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The U.S. Manufacturing Recovery: Uptick or Renaissance?

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Abstract

The notable rebound of U.S. manufacturing activity following the Great Recession has raised the question of whether the sector might be experiencing a *renaissance*. Using panel regressions, we find that a depreciating real exchange rate, an increasing spread in natural gas prices between the United States and other G-7 countries, and in particular decreasing unit labor costs have had a positive impact on U.S. manufacturing production. While we find it unlikely for manufacturing to become a main engine of growth in the United States, we find that U.S. manufacturing exports could provide nonnegligible growth opportunities going forward.

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I. INTRODUCTION

The strong recovery of U.S. manufacturing output in the aftermath of the Great Recession has spurred renewed interest in this sector among analysts and policymakers alike. Although it has seen its relative weight in U.S. GDP and employment decline over time, manufacturing remains an important part of the U.S. economy, accounting for about three fourths of private R&D investment, more than half of export earnings, and most of the high-wage blue-collar jobs (McKinsey Global Institute, 2012).²

Many commentators have argued that a number of favorable conditions could support continued steady increases in U.S. manufacturing output and employment in the years ahead, beyond those that could be attributed to a cyclical rebound to the pre-recession trend. These conditions include a more depreciated exchange rate, lower domestic energy prices, higher demand from booming shale oil and gas activity, volatile international shipping costs, and significant increases in labor costs in emerging markets. Skeptics argue that manufacturing production is merely rebounding to its pre-crisis level after a sharp cyclical drop and highlight that it is difficult to find prior examples of a significant reversal of the relative weight of manufacturing in advanced economies.³ The GDP share of manufacturing indeed declined steadily in the developed world over several decades prior to the Great Recession—although it has stabilized in the United States since then.

This paper investigates whether a manufacturing *renaissance* is evident in U.S. macroeconomic data. It first examines the pre- and post-crisis evolution of production levels for the overall U.S. manufacturing sector and its sub-sectors, as well as the share of U.S. manufacturing in U.S. and global GDP. Second, it documents a number of key structural factors contributing to the profitability of the U.S. manufacturing sector—in particular declining relative labor and energy costs. Third, the paper explores whether manufacturing could make a first order contribution to U.S. economic growth in the coming decade on the back of relative cost advantages and higher demand from growing shale oil and gas activity in the United States.

The rest of the paper is organized as follows. Section II presents stylized facts on the U.S. manufacturing recovery. Section III presents results from a panel regression seeking to establish a link between manufacturing production and input costs that appear to be relevant as determinants of activity in the short-to-medium term. Section IV discusses the potential rise in demand for U.S. manufactures from the boom in the shale energy sector. Section V takes a longer-term perspective, and assesses whether manufacturing can significantly add to

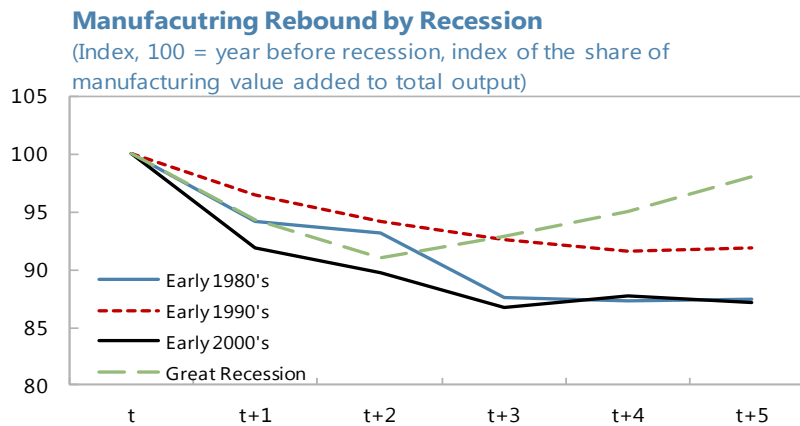
² For instance, recent public media articles and reports (e.g., Financial Times, September 21, 2012; New York Times, November 25, 2012; Citi Research, May 31, 2013).

³ For instance, Goldman Sachs, March 22, 2013; Morgan Stanley, April 29, 2013.

U.S. economic growth in the next decade. The last section concludes with a summary description of the main takeaways.

II. STYLIZED FACTS ON U.S. MANUFACTURING PRODUCTION

After experiencing a steady loss in its relative importance in the last three decades, including through recession episodes, U.S. manufacturing output has rebounded strongly from the Great Recession of 2008-09 (Figure 1). The Great Recession was in fact the first U.S. recession since the early 1980s to be followed by a significant recovery in the share of manufacturing value added in total U.S. GDP.



Source: Haver Analytics.

At the same time, there have been significant differences between the performance of the durables versus nondurables sectors. The nearly 20 percent increase in U.S. manufacturing output following the recession (between 2009Q2 and 2013Q3) has been almost entirely driven by the higher production of durable goods (Figure 2). Although this rebound is in part the natural consequence of a stronger cyclical decline for durables than for nondurables, the difference in performance has been remarkable. Whereas durable goods production surpassed its pre-recession level in 2011Q3—one quarter before overall real GDP—nondurable goods production remained about 10 percent lower than its pre-recession level (and 5 percent above its trough) as of 2013Q3. Compared with the recoveries after the 1990 and 2001 U.S. recessions, the increase in durable goods production has been markedly stronger during the ongoing recovery, whereas the rebound in nondurable goods has been weaker than that observed after the 1990 and 2001 recessions (Figure 3).

The strength of the durable sector has in turn been concentrated in just a few subsectors. Three (out of ten) subsectors are responsible for the observed rebound in durables: *Computer and Electronics*, *Motor Vehicles*, and *Machinery*. While it is possible to argue that the increase in vehicles and machinery is mostly cyclical, computer and electronics have exhibited a robust positive trend during the past decade (see Houseman et al., 2011),

including through the Great Recession (left panel, Figure 4). In contrast, most subsectors within nondurable goods have continued to decline or have shown a slow rebound after the Great Recession, including *Chemicals, Plastics and Rubbers*. The exception has been *Petroleum Products*, which has recovered to pre-crisis levels (right panel, Figure 4).

After a steady decline in much of the last three decades, the U.S. share in global manufacturing output has largely stabilized around 20 percent since the Great Recession. Interestingly, after a strong increase during most of the previous decade, China's share in global manufacturing has also stabilized, around the same level. The decline in U.S. manufacturing production during the Great Recession was comparable to the declines observed in other G-7 countries but the recovery paths have been different. The rebound has been relatively strong in the United States and Germany, but has been muted in France and Italy. Moreover, although the recovery in U.S. manufacturing was in line with that of other G-7 countries through mid-2011, it has been relatively stronger thereafter (Figure 5).⁴

Looking at durable and nondurable goods production in G-7 countries provides additional insights. The post-crisis recovery in durable goods production in the United States was stronger than in other G-7 countries (Germany's recovery had been stronger through mid-2011, but it moderated thereafter). In contrast, the recovery in U.S. nondurable goods production has been poor also compared to that in other G-7 economies (Figure 6).

Although the dynamics of employment in the U.S. manufacturing sector is not the focus of this paper, its differences from the dynamics of the output are worth noting. In contrast to manufacturing output, which has broadly remained on an upward trend despite experiencing declines during recessions, manufacturing jobs have been on a declining trend, with a large further drop in the Great Recession. In particular, manufacturing employment declined by about 19 percent between the start of the 2001 recession and end-2007; it declined another 15 percent during the Great Recession, and has only increased by about 2 percent since the recovery started in mid-2009. Post-recession employment growth has been strongest in durable goods manufacturing (in particular in *Computers and Electronics*, and *Machinery*), while employment in the nondurable goods sector has remained stagnant.

III. DRIVERS OF U.S. MANUFACTURING IN THE SHORT RUN

A number of conditions have been highlighted as potential drivers of a U.S. manufacturing revival.⁵ These include:

⁴ This is illustrated by relatively high correlation coefficients (in excess of 0.8) between quarterly growth rates in U.S. manufacturing and those of comparator countries through mid-2011 (with the exception of Japan, which was affected by an earthquake in 2011), and reduced correlation coefficients thereafter (Figure 3). Interestingly, China's manufacturing output (as measured by Purchasing Managers Index, PMI) seems to broadly lead output changes in U.S. manufacturing through mid-2011, though it seems to stagnate thereafter.

⁵ See e.g., The Atlantic, November 2012; McKinsey Global Institute, November 2012.

- *A more competitive real effective exchange rate (REER);* the U.S. REER has depreciated over the last decade. Since the Great Recession, the weak level of demand and high cyclical unemployment have contributed to a weaker U.S. dollar, in particular against emerging market currencies.
- *A decrease in the relative price of labor in the U.S. vis-à-vis emerging markets;* the significant relocation of production to emerging Asia during the 1990s and the 2000s and high unemployment in the aftermath of the Great Recession have resulted in lower wage pressures and favorable changes in unit labor costs (ULC) in the United States.
- *A significant reduction in domestic energy prices following technological breakthroughs in the exploitation of shale gas;* in particular, recent advancements in drilling technology (including shale gas fracking) resulted in a significant increase in natural gas production in the U.S. and led to a reduction of domestic prices, which are currently about one fourth of those in Asia and Europe (Figure 7). According to projections by the Energy Information Agency (EIA), continued increases in shale gas production in the next few decades should keep U.S. energy prices comparatively low, though the favorable price gap in the U.S. with respect to Europe and Asia is expected to gradually diminish after the next few years.

The importance of these factors for manufacturing activity can be assessed through a simple panel regression. The model includes natural gas prices, ULCs, and REERs as drivers of manufacturing production:

$$LD(IP)_{t,i} = \beta_1 LD(IP)_{t-1,i} + \beta_2 Spread_{t,i} + \beta_3 LD(REER)_{t,i} + \beta_4 LD(ULC)_{t,i} + \beta_5 RecDummy + \mu, (1)$$

where $LD(IP)$ is the difference of the logarithm of Industrial Production index (IP) in the manufacturing sector in country i and year t , $Spread$ is the difference between the world average price of natural gas and the price of natural gas in country i (*with a positive value denoting a cost advantage in country i*), $LD(REER)$ is the log difference in real effective exchange rates, $LD(ULC)$ is the log difference of unit labor costs, and $RecDummy$ is a dummy for the Great Recession.

The regression results are reported in Table 1. As time series covering a sufficiently long period are only available for developed economies, cross sections only include G-7 countries. Columns (1)-(3) include the main regressors; the spread between domestic gas prices and the average in the rest of G-7 countries, the log difference of the REER, and log difference of the unit labor cost index, one at a time, respectively. In addition, all regressions include one lag of the dependent variable, the Great Recession dummy, and quarterly time fixed effects. The dataset consists of quarterly observations from 2001Q2 to 2013Q1.⁶

⁶ The ULC series ends at 2011Q3.

The coefficient of each of the three potential determinants of manufacturing is found to be highly statistically significant, with the expected signs. Specifically, the estimated coefficient for *Spread* is positive, indicating that the lower natural gas price in the U.S. relative to the G-7 average is positively correlated with growth of U.S. manufacturing (and negatively correlated with manufacturing growth in the rest of the G-7 countries). The negative estimate for *REER* is consistent with the prior that a depreciating currency would boost manufacturing production growth, as demand for exports increases. In turn, the negative sign for the *ULC* coefficient indicates that decreasing labor costs could augment U.S. manufacturing growth.

Labor costs seem to be a more robust determinant of manufacturing activity than the other factors. Column (4) considers *Spread* and *REER* together in the same regression and shows that both variables remain significant. Column (5) includes all three variables in the same regression and shows that only the coefficient estimates on *REER* and *ULC* remain significant while estimates of the *Spread* variable becomes insignificant. It is worth noting that magnitudes of the significant coefficients indicate that *ULC* dominates the other two relationships, which could in turn reflect the importance of the strong decline of labor costs in the U.S. relative to other G-7 economies. At the same time, this result needs to be interpreted cautiously given the small number of observations and possible noise in the *ULC* data.

Splitting the dependent variable into durable and nondurable manufacturing production provides a robustness check (Table 2). The positive correlation between *Spread* and manufacturing growth is mainly driven by durable goods production; the same applies for both *REER* and *ULC*, as the regression for nondurable goods production results in significant coefficients for both *REER* and *ULC*, but of magnitudes that are four and six times smaller than the coefficients obtained for the durable goods regression. Other robustness checks also underline the dominating effect of durable goods in total manufacturing production trends.⁷

Input-Output (I-O) tables suggest that a number of manufacturing sectors would profit from lower energy costs. Notably, a 10 percent decrease in the cost of energy implies a 10 percent increase in the gross operating surplus of the *Primary Metals* sector, a 6 percent increase in *Printing and Related Activities*, a 5 percent increase in *Paper Products*, and a 4 percent increase in *Chemical Products*.

The model suggests that U.S. manufacturing could benefit from a continuation of recent trends in key costs. For example, a 1 percent decrease in U.S. ULC *vis-à-vis* other G-7 economies would result in an increase in U.S. industrial production of about 0.8 percent; similarly, a 1 percent REER depreciation would boost production by 0.2 percent. In turn, if the natural gas price gap between the U.S. and other G-7 economies would double, this

⁷ Further robustness checks (including using more lags of key regressors, using different sub-periods, and including additional regressors) did not qualitatively alter the results.

would provide an additional stimulus to manufacturing production equivalent to 1.5 percent. Given the elevated degree of slack in the U.S. labor market, unit labor costs are likely to decline further in the next few years (before recovering) while the favorable cost advantage in natural gas is also likely to last for a few more years, thus supporting manufacturing activity in the United States.

IV. THE ENERGY BOOM—HOW MUCH OF A PULL FOR U.S. MANUFACTURING?

The increasing U.S. production of oil and gas through unconventional extraction techniques can result in positive spillovers for manufacturing. In its *Annual Energy Outlook* for 2013, the U.S. Energy Information Agency projects that total domestic production of oil and gas could increase by 10–15 percent through the end of the decade, with upside risk scenarios pointing to increases of 30–50 percent. These scenarios factor in decreases in conventional production as well as significant increases of shale gas and tight oil production volumes. In this connection, tight oil is projected to increase by 40–120 percent through 2020, while the growth of shale gas production is projected to be in the 35–60 percent range. Higher production will necessitate higher inputs, including from the manufacturing sector.

However, basic analysis using I-O accounts suggest that the demand ‘pull’ from the energy boom to manufacturing would be limited. The additional production in the oil and gas industry brought about by the energy boom would result in a positive contribution to manufacturing growth of around 0.1–0.3 pp per year through the end of the decade.⁸ The increase would be larger for nondurable goods manufacturing (between 0.2 and 0.3 pp per year), as this includes the production of refined products. The industries that would benefit the most include chemical products, primary metals, fabricated metal products, and machinery. Interestingly, a number of the sectors that would be most benefitted have not been part of the manufacturing recovery to date, so the new source of demand for these sectors marks a positive development.

V. LONG-TERM IMPACT OF U.S. MANUFACTURING

The evidence presented so far suggests that cyclical factors and favorable relative costs conditions may have supported the observed recovery in U.S. manufacturing. In particular, the regressions in Section C provide evidence that reductions in labor and energy costs and a

⁸ The gross increase in production (by type of activity) is given by $X = T^{-1} * D$, where X is a 65-row vector consisting of the value of inputs used in production, T^{-1} is the inverse of the transformation matrix (which includes the intermediate input coefficients used by all production sectors), and D is a “shock” vector, with zeros in all lines except in those corresponding to oil and gas extraction and oil and coal products. The latter two were filled alternatively by the projected increase in production in tight oil and shale gas from 2012 to 2020 as included in the EIA reference and high-resource cases corresponding to the *2013 Annual Energy Outlook*. Increases in durable and non-durable goods production was converted to value added using the aggregate ratios of value added-to-gross output for 2011.

more depreciated REER have underpinned the recovery in U.S. manufacturing, and that these factors affected more strongly durable goods production.

Going forward, a key question is whether a U.S. manufacturing revival could make a first-order and sustained difference to growth. To approach this question, this section analyzes cross country evidence on the determinants of the share of manufacturing in output, as well as long-term trends in U.S. manufacturing exports.

Could the convergence in per capita incomes bring about a convergence in manufacturing-to-output ratios in the medium term?

As emerging markets grow richer, the difference in their manufacturing-to-output ratio relative to that in the U.S. should decrease. Economic development models suggest that the manufacturing-to-output ratio increases at early stages of development, but that it then peaks and decreases as real per-capita income reaches relatively higher levels (Herrendorf et. al., forthcoming). Part of the reason could be that as an economy develops its currency tends to appreciate, losing part of its cost advantage to less-developed economies, in particular for low-technology, more labor-intensive, industries.

Cross-country data indeed supports the claim that the manufacturing-to-total output ratio tends to decline as per capita income grows, with evidence of bimodal distributions for both per capita income and the manufacturing-to-output ratio across countries. In particular, when their per capita income is compared to that in the U.S., countries cluster in two groups: one group (which includes most emerging and developing economies) is concentrated around per capita income levels which are about 20 percent of those of the United States, while the other group (which includes most developed economies) is concentrated around per capita income levels of about 80 percent of that in the United States. Countries in the first group have manufacturing-to-GDP ratios that are larger than in the United States, while for the second group, the ratios are similar to the United States. Real per-capita income and manufacturing-to-GDP ratios within the set of s G-20 countries follow the same bi-modal distribution.

We run panel regressions to explore the association between the manufacturing-to-output ratio (relative to that in the United States) with relative costs and real per-capita income levels.. Concretely, we estimate the following specification:

$$MR_{t,i} = \alpha + \beta_1 YR_{t,i} + \beta_2 YRSQ_{t,i} + \beta_3 PR_{t,i} + \mu, \quad (2)$$

where $MR_{t,i}$ denotes the ratio of the share of manufacturing in output in country i to that of the U.S. (both in nominal terms) at time t , $YR_{t,i}$ denotes the ratio of real per capita income in country i to that of the U.S. at time t , $YRSQ_{t,i}$ denotes the same variable but raised to the square power, and $PR_{t,i}$ represents the manufacturing deflator (calculated on US\$ values) in country i to that of the U.S., at time t ; the latter variable serves as a proxy for relative currency appreciations. For robustness considerations, the regression in (2) was estimated for 20-year rolling periods (beginning in 1970), and for a number of alternative country groupings including developed, emerging markets, and developing economies.

Results suggest that it is unlikely that the manufacturing-to-output ratio in emerging market economies will lose significant ground *vis-à-vis* the U.S. in the next few years. The estimates suggest that the share of manufacturing in output *vis-à-vis* the U.S. begins to decrease for countries that reach real per capita incomes between 40 and 70 percent of those in the U.S. (i.e., at about those levels of relative real per capita income the quadratic term in equation (2) offsets the linear term). Since that level is rather distant from the 20 percent around which emerging market countries are clustered now, a decline in the relative ratios due to per capita income convergence seems unlikely in the medium term (though might occur in the longer term). The effect of relative currency appreciations is less robust, but results for country samples including developed and developing countries suggest a negative effect of up to 0.7 percentage points in the relative ratio of manufacturing to output for a 10 percent currency appreciation; this effect is much stronger (and statistically significant) for G-7 countries (Table 3).⁹

Could U.S. manufacturing exports provide an outlet for stronger growth in the sector during the coming years?

A look at the last few decades suggests that U.S. manufacturing exports have been more resilient than total manufacturing production. While manufacturing has decreased as a share of GDP, manufacturing exports have remained about constant, and have come to constitute a larger share of total manufacturing output. However, in spite of this resilience, U.S. manufacturing exports have lost market share during the past few decades, in particular with respect to China and other emerging market economies. The application of a ‘Constant Market Share’ analysis to U.S. manufacturing exports suggests that the loss in market share is in part explained by the fact that U.S. exports have been primarily directed towards less dynamic regions.¹⁰

These elements allow exploring a possible channel of contribution of manufacturing to medium-term U.S. GDP growth. As indicated above, it is unlikely that convergence in per-capita income during the next few years will be enough for the manufacturing-to-output ratio in emerging market economies to begin losing ground *vis-à-vis* that in the U.S. However, this does not mean that the manufacturing share in U.S. GDP will necessarily decrease.¹¹

⁹ The source for the data is the United Nations Database. Results reported in Table 3 correspond to fixed-effect regressions for 1990–2010. Details on the results for non-fixed effect regressions, other time periods, and other country groupings, as well as databases, are available from the authors upon request.

¹⁰ The Constant Market Share Analysis is based on the idea that the product and geographical structure of a country’s exports can affect its export growth. It constitutes a common method of analysis in international trade.

¹¹ The model does not allow establishing to what extent changes in the relative ratio of manufacturing-to-output between two countries will occur through changes in the numerator, the denominator or both. Evidence for the past decade suggests that the U.S. manufacturing-to-output share, as well as the relative price of manufacturing, have both stabilized. Calculations on the potential impact of manufacturing in GDP growth assume that the

(continued...)

Emerging market economies are projected to continue growing at faster rates than developed economies and to increasingly contribute to global trade (including of manufacturing goods), which will continue to grow faster than world GDP.¹² If the U.S. share in G-20 manufacturing exports remains constant through the end of the decade at the level observed in 2011, manufacturing could add up to 0.4 percentage points to growth per year through 2020. Further, an increase of 1 percentage point in the U.S. share in total G-20 manufacturing exports by 2020 would result in an additional 0.2 percentage points of growth per year. Moreover, the results from estimating (2) suggest that a one standard deviation increase in currency appreciation (equivalent to a 25 percent increase in manufacturing prices in comparator countries in US\$ terms) through 2020 could add up to about 0.5 percentage points of additional GDP growth in the United States per year. Contributions to growth of such magnitudes are significant, given that manufacturing contributed less than 0.2 percentage points to growth per year (on average) during the last decade.¹³

For manufacturing to have a first-order impact on growth during the next few years, the U.S. will have to diversify its export base. In order to keep its share in international markets, the U.S. will have to diversify its manufacturing exports base to more dynamic regions (e.g., Advanced and Emerging Asia). COMTRADE data compiled by the United Nations suggest that the share of U.S. manufacturing exports to the world's dynamic regions remains low, but that has grown significantly during the past decade. In this connection, a look at the product composition of exports suggests that the external sales of chemical and plastic materials (all of which use energy intensively) have broadly outperformed the external sales of other sectors during the past decade. The growth rate of exports of machinery (electrical and other), and transport equipment (which together account to about 40 percent of exports), has been less impressive, but the lower-than-average growth rates masks a change in the direction of exports, with sales to more dynamic regions (most notably Emerging Asia) increasing, and those to more mature markets stabilizing or decreasing during the past few years. The more attractive input costs vis-à-vis other G-7 economies (as pointed out in Section III) also bodes well for the future performance of U.S. exports.

VI. CONCLUDING THOUGHTS

While overly optimistic claims of a U.S. manufacturing renaissance seem unwarranted, some sectors have indeed rebounded strongly following the Great Recession. Available data suggests that there are sectors within the durable goods category that have withstood the

relative price of manufacturing remains stable vis-à-vis GDP deflator. Moreover, it is assumed that the share of manufacturing exports in total manufacturing remains unchanged.

¹² Growth and trade projections used in the analysis are those in *World Economic Outlook* (2013).

¹³ Manufacturing contributed about 0.7 percentage points (pp) per year to growth in the 1970s, and about 0.5 pp in the 1980s and the 1990s. The contribution to growth was larger in the 1960s (about 1.3 pp/year) and the 1950s (1.1 pp/year), on average.

Great Recession well or have rebounded strongly thereafter, possibly foreshadowing a strong manufacturing presence in the U.S. and the global marketplace in some subsectors.

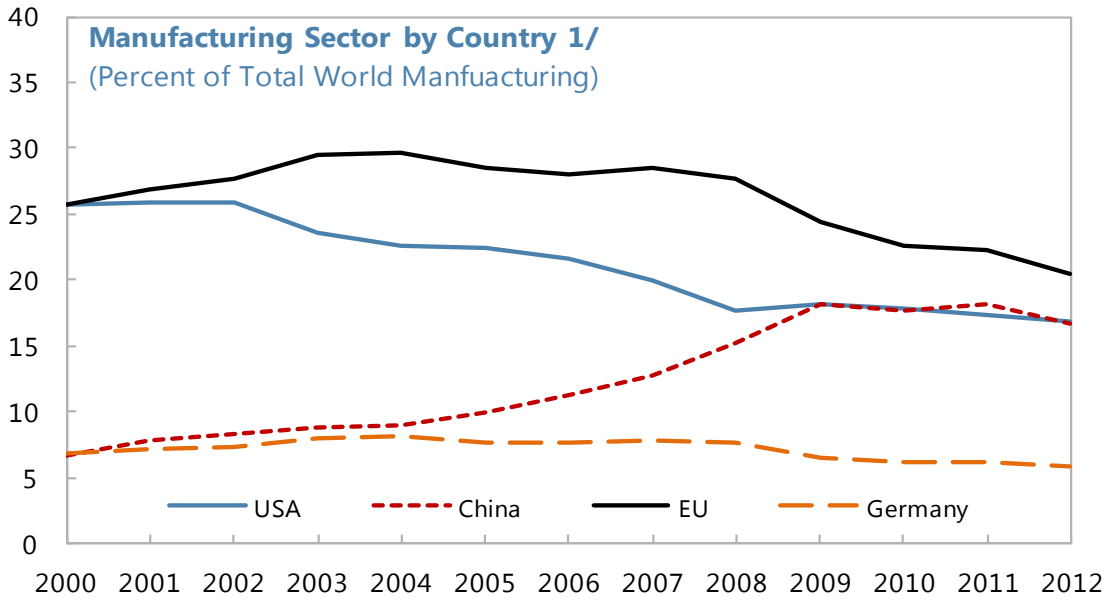
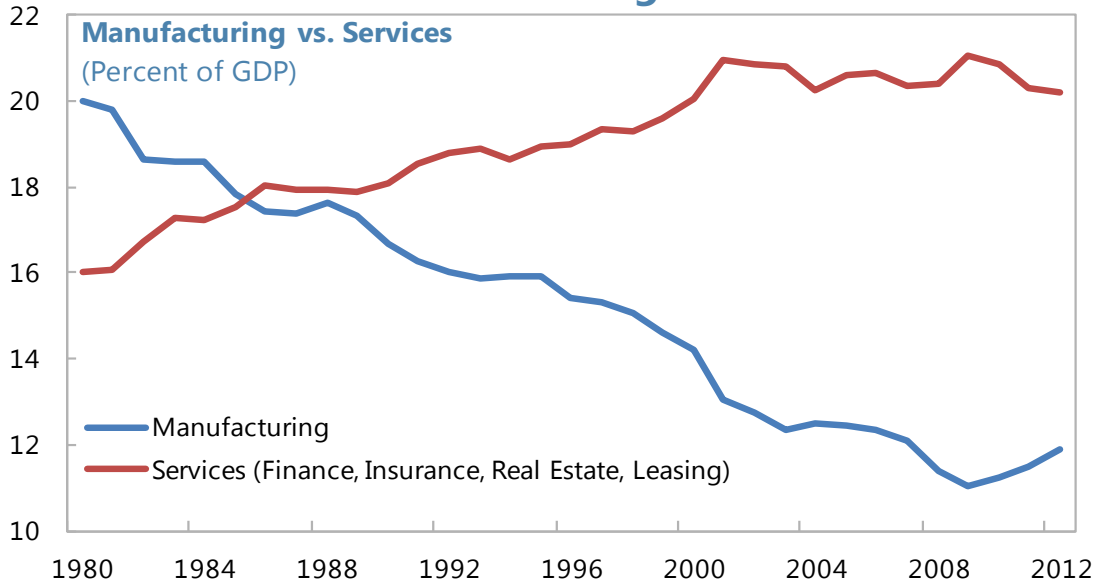
A number of ongoing factors are likely to positively impact the profitability of the U.S. manufacturing sector in the near-to-medium term. First, a combination of declining production costs—falling natural gas prices and ULC, and some real depreciation of the U.S. dollar—could catalyze new investment in the manufacturing sector, providing a boost to growth. Second, expanding shale oil and gas activity will create new demand for U.S. manufacturing output going forward.

The contribution of manufacturing exports to growth could exceed those of the recent past, fueled by rising global trade. U.S. manufacturing exports have proven resilient during the crisis. Further increases will require that the U.S. diversify further its export base towards the more dynamic world regions. In the long term, it is likely that a U.S. REER depreciation and the convergence of real per capita income in fast growing emerging market economies would result in a gradual increase in the manufacturing-to-output ratio in the U.S. vis-à-vis such economies.

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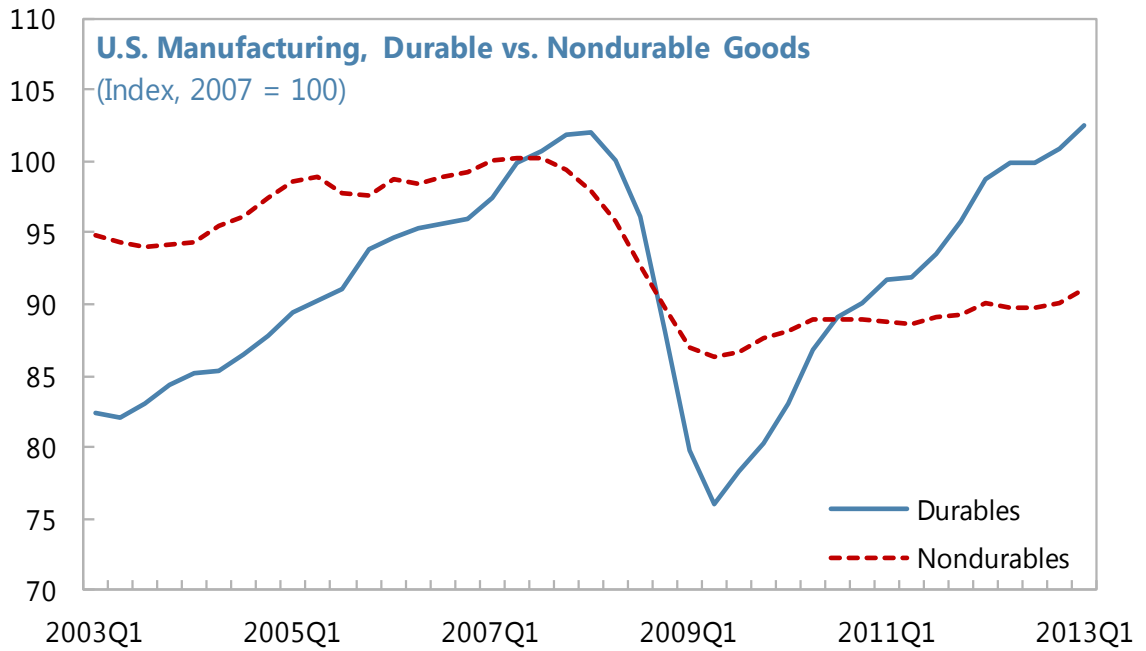
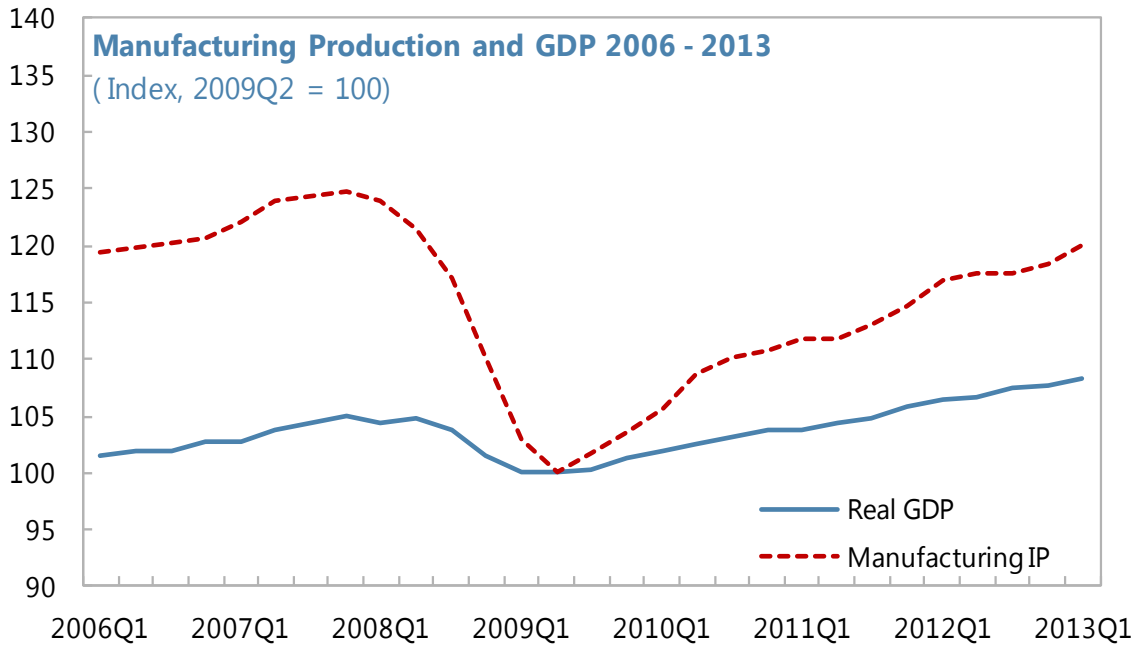
Figure 1. Historical Look at the U.S. Manufacturing Sector



Source: Haver Analytics and World Bank Development Indicators.

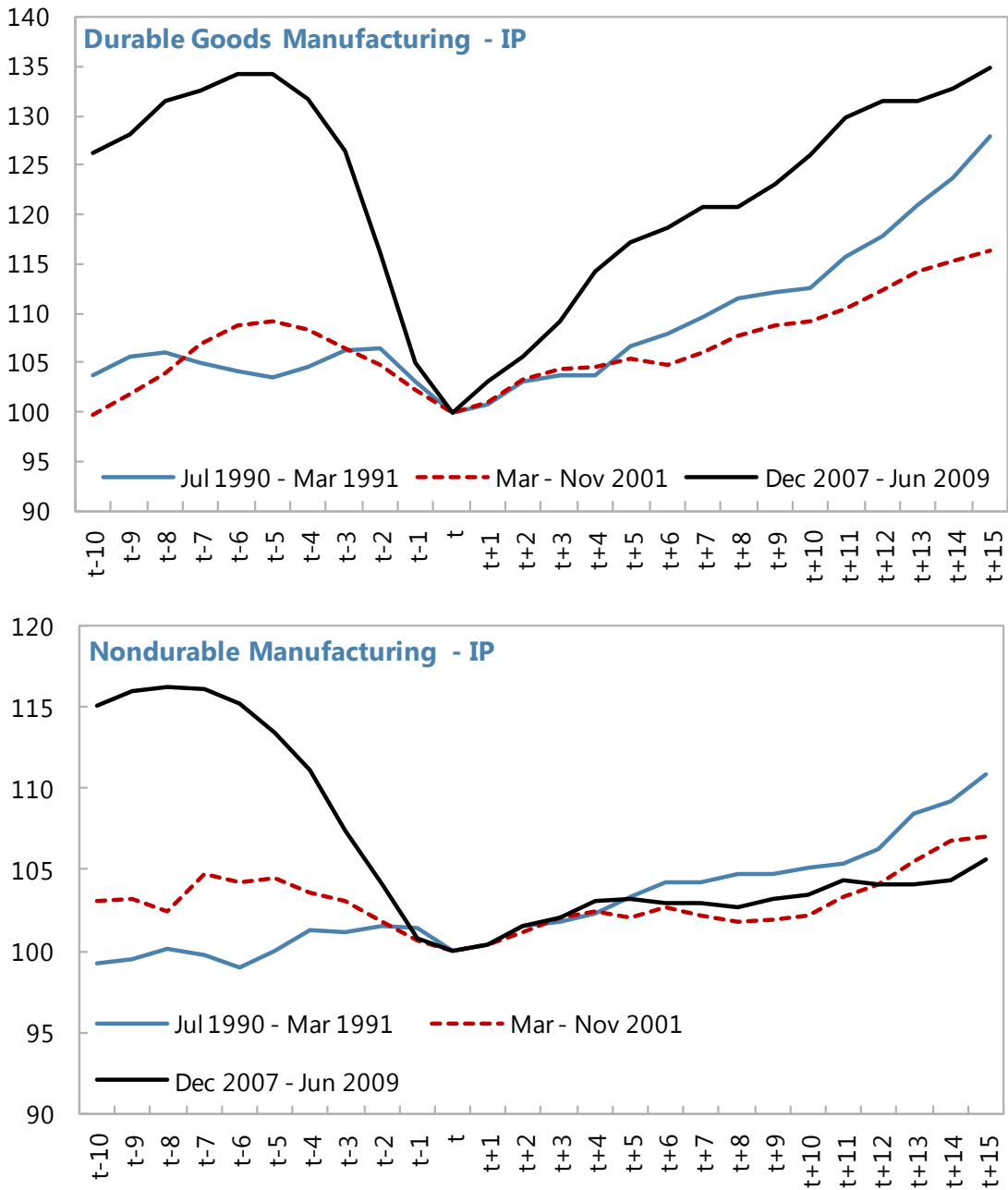
1/ Values for 2011 and 2012 are staff estimates based on IP growth rates of each country.

Figure 2. Durable and Nondurable Goods



Source: Haver Analytics.

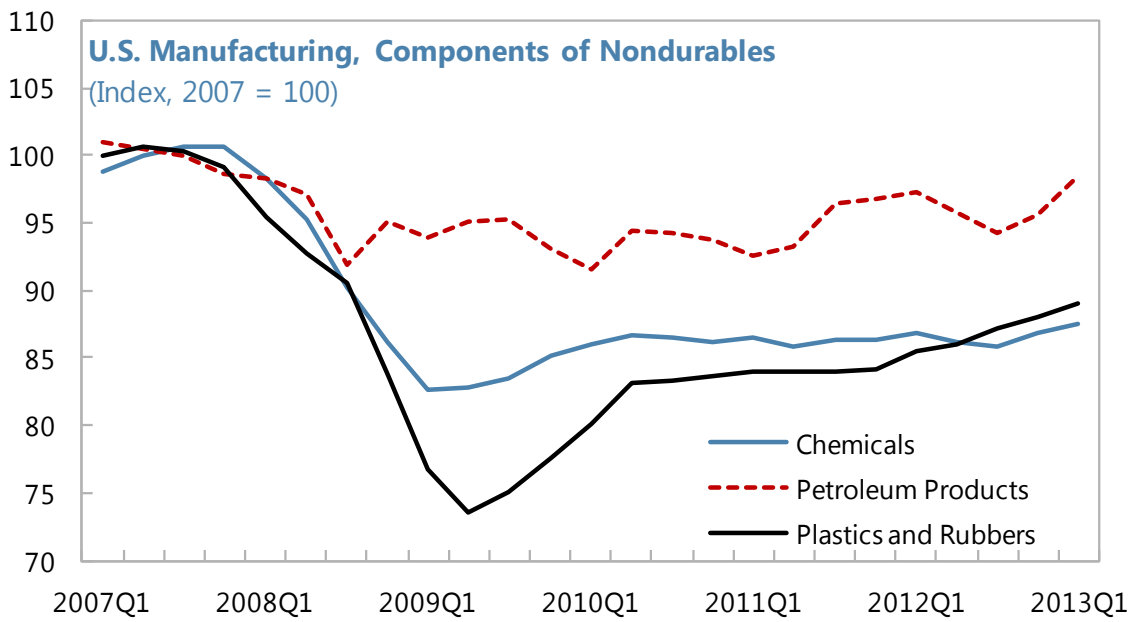
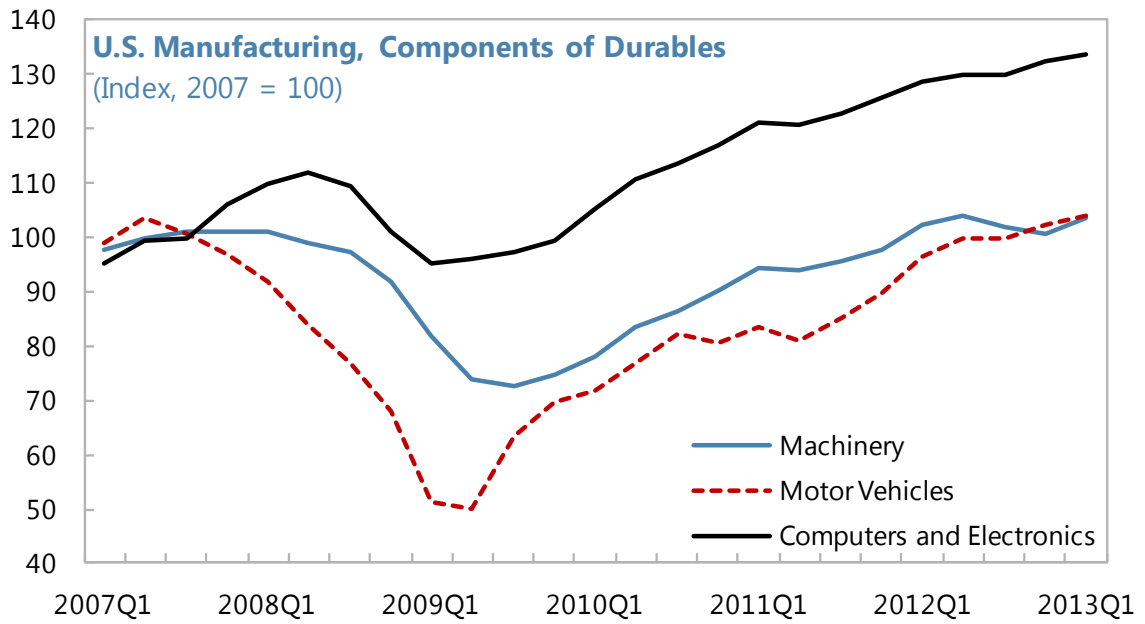
Figure 3. Comparison of Rebounds Across Recessions



Source: Haver Analytics.

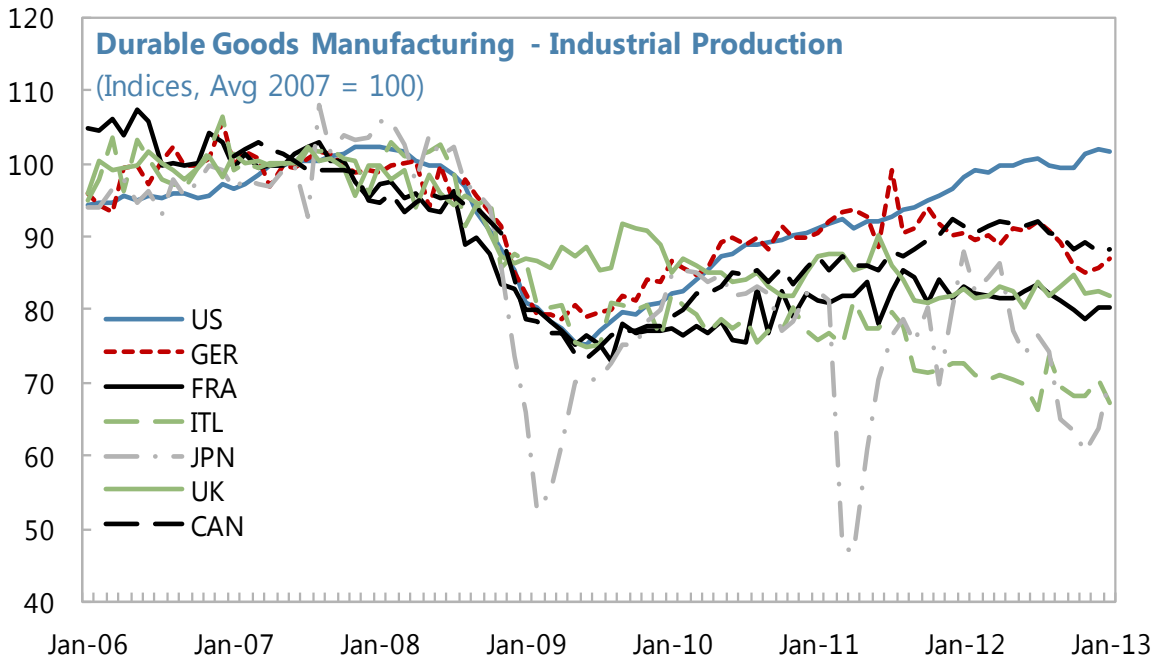
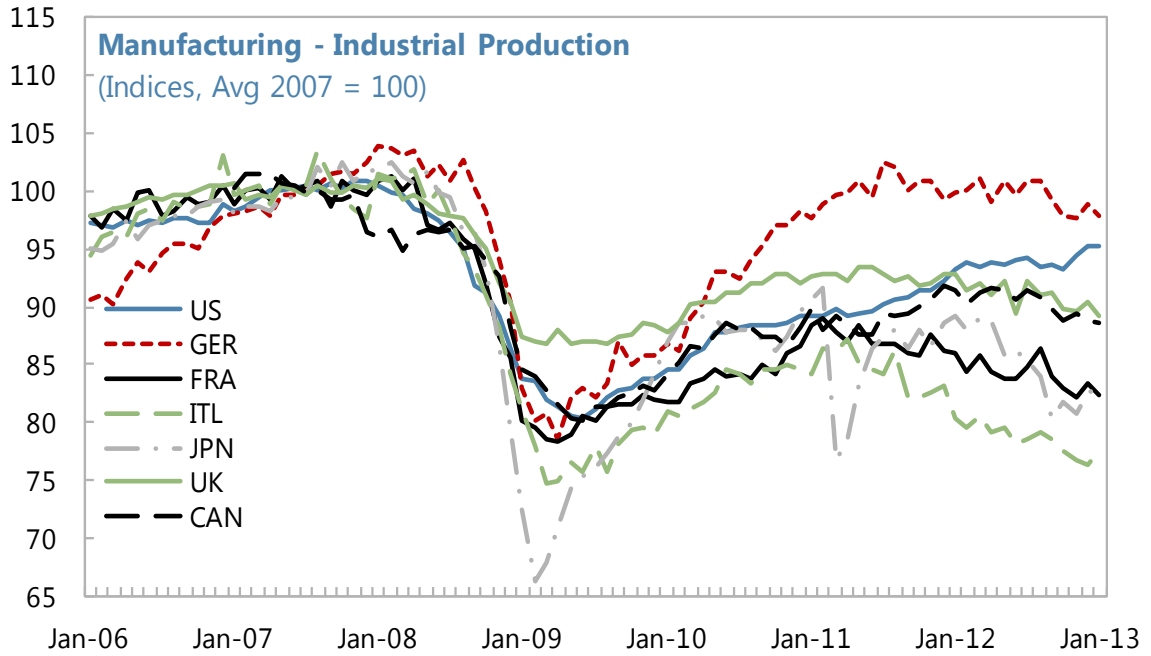
1/ For the Dec 07 - Jun 09 recession, t+15 represents January 2013.

Figure 4. Components of Durable and Nondurable Goods



Source: Haver Analytics.

Figure 5. Manufacturing Rebound in G-7 Countries



Source: Haver Analytics.

Figure 6. Manufacturing Production in Selected Countries

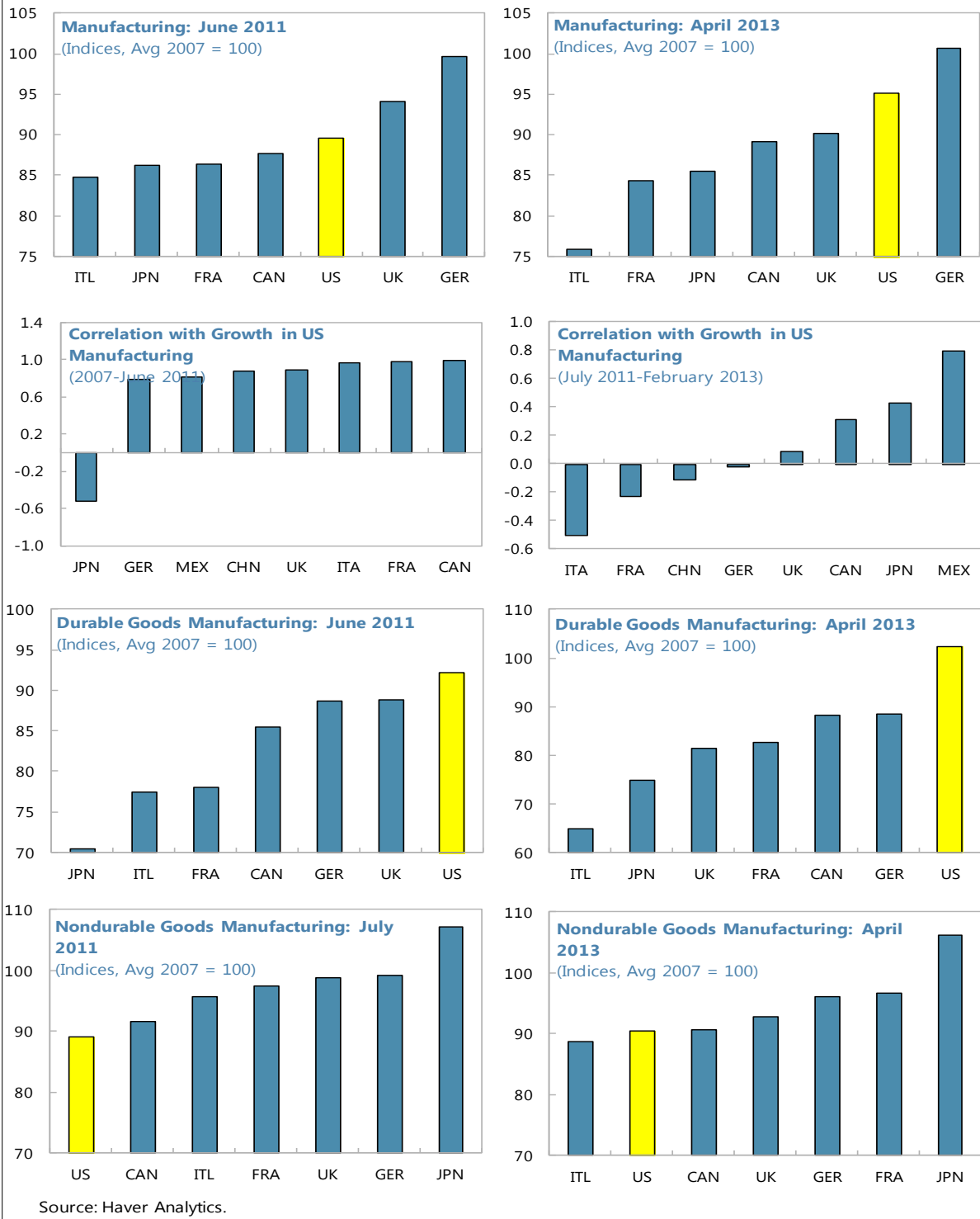


Figure 7. Natural Gas Production and Prices

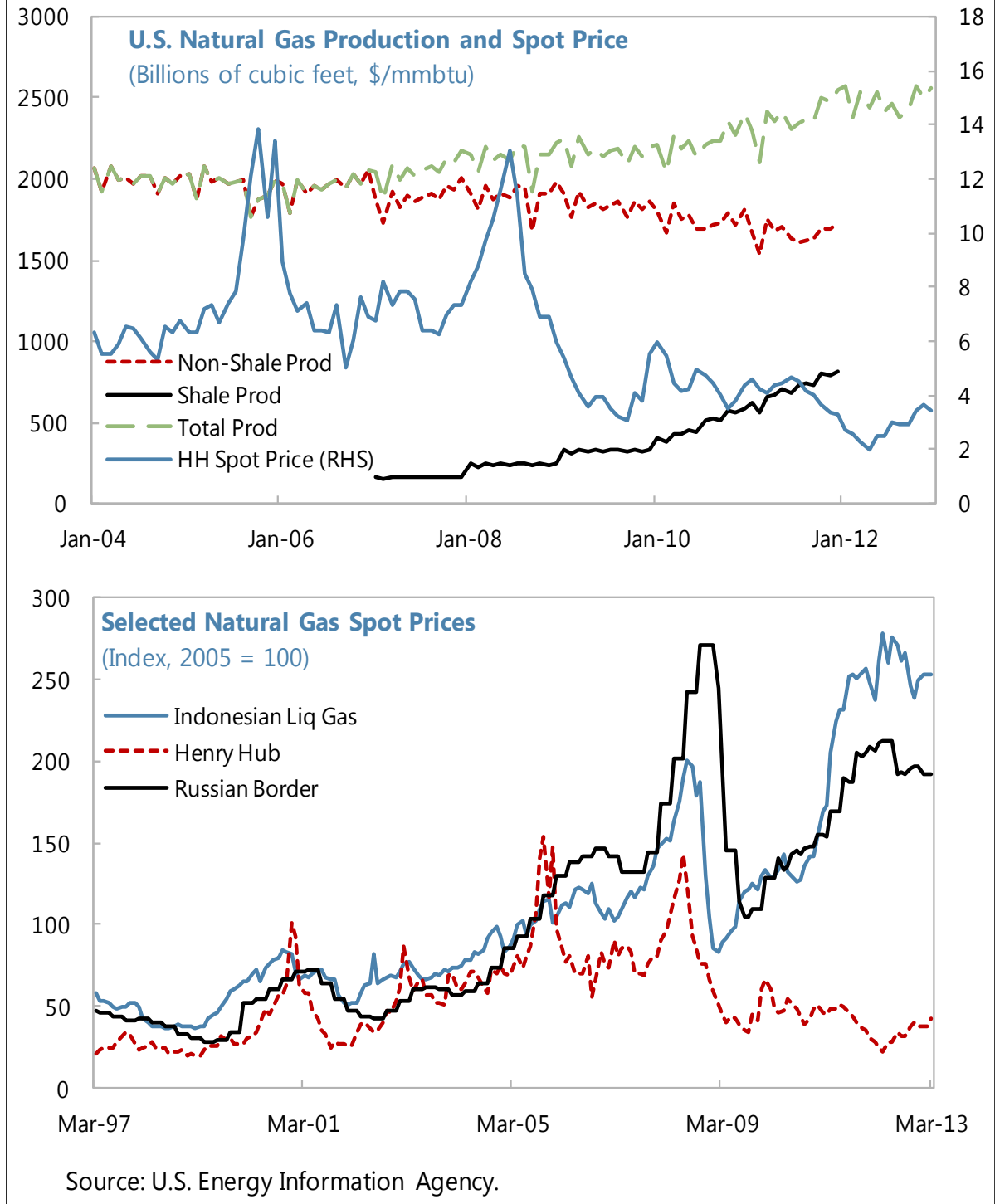


Table 1. Panel Regression Estimates for Total Manufacturing Production					
VARIABLES	(1) Spread	(2) REER	(3) ULC	(4) Spread-REER	(5) All
Spread	0.000774** (0.0466)			0.000780** (0.0341)	-0.000225 (0.653)
Ind(REER)		-0.170*** (1.23e-07)		-0.170*** (9.87e-08)	-0.143*** (7.41e-06)
Ind(UCL)			-0.418*** (1.59e-10)		-0.352*** (4.50e-08)
Constant	-0.0240*** (0.00324)	-0.0247*** (0.00152)	0.0269*** (0.00328)	-0.0253*** (0.00108)	-0.0156* (0.0754)
Observations	303	303	260	303	260
R-squared	0.708	0.735	0.778	0.740	0.798
Number of Countries	7	7	7	7	7
<p>Dependent variable is the log difference of IP manufacturing. Spread is the gas price spread between the rest of G-7 countries and U.S. ; Ind(REER) is the log difference of the real effective exchange rate; Ind(ULC) is the log difference of unit labor cost. p-value in parentheses. All regressions include a lag of log difference of IP manufacturing, and a Global Crisis time dummy in addition to quarterly time fixed effects. *** p<0.01, ** p<0.05, * p<0.1.</p>					

Table 2. Panel Regression Estimates for Durable and Nondurable Manufacturing Production

VARIABLES	(1a) D Goods Spread	(1b) Non D Goods Spread	(2a) D Goods REER	(2b) Non D Goods REER	(3a) D Goods ULC	(3b) Non D Goods ULC	(4a) D Goods Spread & REER	(4b) Non D Goods Spread & REER	(5a) D Goods ALL	(5b) Non D Goods ALL
Spread	0.000627 (0.477)	-0.0000863 (0.759)					0.000634 (0.465)	-0.0000834 (0.766)	-0.0017 (0.152)	-0.000731* (0.073)
In(REER)			-0.223*** -0.00247	-0.0483** -0.42			-0.224*** -0.00248	-0.0482*** -0.0425	-0.227*** -0.00235	-0.463* -0.0679
In(ULC)					-0.439*** -0.00235	-0.0648 -0.181			-0.357** -0.0148	-0.0553 -0.268
Constant	0.00313 (0.886)	0.00471 (0.487)	0.000789 (0.971)	0.0036 (0.592)	0.0899*** (-3.11E-05)	0.00204 (0.774)	0.000213 (0.992)	0.00372 (0.581)	-0.0609*** (0.004)	0.0097 (0.172)
Observations	303	303	303	303	260	260	303	303	260	260
R-Squared	0.409	0.319	0.429	0.33	0.499	0.333	0.43	0.33	0.525	0.353
Number of Countries	7	7	7	7	7	7	7	7	7	7

The dependent variable is the log difference of IP durable (a) and non-durable (b) manufacturing. Spread is the gas price spread between the rest of the G-7 countries and the U.S.; In(REER) is the log difference of the real effective exchange rate; In(ULC) is the log difference of unit labor cost. All regressions include a lag of log difference of IP (durable and non-durable, accordingly) manufacturing, and a Global Crisis time dummy in addition to quarterly time fixed effects. *** p<0.01, **p<0.05, *p<0.1.

Table 3. Panel Regression Estimates for Long-Term Manufacturing Model

VARIABLES	G - 20	G - 20 (ex- CHN)	G - 7	S - 1	All
Constant	3.74	26.00	331.02 **	33.55 *	49.24 ***
Real Per Capita Income	6.08 ***	4.70 ***	-3.61	3.61 *	2.67 ***
Real Per Capita Income (squared)	-0.04 ***	-0.03 ***	0.01	-0.02 *	-0.01 ***
Manufacturing Deflator	0.03	0.00	-0.25 ***	0.07	0.06
R-squared (adjusted)	0.81	0.77	0.81	0.75	0.78
Number of Observations	5	5	5	5	5
Number of Cross Sections	18	17	6	30	49
Number of total Observations	90	85	30	150	245
Notes:					
The time period corresponds to 1990-2010.					
G-20', and 'G-7' includes countries in the respective country groupings, while 'G-20 (ex-CHN)', excludes China.					
S-1 'includes Argentina, Austria, Belgium, Bulgaria, Brazil, Canada, Chile, Colombia, Germany, Spain, Finland, France, Great Britain, India, Italy, Japan, Korea, Laos, Mexico, Morocco, Netherlands, Panama, Peru, Poland, Portugal, Singapore, Tunisia, Turkey, Uruguay, and South Africa.					
All' includes Argentina, Australia, Austria, Bangladesh, Belgica, Bulgaria, Brazil, Canada, Chile, China, Switzerland, Colombia, France, Costa Rica, Germany, Spain, Finland, Great Britain, Greece, Hong Kong, Indonesia, India, Ireland, Italy, Japan, Korea, Laos, Saudi Arabia, Luxembourg, Mexico, Morocco, Malaysia, Netherlands, New Zealand, Pakistan, Panama, Peru, Poland, Portugal, Romania, Russia, Singapore, Thailand, Tunisia, Turkey, Uruguay, Venezuela, and South Africa.					
*** p<0.01, ** p<0.05, * p<0.1					