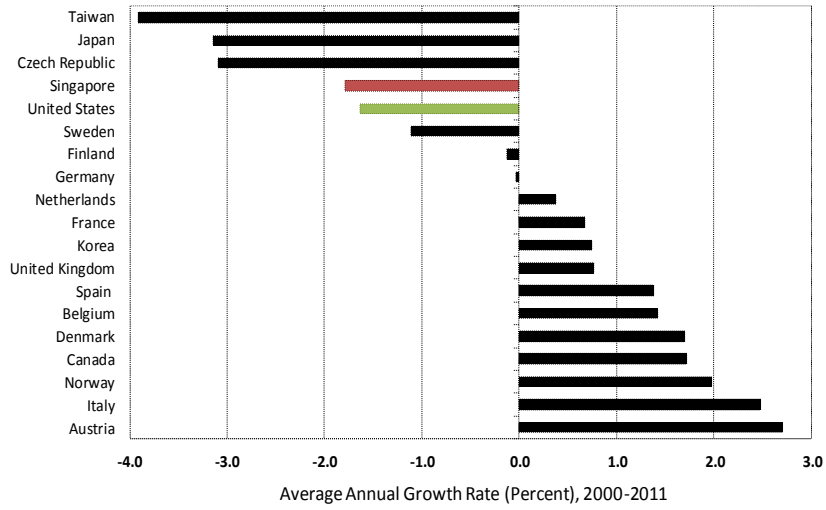

Source: Federal Reserve and Inforum

cent years the dollar has
m historically elevated
to the currencies of most
partners, as shown in
spite the threat of
urrency devaluations,
was motivated by a
at U.S. monetary policy
ed to weaken the dollar,
e scenario assumes that
eakening will continue at
ace in coming years,
another 15 percent against
s of major trading partners.
mental tenet of
ne large trade deficit must
corrected, in part by changes in the relative value of the dollar. Additionally, the "safe haven" component of the strong dollar is likely to diminish as the volatility and fear embedded in global economic activity during the Great Recession evolves into a more stable climate. Finally, central banks in surplus countries, such as China and Japan, have relied on huge dollar purchases to both keep their currencies from rising too fast—in their own perception—and to support their export-dependent growth models. As China and some other Asian surplus countries slowly move to more balanced growth strategies enhancing purchasing power, the dollar should weaken. These new policies are one means to respond to consumer aspirations for higher standards of living and attempt to prudently diversify core currency reserves. Defusing the currency wars will receive more attention in the section of this paper on policy choices. Japan, it should be noted, will also need to rebalance its central bank reserves to reflect the growth of the major developing countries.

[7] See, "Reshoring Global Manufacturing: Myths and Realities" (London: The Hackett Group, 2012); and Sirkin, *et al.*, *op. cit.*

Continued high growth in productivity in manufacturing, technological leadership which results from the work of the great research establishments in the United States, and the attractiveness of the United States as a destination for foreign direct investment are other factors favoring the growth of exports. One cluster of examples illustrates the convergence of many of these trends to support growth in exports. Most major foreign automakers now produce vehicles in the United States, not only to serve the large U.S. market, but increasingly, for export to third markets. BMW, for example, is again raising its production capacity in South Carolina and already exports about 70 percent of its production from its U.S. [illegible]xporting sports utility [illegible]ehicles to Australia and [illegible]ussia from its landlocked [illegible]diana plant.[8] These [illegible]xamples speak to the [illegible]traction of the United States [illegible] a production platform, and [illegible] the ample confidence that [illegible]reign multinationals have in [illegible]e value of their U.S. [illegible]cilities. Foreign firms will [illegible]ntinue to play an important [illegible]le in any manufacturing [illegible]surgence. Another way to [illegible]pture the advantages of [illegible]oductivity growth, cost [illegible]ntrols, and process [illegible]provements is to look at the [illegible]c of unit labor costs over time. Figure 6 shows that the U.S. manufacturing sector has done a good job in improving this measure of competitiveness in the last decade, relative to its major trade competitors.

Figure 6
**Manufacturing Sector's Falling Unit Labor Costs Increase Global Competitiveness**




Source: U.S. Bureau of Labor Statistics

## Impact of the Domestic Energy Boom

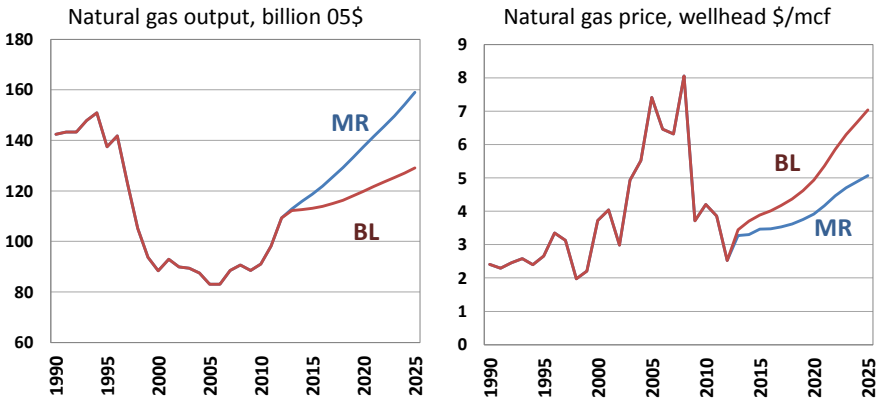
The boom in natural gas and oil production in recent years in the United States is also a huge wind at the back of U.S. manufacturing. The industrial sector is the nation's largest consumer of energy, both directly as raw material used in the manufacturing process and indirectly through the use of electricity and heat. The natural gas boom has resulted in much lower prices in the United States for this important fuel compared to its Asian and European competitors and has contributed to significantly lower electricity costs as well. Figure 7 provides our simulated forecasts for both production and prices of natural gas. It illustrates the rapid growth of production in recent years. Table 5 displays the prices and the detailed supply and demand balance for natural gas, in trillions of cubic feet, for both scenarios. In the MR alternative, we assume that enhanced domestic supply will cushion an expected increase in the

[8] See Jeff Wilkinson, "Exports Soar at BMW's Spartanburg Plant," *The State.com*, June 12, 2012, http://www.thestate.com/2012/06/12/2312060/exports-soar-at-bmws.html; and "Toyota to begin Highlander exports from Indiana in 2013; adds 400 Jobs," Toyotanation.com, February 8, 2012, http://www.toyotanation.com/forum/38-toyota-news/404708-toyota-begin-highlander-exports-indiana-2013-adds-400-jobs.html.

real (inflation-adjusted) price of natural gas over the projection horizon. While the price still grows at an annual rate of 3.3 percent in the MR alternative, it is almost 28 percent lower compared to the BL scenario by 2025. Prices rise at an annual rate of 5.8 percent in the BL.

Figure 7

**Supply: Ample Natural Gas Supplies Drive Down Price, Provide Incentive To Onshore Energy Intensive Activities**




Source: Inforum

Turning to supply, in contrast to growth of only 1.3 percent in the BL scenario, natural gas production grows by 2.9 percent per year in the MR. At this rate, production is 23.2 percent higher in 2025 relative to the BL figures. Much of this production goes to displace natural gas imports. They are expected to grow in the BL alternative, but fall substantially in the MR scenario and finish 58.8 percent lower compared to the BL.

Table 5

**Natural Gas Supply, Disposition, and Prices**

(trillion cubic feet, unless otherwise noted)

| | 2012 | 2013 | 2015 | 2020 | 2025 | Avg. annual % change 2012-2025 |
|---|---|---|---|---|---|---|
| **Henry Hub Spot Price (Real)** | | | | | | |
| BL 2011 dollars per mcf | 2.6 | 3.5 | 3.7 | 4.3 | 5.6 | 5.8 |
| BL 2011 dollars per mcf | | 3.3 | 3.4 | 3.4 | 4.0 | 3.3 |
| Percent difference from baseline | | -5.1 | -10.5 | -20.7 | -27.7 | |
| **Supply** | | | | | | |
| **Domestic Production** | | | | | | |
| BL level, tcf | 24.0 | 24.6 | 24.8 | 26.3 | 28.3 | 1.3 |
| MR level, tcf | | 24.8 | 26.0 | 30.1 | 34.9 | 2.9 |
| Difference from baseline, tcf | | 0.2 | 1.2 | 3.9 | 6.6 | |
| Percent difference from baseline | | 0.6 | 4.9 | 14.7 | 23.2 | |
| **Imports** | | | | | | |
| BL level, tcf | 3.4 | 3.3 | 3.5 | 3.9 | 4.1 | 1.5 |
| MR level, tcf | | 3.3 | 3.1 | 2.5 | 1.7 | -5.3 |
| Difference from baseline, tcf | | 0.0 | -0.4 | -1.4 | -2.4 | |
| Percent difference from baseline | | 0.7 | -12.1 | -35.7 | -58.8 | |
| **Demand** | | | | | | |
| **Domestic Demand** | | | | | | |
| BL level, tcf | 25.7 | 25.8 | 26.5 | 27.9 | 29.4 | 1.0 |
| MR level, tcf | | 26.4 | 27.5 | 30.6 | 33.8 | 2.1 |
| Difference from baseline, tcf | | 0.6 | 1.0 | 2.7 | 4.3 | |
| Percent difference from baseline | | 2.2 | 3.9 | 9.6 | 14.7 | |
| **Exports** | | | | | | |
| BL level, tcf | 1.6 | 2.1 | 1.9 | 2.2 | 3.0 | 4.7 |
| MR level, tcf | | 1.7 | 1.6 | 2.0 | 2.8 | 4.1 |
| Difference from baseline, tcf | | 1.6 | 1.9 | 2.7 | 4.0 | |
| Percent difference from baseline | | -0.1 | 0.3 | 0.7 | 1.2 | |

Source: Inforum

The manufacturing resurgence creates substantial extra demand for natural gas through two channels. First is the direct demand for gas by industrial sectors, especially chemicals, non-metallic minerals, metals, and other materials sectors. Second, greater industrial demand for electricity use requires more natural gas indirectly, especially because the lower price profile means a shift toward natural gas in generating fuel. Domestic demand grows by an average of 2.1 percent in the MR alternative, versus only 1.0 percent in the BL scenario. Because of the enhanced domestic demand, the MR alternative assumes only a limited opportunity to increase natural gas exports above those in the BL scenario.

Wholesale electricity prices in Germany are about double those of the United States, to take just one example of the global importance of lower domestic gas prices. Higher electricity prices are starting to reduce the competitiveness of German industry.[9] Natural gas prices in Europe and Japan are about triple those in the United States, which gives special advantage especially to the chemicals and mini-mill steel industries which use gas as raw material in their processes. More than two-thirds of U.S. chemicals plants use natural gas and natural gas liquids as the raw materials to make chemicals and plastics, whereas in Europe and Asia, about two-thirds of the inputs are in the form of petroleum. Relative to current prices of natural gas, the gap with petroleum prices is at record highs, giving the U.S. chemicals and plastics sector an enormous competitive advantage. Other domestic industries, such as steel, benefit as well.[10]

Table 6
**Manufactured Exports and Imports by Producing Sector**

| EXPORTS BY PRODUCING SECTOR (Billions of 2005$) | 1998 | 2012 | 2025 | Avg. % change 2012-2025 |
|---|---|---|---|---|
| **TOTAL EXPORTS** | 1000.3 | 1573.1 | 3665.7 | 6.5 |
| Manufactured exports | 569 | 800 | 2290 | 8.1 |
| Natural gas extraction | 2.02 | 11.87 | 21.16 | 4.4 |
| Nondurable consumer products | 53.67 | 64.21 | 190.01 | 8.3 |
| Paper | 13.39 | 17.33 | 38.50 | 6.1 |
| Plastic and rubber materials | 18.19 | 30.16 | 121.85 | 10.7 |
| Other chemicals | 44.99 | 66.05 | 226.87 | 9.5 |
| Plastic products | 9.94 | 13.61 | 37.01 | 7.7 |
| Iron and steel | 6.58 | 13.75 | 32.38 | 6.6 |
| Fabricated metal products | 18.47 | 23.83 | 72.56 | 8.6 |
| Agric., cst., and mining equip | 17.66 | 24.60 | 75.75 | 8.7 |
| Industrial machinery | 8.21 | 17.41 | 52.21 | 8.4 |
| Engine, turbine, power equip | 11.09 | 19.90 | 60.77 | 8.6 |
| Electronic, electrical products | 123.53 | 139.35 | 443.70 | 8.9 |
| Computers and peripherals | 25.27 | 20.31 | 118.86 | 13.6 |
| Semiconductors and other elect | 45.87 | 52.35 | 138.11 | 7.5 |
| Motor vehicles | 23.79 | 47.45 | 92.33 | 5.1 |
| Aerospace products and parts | 70.82 | 78.74 | 203.59 | 7.3 |

| IMPORTS BY PRODUCING SECTOR (Billions of 2005$) | 1998 | 2012 | 2025 | Avg. % change 2012-2025 |
|---|---|---|---|---|
| **TOTAL IMPORTS** | 1339.1 | 2060.5 | 2935.0 | 2.7 |
| Manufacturing imports | 912.6 | 1517.4 | 2099.0 | 2.5 |
| Natural gas extraction | 24.7 | 24.9 | 12.5 | -5.3 |
| Nondurable consumer products | 133.9 | 215.0 | 262.2 | 1.5 |
| Paper | 18.2 | 18.5 | 25.5 | 2.5 |
| Plastic and rubber materials | 9.5 | 10.6 | 12.6 | 1.3 |
| Other chemicals | 36.7 | 48.1 | 61.1 | 1.8 |
| Plastic products | 9.8 | 19.4 | 28.5 | 3.0 |
| Iron and steel | 33.6 | 23.4 | 28.6 | 1.5 |
| Fabricated metal products | 29.0 | 40.7 | 68.6 | 4.0 |
| Agric., cst., and mining equip | 15.3 | 15.2 | 26.7 | 4.3 |
| Industrial machinery | 12.2 | 13.8 | 30.0 | 6.0 |
| Engine, turbine, power equip | 8.7 | 18.0 | 44.8 | 7.0 |
| Electronic, electrical products | 188.5 | 413.0 | 565.2 | 2.4 |
| Computers and peripherals | 59.9 | 96.1 | 190.1 | 5.2 |
| Semiconductors and other elect | 53.7 | 54.6 | 63.4 | 1.2 |
| Motor vehicles | 103.5 | 140.1 | 156.9 | 0.9 |
| Aerospace products and parts | 24.5 | 19.9 | 15.2 | -2.1 |

Source: Inforum

Table 6 lists some of the major exporting industries and provides detail on our forecast of growth in export volume (real) to 2025. It also shows the trajectory of imports in the same time frame. Overall manufacturing goods exports grow by 8.1 percent per year over the projection horizon. Consistent with plentiful, low cost supplies of natural gas, the plastic and rubber materials and the (non-pharmaceutical) chemicals sectors are two of the fastest growing export industries. They grow at 10.7 percent per year

[9] See Jeff Ryser, "US and Europe through a prism of electricity prices," *The Barrel Blog*, November 20, 2012, http://blogs.platts.com. Also, William Boston, "Germany Takes New Look at Fracking as Energy Bills Soar," *The Wall Street Journal*, March 2, 2013, A11.
[10] On the steel industry, see Laplace Conseil, "The Future of Steel: How Will the Industry Evolve" (Paris: OECD, November 2012), Publication No. DSTI/SU/SC(2012)21.

and 9.5 percent per year, respectively. The export volume of electronics, including computers and semiconductors, grows very rapidly, although in the case of computers it is from a relatively low base. Capital goods sectors like industrial machinery; engines, turbines and power equipment; fabricated metals; semiconductors; computers; and aerospace products also grow at above-average levels. Heat-intensive industries, such as steel and paper, also grow.

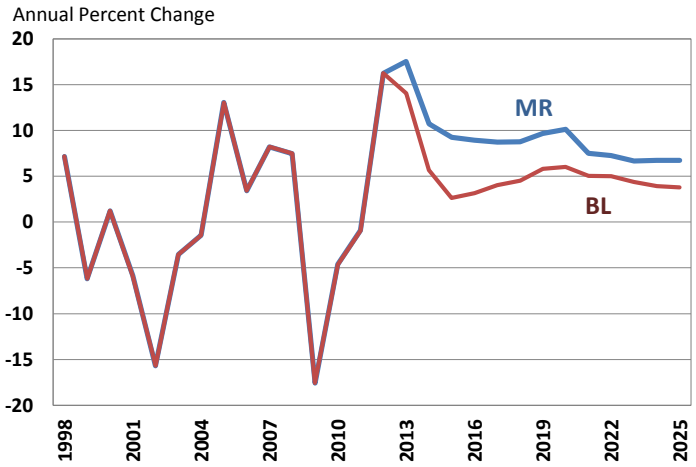
Real imports of manufactured goods are more restrained, growing at only 2.5 percent per year. Imports of computers, plastic products, fabricated metal products, and engines and turbines grow faster than average imports, but not as fast as exports in these categories. Many energy-intensive sectors go from deficit to surplus numbers between 2012 and 2025. Natural gas, plastics, paper, and steel are all in this category. Semiconductors trade improves from a small deficit in 2012 to a larger surplus in 2025.

## The Investment Imperative

More capital investment is required under our MR scenario, not only to build and equip the factories needed to fuel production growth but also to enhance productivity and innovation. Shifting resources from consumption to investment also serves to rebalance the economy, support longer-term growth, and reduce the trade deficit. Capital investment, as traditionally measured, has been weak since the "dot-com bust" nearly 15 years ago. Figure 8 illustrates this historical weakness, whose low point was reached in 2009 when investment in equipment and software, when adjusted for depreciation, was negative for the first time since the Great Depression in the 1930s.[11] Net business investment, including structures, was still well below pre-recession levels. Our MR scenario charts the slightly stronger growth expected in the next decade. Even these two recovery and growth scenarios are somewhat modest by historical standards and by the standards of competitors like China, which devoted more than 24 percent of GDP output to capital investment to build out its industry in 2012, more than two and a half times the level in the United States last year. Gross fixed private capital formation grows at only 4.7 percent annually in the BL scenario, compared to 6.2 percent in the MR.

Figure 8

**Fixed Capital Investment, Manufacturing**




Source: Inforum

As noted earlier, investment is needed to spur innovation and advances in productivity. Although not an explicit part of our modeling, it is instructive to think about what some economists call intangible capital, including not only software (already included in official investment data), but other expenditures on innovation and productivity-related factors: research and development, skills training, improvement in business processes, and efforts to protect and expand intellectual property rights (IPR), i.e., patents, copyrights, and trademarks. Early econometric research on the impact of such investment-related

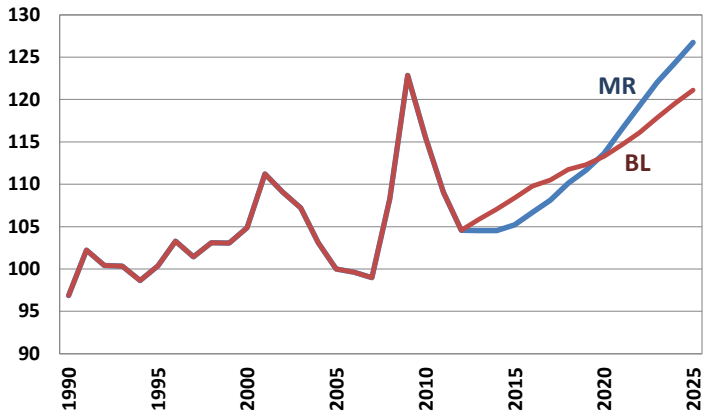
[11] See Bureau of Economic Analysis, "National Income and Product Account Tables," Table 5.2.3 (2013).

expenditures, whose size was estimated at over $800 billion in 2003, suggests that this type of investment, when counted as a capital expenditure, would materially raise measured, aggregate GDP productivity. The authors of a seminal study suggest that intangible investment ". . . becomes the unambiguously dominant source of growth in labor productivity. . . ."[12] Manufacturing is already the dominant source of research and development expenditures in the United States and spends heavily to enhance its information technology, IPR, worker skills, and process improvement capabilities. Even if we are not yet able to accurately judge the precise impact of such investments, the early work suggests this to be a source of competitive strength not only for the U.S. manufacturing sector, but also for its suppliers and customers in the raw materials, utilities, transportation, and service industries. The increased level of investment in manufacturing is required to support the extra production, especially in the capital-intensive sectors, such as plastics, chemicals, refining, metals, machinery, and electronics. Indeed, expansion in this mix of industries drives a modest increase in the capital intensity of the manufacturing sector, as Figure 9 illustrates.

Figure 9

**Capital Intensity of Manufacturing, Installed Capital**

Per Unit of Output, 2005=100




Source: Inforum

## Improving Skills for Labor Moving to Manufacturing

A meaningful shift in employment to the manufacturing sector and improvement in the skills level of the workforce is required for the success of our MR scenario. Not only do we need to fill 3.7 million new jobs, but we must also replace retiring workers. The weak performance of manufacturing in recent decades, combined with the reluctance of educational institutions and parents to direct students to manufacturing occupations, resulted in a level of entrants to the workforce below the replacement rate in recent years. Many industries see a 50 percent retirement rate—or higher— for their skilled workforce in the next decade. How are we to fill these shortcomings? One can start by assuming that a stronger rate of growth will both lower the persistently high unemployment rate and increase the labor participation rate, which declined from around 67 percent of the workforce to a low of around 63 percent in recent years. Figure 2 showed the path of employment growth and the relative share of employment represented by this sector. It is important to note that in recent decades service-related jobs previously kept in-house by

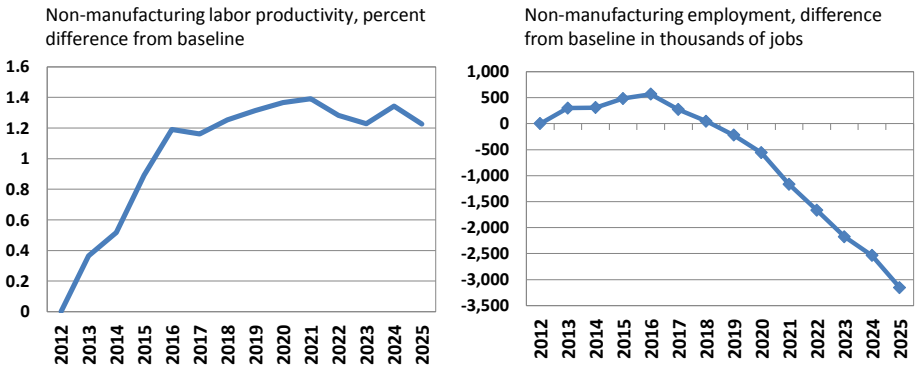
[12] See Carol Corrado, Charles Hulten, and Daniel Sichel, "Intangible Capital and U.S. Economic Growth," *The Review of Income and Wealth*, Series 55, September 3, 2009. Ben Bernanke has also spoken at the importance of intangible capital; see his "Remarks Before Leadership South Carolina" on productivity," August 31, 2006, http://www.federalreserve.gov/newsevents/speech/Bernanke20060831a.htm.

manufacturing firms have been outsourced. This is one reason that the jobs multiplier is so high for manufacturing.

Second, some labor shifts from the services sector to manufacturing, as shown in the second graph of Figure 10. [13] Our modeling assumes that a higher intensity of manufacturing in the economy results in competitive pressures to conserve on labor in fast-growing, large, labor-intensive sectors such as construction, trade, business services, finance, education, and health. These sectors tend to absorb large amounts of labor because their productivity growth is relatively low. Moreover, a larger domestic manufacturing footprint developed in the sector a

Figure 10

**Supply: Modest Labor Productivity Acceleration in Key Services Sectors (Construction, Trade, Finance, and Health) Frees Labor Resources for Manufacturing Growth**




Source: Inforum

## Capturing Benefits of Lower Intermediate Costs

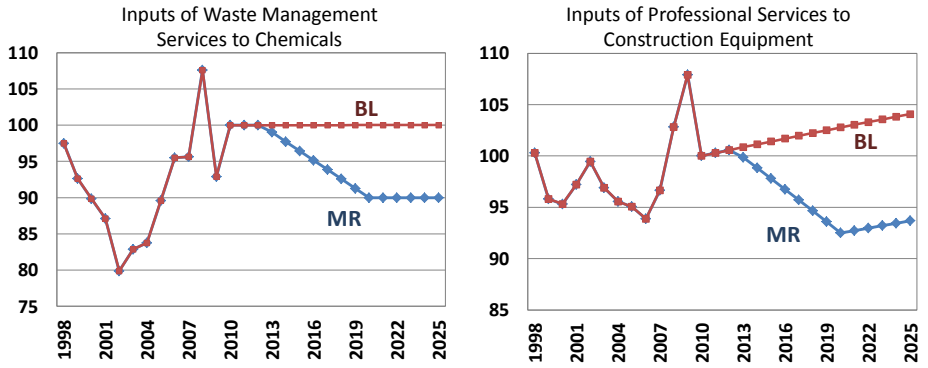
Our model also assumes some regulatory forbearance, which would at least slow the pace of new regulation and provide some relief in the growth of intermediate costs to business. The pace of new regulation picked up in the last 12 years in many areas, although those related to workforce conditions, energy development and uses, and environmental health and safety are among the most important to manufacturing. It is not just the isolated costs of a new regulation, but the cumulative impact of more and more layers of regulation that weighs on manufacturing. A recent NERA Economic Consulting study for the cosponsor of the present study, MAPI, estimates that: "From 1998 through the end of 2011, the cumulative inflation-adjusted cost of compliance with major regulations affecting the manufacturing sector grew by an annualized rate of 7.6 percent." This is more than three times the rate of GDP growth.[15] Over 2,183 unique new manufacturing-related regulations have been implemented at the federal level alone and could, according to NERA, reduce manufacturing output by 2.3 percent to 6 percent over the next decade if the trend continues.

[13] It is also worth noting again that the chart shows the differences in employment from the baseline scenario, not an absolute decline in 3 million workers from services.
[14] See the work of Gregory Tassey, especially *The Technology Imperative* (Northampton, MA: Edward Elgar, 2007).
[15] NERA Economic Consulting, *Macroeconomic Impacts of Federal Regulation of the Manufacturing Sector* (Washington, DC: NERA, 2012).

Compared to the BL scenario, the MR scenario assumes a moderation in the pace of new regulation and a partial savings in real compliance costs. Specifically, we reduced manufacturing's real purchases of professional, administrative, and waste management services dedicated to regulatory compliance. To illustrate, some impacts of a reduction in regulation-related costs on the chemicals and heavy equipment sectors are shown in Figure 11. The left graph shows the index of the real input requirements of waste management services (WMS) to one unit of chemical manufacturing. By 2020, the

Figure 11

**Regulatory Relief Reduces Input of Business and Waste Management Services**




Source: Inforum

nd this ratio between the two is constant for the final five years. The second is an index of the input requirements of professional services (especially including engineering and the like) per unit of output in the agricultural, construction, and mining equipment sectors. The relative decline in input requirements is similar, 10 percent lower by 2020. Note that in the first instance the index re increasing in the ut $150 billion in current dollars in 2025, or about 1.1 percent of total current-price manufacturing output in the MR scenario.

## Some Policy Considerations

Our modeling highlights several of the forces that could help drive a manufacturing resurgence: (1) regaining lost market share in both foreign and domestic markets; (2) diversion of resources from consumption to capital investment; (3) greater supply and lower costs for energy, especially natural gas; (4) greater availability of labor with proper skills for manufacturing; and (5) a reduction of the increasingly heavy and layered regulatory burden. U.S. policy choices in the next decade can either help or hurt the potential for regaining the stronger position of manufacturing in the national economy that it enjoyed just 15 years ago. Some of the most important policy drivers that could catalyze action in a constructive fashion are outlined in this section.[16]

### Trade Policy

In terms of trade policy, it is essential to note at the outset that the most important determinant of our MR outcome would be strong global growth, not only in the developing world, but also in the

[16] Many of the themes that follow were developed in an Aspen CEO Seminar in 2012: See Thomas J. Duesterberg, *Summary Findings of the Aspen Seminar on Policy Priorities for Manufacturing in the 21st Century* (Washington, DC: The Aspen Institute, 2012).

advanced economies of Europe, Japan, and the Pacific Rim. Policy in the United States cannot materially influence growth in other countries. Nevertheless, working constructively with our trading partners in traditional venues, such as the G-8, the G-20, the International Monetary Fund (IMF), the World Bank, and the Organization for Economic Cooperation and Development (OECD), to achieve stability and promote growth-oriented policies can contribute to the global prosperity important to our projections of export growth.

More directly, the United States needs to employ trade policy more aggressively to reduce barriers to exports and to enforce existing obligations that trading partners have assumed in past negotiations. Importantly, completion of the Transpacific Partnership, or TPP (ideally including Japan), would help U.S. firms to regain some of the market share lost in recent decades and to participate fully in the fastest growing markets in the world. The recently announced Transatlantic Trade and Investment Partnership also has great promise to revitalize growth in Europe, which remains the largest foreign market for U.S. firms. Perhaps, equally as important, this agreement will address non-traditional barriers to trade and undertake an ambitious program to narrow regulatory differences across the Atlantic, which has great promise to lowering intermediate input costs as well as opening huge new markets. Congress will need to cooperate by authorizing new Trade Promotion Authority (TPA) so that these agreements can be effectively negotiated.

Some effective action is also needed to address the worrisome "competitive currency devaluations" that can have material impact on trade flows. If mechanisms such as the G-20 cannot tame the fires of this competition, careful thought should be given to using existing authority under Article XV of the GATT (now the WTO), in conjunction with IMF consultations under Article IV of its charter, both of which address and prohibit currency manipulation. The U.S. Treasury is required every six months to determine whether any countries are "currency manipulators" under the IMF definition, but in recent years has invoked this authority only once to label other countries as manipulators and work actively with them to address distortions resulting from "protracted, large-scale intervention in one direction in currency markets."[17] If diplomatic consultations and prudential considerations by central banks cannot ensure generally market-determined currency values, careful consideration should be given to the IMF-WTO policy solution.

**Energy Policy**

The simplest way to think about energy policy to support our more aggressive scenario is: do no harm. Forces are now in motion in the United States to unleash the huge potential for manufacturing of the energy renaissance, if we do not get in the way with new regulation or tax policy to thwart it. On the margins, some positive steps would be helpful: for example, allowing new pipelines to transport Alaskan gas to the lower 48 states and to bring Canadian oil to refineries in the United States. A more efficient process for drilling permits on federal land would also be helpful. The average time for approval of permits on federal lands in 2012 was approximately 307 days, whereas the equivalent times for permits granted by state agencies were much shorter, i.e., 27 days in Colorado, 14 days in Ohio, and 10 days in North Dakota.[18] Construction permits for some of the proposed new refining facilities, for making

[17] One of the first to draw attention to this problem and suggest a constructive IMF-WTO approach to its solution is: Ernest Preeg, *The Emerging Chinese Advanced Technology Superstate* (Arlington, VA: MAPI and the Hudson Institute, 2005), Chapter 8. See also William Krist, *Trade Negotiators Need to Address Exchange Rate Manipulation* (Washington: Woodrow Wilson International Center for Scholars, March 2013).

[18] See James Slutz, "Energy Policy: Building on Abundance" (Washington, DC: U.S. Chamber of Commerce, Forum for Innovation, 2013).

everything from ethanol and gasoline to diesel fuel (largely for export) from natural gas, ought to be reviewed in an expeditious fashion as well. Attention to improving the national electricity grid would also be very helpful to the wind and solar energy industries, and implementation of a "smart grid" can assist in conservation efforts, benefiting businesses and individuals alike.

**Regulatory Recalibration**

The complex issue of regulatory forbearance is fraught with controversy, and it is difficult to chart a responsible middle ground. Our assumption in the MR scenario does not depend on the wholesale roll-back of existing regulations, but rather on thoughtful and systematic review of overlapping and duplicative regulation. Enacting new regulation at a pace difficult for firms to administer, and without properly exploring the true costs, is an especial burden for manufacturers. The pace of major new federal regulations quickened from an annual average of 36 between 1993 and 2000 to 45 in 2001-2008 and to 72 from 2009 to 2011.[19] Congress needs to be part of the solution to this problem, and it would be useful in some cases to have better state-federal cooperation.

A promising area for reducing overlapping and sometimes contradictory regulatory standards may lie in the more sophisticated trade negotiations between advanced economies, especially the U.S.-EU and TPP negotiations now under way. The progressively globalized industrial sector must often make different versions of its products for different markets. For major industries, such as autos, this adds considerably to costs. In the chemicals sector, the United States and Europe have different burdens of proof for the safety of products, which require different types of testing and sometimes leads to products being taken off the market or a need to make different formulations of products. Despite the difficult issues of national sovereignty, divergent cultural standards, and simple regulatory inertia, it is worth trying to reach agreement on the mutual recognition or, in some cases, harmonization of different national standards. In the auto sector, for instance, EU Trade Commissioner Karel De Gucht speculated that harmonization of standards could cut costs as much as 10 or 20 percent.[20]

**Skilled Workforce**

In order to meet the growing demand for skilled labor, without sparking the wage inflation that could cause the Federal Reserve to slow growth, including advanced researchers and engineers, a number of steps at the federal, state, and local levels would be helpful. The need for engineers and research scientists is also important. A shorthand version of policies that should be considered includes:

- Improve K-12 schools to better achieve literacy and numeracy standards.
- Add more apprenticeships and vocational education curricula, in close cooperation with industry, to the education systems. Work to overcome the cultural bias against vocational or skills-based education.[21]
- Develop nationally recognized skills certifications so that training is more portable and employees will have confidence in certificates and degrees. The NAM-endorsed "Skills Certification System" for instance has a goal of adding 500,000 skills certifications by 2015.

[19] MAPI and NERA, *op. cit.*, p. 5.
[20] "Around the Globe," *Washington Trade Daily*, February 26, 2013, p. 4.
[21] See Robert Lerman, "Expanding Apprenticeship in the United States: Barriers and Opportunities," in A. Fuller and L. Unwin, eds., *Contemporary Apprenticeship: International Perspectives on an Evolving Model of Learning* (London: Routledge, 2012), pp. 105-124.

- Emphasize Science, Technology, Engineering, and Mathematics (STEM) curricula in K-12 and post-secondary education.
- Reduce the long-standing barriers to entry that exist in several professional fields, especially in medicine, science, and engineering.
- Implement reform in health care, finance, and professional services focused on producing substantially greater productivity growth in those sectors.
- Make concerted effort to recruit non-traditional students—immigrants, adults in transition, women, and minorities—to STEM fields. Business can play a role in mentoring new entrants to the field and taking steps to facilitate participation of these groups in an industrial setting.
- Adjust immigration policy to facilitate permanent visas and citizenship for skilled workers, especially scientists and engineers with degrees from U.S. colleges and universities.
- Industry and government leaders can play a more active role in helping the public understand the realities of modern manufacturing and its promise for the future.
- Encourage partnerships, based in part on the German Model, between manufacturing firms and local schools and community colleges to develop training programs appropriate to local industries.

**Tax Policy**

Tax policy is one key to making sure we have the capital investment needed to rebalance our economy and fuel the growth in physical and non-tangible capital required in our MR scenario. In the first place, especially to continue to attract foreign direct investment, the high corporate tax rate needs to be brought closer to the OECD average, around 25 percent.[22] Lowering corporate tax rates will help to liberate capital locked away in foreign locations, eliminate the incentive to reincorporate in low-tax havens, and reduce wasteful expenditures on tax arbitrage schemes. It is also important to keep depreciation rates as close to current-year 100 percent expensing as is politically feasible. These two factors go a long way to making the purely economic (or accounting) case for locating a plant in the United States. Without leveling the playing field, the pure economic return to capital is likely to be higher in places like Ireland, Switzerland, Canada, or elsewhere with lower corporate tax rates. Unfortunately, part of the off shoring of manufacturing firms in recent decades is tax driven. Moving to a territorial tax system, in which taxes are paid only to the country where a plant is domiciled, would also address this problem.

Second, making the research and experimentation (R&E) tax credit permanent, and perhaps expanding its reach beyond the narrow bounds of positive increments in R&E outlays, would also be helpful to encouraging the research and development expenditures needed to translate the outstanding science and technology in the United States into useful new products and processes. Many other nations provide superior R&D credits relative to the United States.[23]

[22] Using effective rates do not appreciably change the estimates, as they do not change the order of developed countries in the tables. On this and what follows, see Jeremy Leonard, "A Closer Look at the U.S. Corporate Tax Burden," *Tax Notes*, November 17, 2008, pp. 849-860. See also, Kevin Hassett and R. Glenn Hubbard, "Tax Policy and Business Investment," in A. Auerbach and M. Feldstein, eds., *Handbook of Public Economics*, Vol. 3 (Amsterdam: North Holland, 2002), Chapter 20.

[23] See Robert Atkinson, "Expanding the R&D Tax Credit to Drive Innovation, Competitiveness and Prosperity" (Washington, DC: Information Technology and Innovation Foundation, 2007).

Finally, any further changes in the corporate tax structure, which might involve trading lower rates for elimination of preferences, such as the last-in, first-out accounting method, or changes in our depreciation rates, need to be evaluated partly in terms of their impact on the hundreds of thousands of pass-through entities (S-corporations, partnerships, and limited liability corporations or LLCs) which account for about one-third of all business income in the United States. Pass-throughs generally have already been affected by the recent increases in personal tax rates in 2013. Manufacturing pass-throughs benefit from most of the preferences available to C-corporations, so eliminating these preferences would be a double blow to the more than 200,000 small and medium enterprises which serve, in many cases, as innovators in the manufacturing sector. If we do not want to subject these smaller producers to converting to C-corporations, adding at least temporarily to their expenses and diverting their attention from growing their businesses, then we should carefully consider the impact of further changes in the tax code on these entities.

**Investment in Research**

One other factor that merits the attention of policy makers is our national investment in basic and applied research. Not only is manufacturing the sector which performs about 70 percent of R&D in the United States, but it is the prime beneficiary of basic research, transforming new science into new products and capturing the gains of the "first movers," often protected for many years through perfecting intellectual property rights. If the United States is to regain global market share, it will be in some large part due to new products or processes emerging from new sciences. For instance, our MR scenario projects a larger increase in exports of electronics and other high technology products. We do not know all the products that may flow into this category, but they could be due to advances in nanotechnology, robotics, perfection of 3-D printing, or enhances in bio-engineered products that we cannot conceive of today.

The United States still makes the largest investment in R&D of most developed nations. Relative to GDP, Japan and Korea spend more than we do, and the rate of growth in China is much superior to ours. Additionally, in recent decades, the amount and distribution of federal research dollars has changed in ways not the most helpful to the interests of manufacturing. Federally funded research increasingly is devoted to health care, whereas expenditures on the physical sciences, mathematics, and engineering have been flat. Federal spending on health-related basic research in 2009, obviously vital to national interests and helpful to some areas of manufacturing, is now double that of spending on space, energy, and general science (including social science). In 1980, the ratios were about equal. In terms of R&D, federal health spending on health went from a ratio of one-half the other categories to twice those between 1980 and 2009.[24] It is hard to imagine that four decades ago, in the era of the Apollo program, the United States devoted nearly 1 percent of GDP (at the height of the program) to non-defense scientific research, the lion's share in the physical sciences, mathematics, and engineering. This massive investment has paid rich dividends to manufacturing up to the present in areas such as computing, communications technology, semiconductors, advanced materials, and aerospace. Federal budgets are much more restrained today, but a consideration of a more robust investment in basic research in the manufacturing-

[24] National Science Foundation, *Science & Technology Industries 2012* (Arlington, VA: NSF, 2012), Appendix Tables 4-28 and 4-29.

related areas seems warranted. Econometric research done at MAPI shows a good link between basic research, largely at universities, and the best proxies available for innovation in manufacturing.[25]

## Concluding Remarks

Our manufacturing resurgence projection shows important gains in macroeconomic indicators as we reach 15.8 percent of GDP by 2025. Most of the gains in real GDP, about 5.6 percent above our baseline in 2025, result from the large increase in manufacturing production. Capital investment is 12 percent higher, productivity up 0.7 percent for a total gain of 4.7 percent, employment in manufacturing up over 3.6 million jobs, total employment up 0.5 percent, overall exports up 20.9 percent (including 37.2 percent in manufacturing exports), average real wages up 2.8 percent, and real disposable income up 1.6 percent, relative to the BL. The trade and current deficits are reversed, and the unemployment rate falls to 5.3 percent. All of these results are achievable with only modest acceleration of current trends. None of the policy recommendations advanced to help guide the economy mark a radical departure from current policy trajectories, but they do require a willingness to change in a disciplined way. For some, the inevitable trade-offs in policy choices may outweigh the economic gains attainable under our optimistic scenario. But at a minimum, this forecasting exercise ought to lend some hope that we can indeed look ahead to a manufacturing resurgence and the sustainable macro and microeconomic gains that it brings, if we choose to follow this path.

[25] See Jeremy Leonard and Cliff Waldman, "An Empirical Model of the Sources of Innovation," *Business Economics*, October 2007, pp. 33-45.

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