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Approved By
**Western Hemisphere
Department**

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THE U.S. MANUFACTURING RECOVERY: UPTICK OR RENAISSANCE?¹

A. Introduction

1. A notable rebound of manufacturing production following the Great Recession has generated renewed interest in this sector among analysts and policy makers alike. Amid increasing anecdotes of a “renaissance” in U.S. manufacturing, many commentators have argued that the sector may contribute more significantly to domestic GDP and global industrial output going forward.² They note that a number of favorable conditions—including a more depreciated exchange rate, lower domestic energy prices, volatile shipping costs, and significant increases in labor costs in emerging markets—could support steady increases in U.S. manufacturing output and employment, beyond those that could be attributed to just a cyclical rebound. The potential for growing demand from booming shale oil and gas activity have also been noted. At the same time, promoting manufacturing as an engine of high-wage jobs and growth is a key part of the U.S. administration’s economic policies.³ Others analysts are more skeptical, and argue that manufacturing output is merely rebounding to its pre-crisis level.⁴

2. This chapter investigates whether a renaissance is evident in U.S. macroeconomic data, and whether manufacturing could make a first-order contribution to long-term growth. First, it examines current and pre-crisis production levels for sub-sectors, as well as the share of 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 labor and energy costs). Third, it 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 the pull from growing shale oil and gas activity in the U.S.

3. The remainder of the chapter is organized as follows. Section B presents stylized facts on the U.S. manufacturing recovery. Section C presents results from a cross-country panel regression seeking to establish a link between manufacturing production and input costs that appear to be

¹ This chapter was prepared by Oya Celasun, Gabriel Di Bella, Tim Mahedy, and Chris Papageorgiou. It has benefited from discussions with Tam Bayoumi, Olivier Blanchard, Ben Bridgman, Craig Burnside, Roberto Cardarelli, Thomas Glaessner, Chang-Tai Hsieh, Deniz Igan, Simon Johnson, Gian Maria Milesi-Ferretti, Catherine Pattillo, Dani Rodrik, Nikola Spatafora, Martin Sommer, and Egon Zakrajsek.

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 Issues and policies related to the U.S. Manufacturing had a prominent place in the last State of the Union address (February 12, 2013).

⁴ For instance, Goldman Sachs, March 22, 2013; Morgan Stanley, April 29, 2013.

relevant as determinants of activity in the short-to-medium term. Section D discusses the potential rise in demand for U.S. manufactures from the coming boom in the shale energy sector. Section E takes a longer-term perspective, and assesses whether against the backdrop of increased global economic integration, as well as strong growth in emerging market economies, manufacturing can significantly add to U.S. growth in the next decade. The last section concludes with a summary description of the main takeaways.

B. Stylized Facts

4. Although manufacturing has been losing importance as a share of GDP during the last three decades, it remains an important sector of the U.S. economy. It accounts for about 75 percent of private sector R&D investment, represents more than 50 percent of export earnings, and provides for most high-wage jobs, especially for blue-collar workers.

5. Manufacturing jobs have also been on a declining trend, with a large drop in the Great Recession. 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. It has increased by 2 percent since the recovery started in mid-2009. The Great Recession hit employment in large firms the hardest, and somewhat less small and medium-sized firms, which are contributing more to manufacturing employment growth than in the past. 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.

6. The U.S. share in global manufacturing production declined through most of the past three decades, but it has stabilized since the Great Recession. It currently represents about 20 percent of global manufacturing value added (in nominal terms). Interestingly, after a sharp increase during most of the previous decade, China's share in global manufacturing has also stabilized since the Great Recession, at a level similar to that of the United States.

7. The notion of a manufacturing renaissance has been fuelled partly by the rebound in production since the end of the Great Recession. It is important to note that this recovery was preceded by a very strong cyclical decline of about 20 percent during the Great Recession. Indeed, in early 2013, manufacturing production was still 4 percentage points below its pre-recession level.

8. But this aggregate dynamic masks significant differences between the durable and non durable sectors. The post-recession recovery has been driven almost entirely by a rebound in durable goods production. Although the rebound is in part the natural consequence of a stronger cyclical decline for durables, the difference in performance is remarkable: durable goods production surpassed its pre-recession level in 2011:Q3 (one quarter before overall real GDP did). In contrast, nondurable goods production is still about 10 percentage points lower than its pre-recession level (6 percent above its trough). Compared with the recoveries after the previous two U.S. recessions, the increase in durable goods production is markedly stronger during the ongoing recovery (unsurprisingly, given the comparatively steeper decline). By contrast, the rebound in nondurable goods has been weaker than that observed after the 1990 and 2001 recessions (Figure 1).

9. The strength of the durable sector has 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, including through the Great Recession (Figure 2). 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.

10. The decline in U.S. manufacturing production during the Great Recession was comparable to that 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 2).⁵ 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 stagnated thereafter). In contrast, the recovery in U.S. nondurable goods production has been poor also compared to that in other G-7 economies (Figure 3).

C. Drivers of U.S. Manufacturing in the Short Run

11. A number of conditions have been highlighted as drivers of a U.S. manufacturing revival.⁶ These include:

- *A more competitive real effective exchange rate (REER);* the U.S. REER has depreciated over the last decade, including due to the more advanced cyclical positions of emerging market economies relative to that of the U.S.
- *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 in the U.S. and favorable changes in unit labor costs (ULC) over the last decade.

⁵ 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.

⁶ See e.g., The Atlantic, November 2012; McKinsey Global Institute, November 2012.

- 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 2). According to projections by the Energy Information Agency (EIA), continued increases in shale gas production in the next few decades should keep prices comparatively low, although the favorable price gap with respect to Europe and Asia is expected to persist for the next few years before gradually diminishing (Chapter 2 of the Selected Issues).

12. 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 possible drivers of manufacturing productions:

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

where $LD(IP)$ is the log of difference of Industrial Production (IP) in manufacturing, $Spread$ is the difference between the price of natural gas in country i and the world average, $LD(REER)$ is the log difference in real effective exchange rates, $LD(ULC)$ is the log difference of unit labor cost, 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 U.S. gas prices and the rest of G-7 countries, the log difference of the real effective exchange rate, and log difference of the unit labor cost, one at a time, respectively. In addition, all regressions include one lag of the dependent variable, a Global Recession dummy, and quarterly time fixed effects. The dataset used is based on quarterly observations for G-7 countries from 2001 Q2 to 2013 Q1.⁷

13. Each of the three potential determinants of manufacturing is found to be highly statistically significant, and with the expected signs. Specifically, the estimated coefficient for the $Spread$ is positive, indicating that the spread between the natural gas price in the U.S and G-7 countries 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 could boost manufacturing growth, as demand for exports increases. In turn, the negative sign for the ULC coefficient indicates that decreasing labor costs could augment US manufacturing growth.

14. 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

⁷ The ULC series ends at 2011 Q3.

and shows that only the coefficient estimates on *REER an 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 strong decline of labor costs in the U.S. relative to other G-7 economies. At the same time we have to interpret this result cautiously given the small number of observations and possible noise in the *ULC* data.⁸

15. Moreover, Input-Output (I-O) tables suggest that a number of manufacturing sectors would profit from lower energy costs. For instance, a 10 percent decrease in the cost of energy implies a (continuous) 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*.

16. 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 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 U.S.

D. The Energy Boom—How Much of a Pull for U.S. Manufacturing?

17. The increasing U.S. production of oil and gas through unconventional extraction techniques can result in positive spillovers for manufacturing. In their baseline projections, the Energy Information Agency (EIA) suggest that total domestic production of oil and gas could increase by 10–15 percent through the end of the decade, with their 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 shale gas growth is projected to fall in the 35–60 percent range. Higher production will necessitate higher inputs, including from the manufacturing sector.

⁸ Splitting the dependent variable into durable and nondurable manufacturing production provides a robustness check. 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. Further robustness checks (including using more lags of key regressors, using different sub-periods, and including additional regressors) did not qualitatively alter the results.

18. However, basic analysis using I-O accounts suggest that the ‘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.⁹ 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.

E. Long-Term Impact of U.S. Manufacturing

19. The evidence presented so far suggests that cyclical factors and favorable relative costs conditions may have been behind the observed recovery in U.S. manufacturing. In particular, the regressions in Section C provide evidence that cost reductions and a more depreciated REER have underpinned the recovery in U.S. manufacturing, and that these factors affected more strongly durable goods production.

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

21. 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 other less-developed economies, in particular for low-technology, more labor-intensive, industries. Cross-country evidence provides support to this claim. When their per capita income is compared to that in the U.S., countries cluster in two groups: One group (that includes most emerging and developing economies) is concentrated around per capita income levels which are about 20 percent of those the U.S., while the other group (that includes most developed economies) is concentrated around per capita income levels of about 80 percent of that in the U.S. Countries in the first group have manufacturing-to-GDP ratios that are larger than in the

⁹ The gross increase in production (by type of activity) is given by $\mathbf{X} = \mathbf{T}^{-1} * \mathbf{D}$, where \mathbf{X} is a 65-row vector consisting of the value of inputs used in production, \mathbf{T}^{-1} is the inverse of the transformation matrix (which includes the intermediate input coefficients used by all production sectors), and \mathbf{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.

U.S., while for the second group, the ratios are similar to the U.S.. Real per-capita income and manufacturing-to-GDP ratios across G-20 countries follow the same bi-modal distribution.

22. The following panel regression explores the association between the U.S. manufacturing-to-output ratio (relative to that in other countries) with relative costs and real per-capita income levels. Concretely,

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

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.

23. 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. Results seem to 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). 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 2).¹⁰

24. However, U.S. manufacturing exports could 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. 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

¹⁰ The source for the data is the United Nations Database. Results reported in Table 2 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.

the fact that U.S. exports have been primarily directed towards less dynamic regions (e.g., North America).¹¹

25. These elements allow exploring the possible 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.¹² 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.¹³ If the U.S. keeps its share in G-20 manufacturing exports 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 (namely a 25 percent increase in US\$ manufacturing prices in comparator countries) through 2020 could add up to about 0.5 percentage points of additional GDP growth 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 first decade of the century.¹⁴

26. 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

¹¹ 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.

¹² 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 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.

¹³ Growth and trade projections used in the analysis are those in *World Economic Outlook* (2013).

¹⁴ 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.

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 C) also bodes well for the future performance of U.S. exports.

F. Concluding Thoughts

27. While excessively 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 Great Recession well or have strongly rebounded thereafter, providing hope for a strong manufacturing presence in the U.S. and the global marketplace in some subsectors.

28. 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.

29. The contribution of manufacturing exports to growth could exceed those of the recent past, fueled by rising global trade.

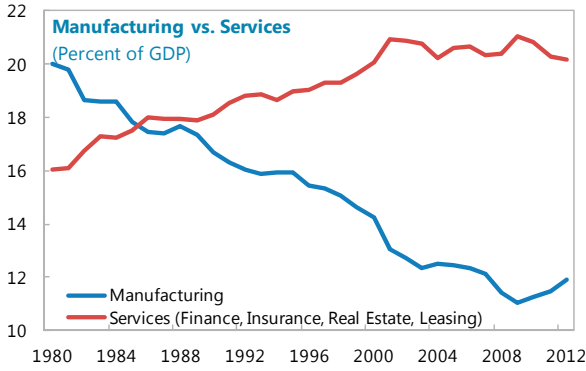
U.S. manufacturing exports have proven resilient during the crisis. Further increases will require that the U.S. diversify further its export base towards the more dynamic world regions. In the long term, it is likely that a U.S. REER depreciation and the convergence of real per capita income in fast 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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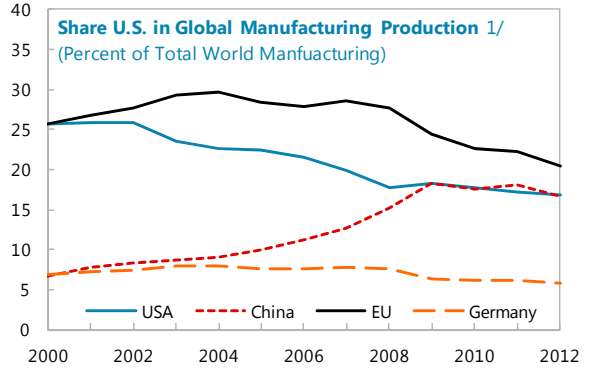
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Figure 1. History of Manufacturing Production

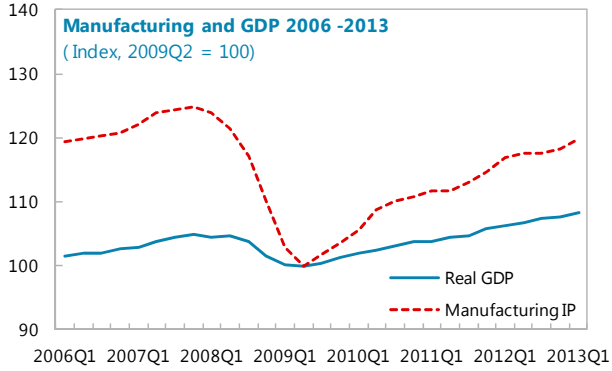
U.S. manufacturing has been declining over the last three decades.



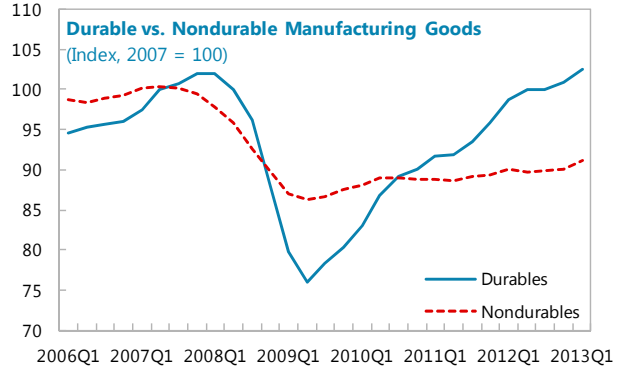
The share of the U.S. in global manufacturing has stabilized.



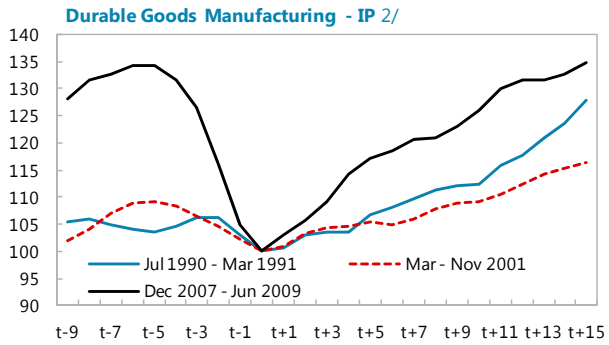
During the recession manufacturing fell and rose more sharply than the economy as a whole.



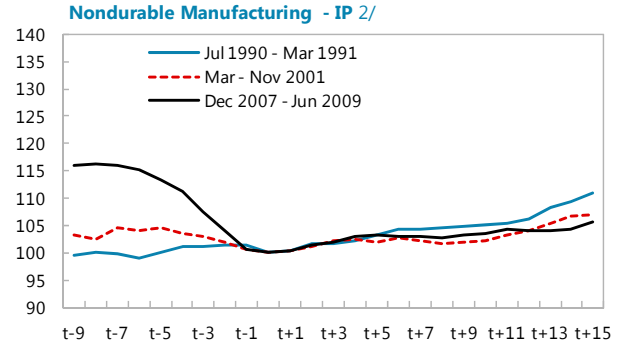
The rebound has been driven by durable goods manufacturing.



Durable goods have rebounded more sharply than in previous recessions.

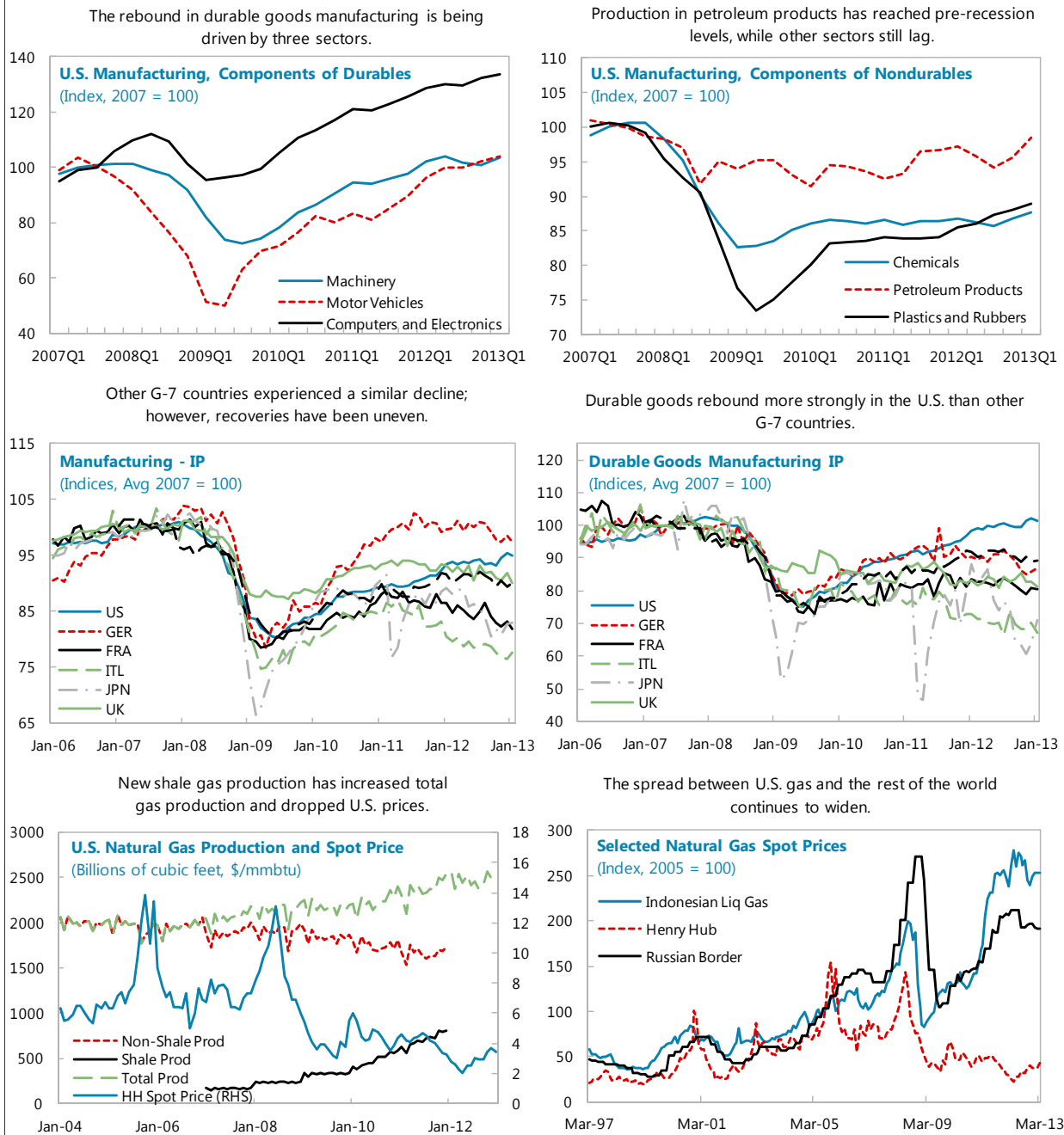


Nondurable goods dropped more steeply than in previous recessions, and have yet to recover.



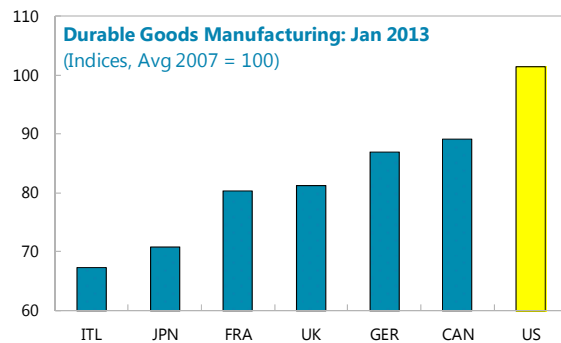
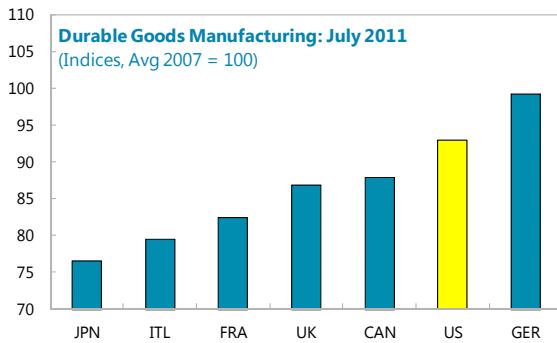
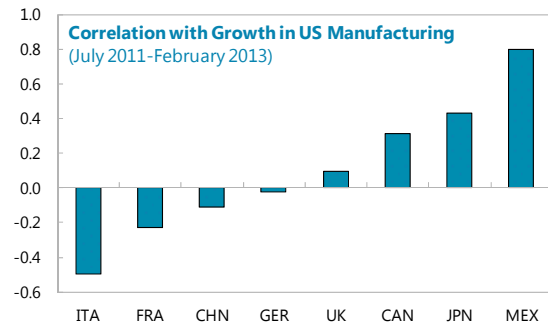
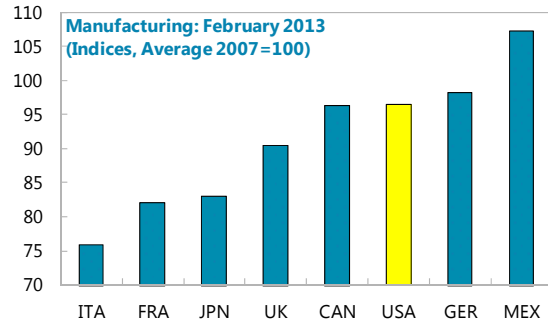
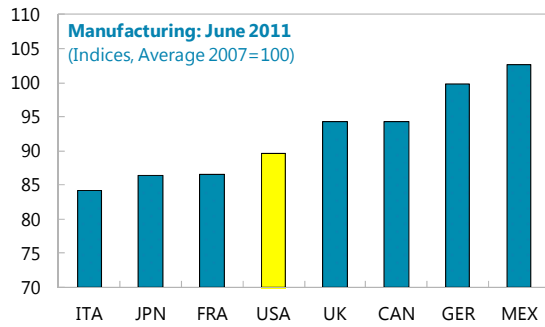
Sources: Haver Analytics, World Bank Databank, and Fund staff estimates.
 1/ Values for 2011 and 2012 are staff estimates.
 2/ For the Dec 07 - Jun 09 recession, t+15 represents January 2013.

Figure 2. The Manufacturing Rebound and Natural Gas Production



Sources: Haver Analytics and the U.S. Energy Information Agency.

Figure 3. Manufacturing Production in Selected Countries



Source: Haver Analytics

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(ULC)			-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 spread between U.S. gas prices and the rest of G-7 countries; 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 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, Belgica, 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					

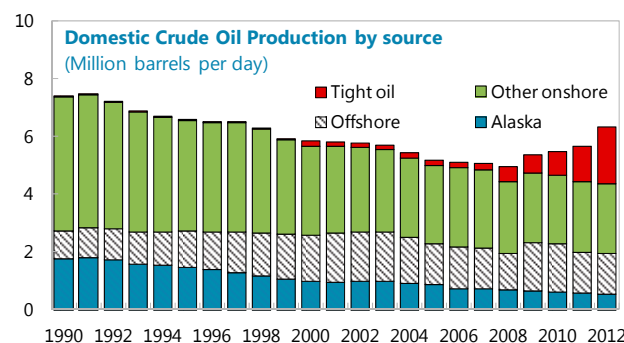
MACROECONOMIC IMPLICATIONS OF THE U.S. ENERGY BOOM¹

Technological advances have stimulated rapid growth in the domestic production of oil and gas. The energy boom is likely to continue going forward, but uncertainty about the possible outcomes is high. The positive GDP effects could be modest in the United States, not least due to the small share of mining and energy-intensive industries in the economy, although implications for the international energy markets could still be significant. The energy boom could put some appreciation pressure on the U.S. dollar. The energy trade balance should continue improving going forward, but the current account implications appear ambiguous.

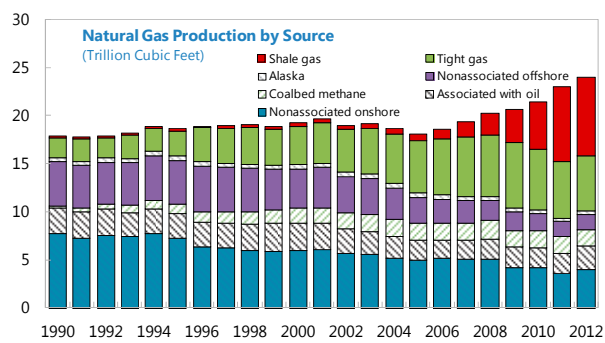
A. Background

1. The United States is currently experiencing rapid growth in oil and gas production.

Technological advances (especially horizontal fracturing and drilling) have helped to unlock unconventional oil and gas from tight-rock formations including shale, reversing a long period of production declines (Box 1). Production of crude oil and other petroleum products has increased by 30 percent over the past 5 years, helping to halve the net imports of crude oil and related liquids. Natural gas output has been up by about 25 percent over the same period.



Source: EIA



Source: EIA

¹ This chapter was prepared by Ben Hunt, Martin Sommer, Gabriel Di Bella, Madelyn Estrada, Akito Matsumoto, and Dirk Muir. The authors have benefited from useful discussions with Samya Beidas-Strom, Gian Maria Milesi-Ferretti, Shane Streifel, and several staff members from the Congressional Budget Office, the Federal Reserve, and the Treasury. The opinions expressed in the chapter are those of the authors, and should not be associated with any of the institutions above.

Box 1. What are Shale Gas and Tight Oil?

Shale is a fine-grained sedimentary rock which can be rich in oil and natural gas. However, due to its low permeability, the oil and natural gas contained in these rocks will not easily flow to wells without assistance from advanced drilling techniques such as hydraulic fracturing and horizontal drilling. Hydraulic fracturing involves pressurized injection fluids commonly made up of water, sand and chemical fluids. This mix is injected under high pressure, down and across into horizontally drilled wells as far as 10,000 feet below the surface. The pressurized mixture causes the rock layer to crack. The fissures are held open by the sand particles so that “tight oil” or “shale gas” flow back to the well.

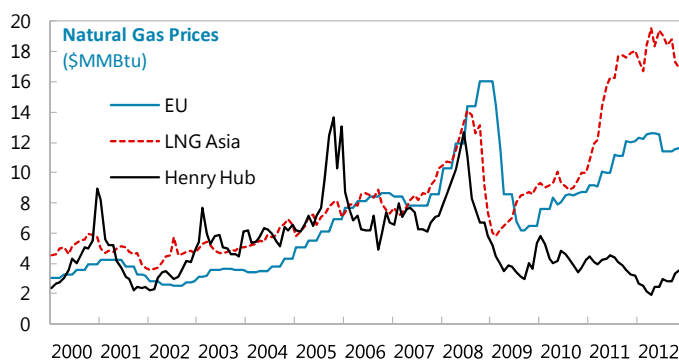
- The largest U.S. **oil shale formation** is the Monterey/Santos play in Southern California, which is thought to hold roughly 2/3 of U.S. shale oil resources. The next largest shale oil formations are the Bakken in western part of North Dakota and eastern Montana, and Eagle Ford in southern Texas. Based on data in EIA (2013b), technically recoverable crude oil resources, including conventional oil, are estimated at about 60 years of current crude production (this figure also includes oil whose production may not be economically viable).
- Most unconventional **natural gas** resources are located in the North East, Gulf Coast, and Southwestern regions. The Marcellus field in the North East holds an estimated 55 percent of total U.S. shale gas supply. Total technically recoverable resources including conventional gas may amount to about 100 years of current natural gas production.



Source: Energy Information Administration based on data from various published studies. Updated: May 9, 2011

Source: Energy Information Agency.

2. The energy boom has already had positive effects on the U.S. economy. Besides the direct benefits from higher oil and gas output, there has been a flurry of activity in the supporting industries (e.g., rigs, pipelines, services). However, reflecting the small share of oil- and gas-related sectors in the U.S. economy (around 1½ percent of GDP), all mining contributed only 0.1 percentage point to real GDP growth last year. Employment in the oil and gas sectors increased by around 50,000 employees in both 2011 and 2012—a small share of the net 2.2 million jobs created in the U.S. economy just last year. That said, technological constraints on gas exports have helped to push the domestic price of natural gas well below prices in other major markets, providing a competitive advantage to domestic industries and helping to support consumer demand through lower utility prices.



Source: IMF, World Economic Outlook.

3. These positive supply developments have been accompanied by continued improvements in energy efficiency. Sustained high oil prices around \$100 a barrel have stimulated lower use of oil in the transport sector—a development also supported by the introduction of more stringent corporate average fuel economy standards as well as demographic and economic changes. According to data by the U.S. Energy Information Agency (EIA), the energy intensity of GDP has fallen by about 15 percent over the past decade, and this pace is expected to pick up gradually to about 20 percent per decade.

4. The rapid growth in natural gas production and the segmented nature of the global gas market has unleashed a wave of rebalancing within the U.S. energy sector. Natural gas has been displacing coal in electricity generation—in turn, coal exports have increased substantially, especially to Europe. Meanwhile, low natural gas prices has incentivized producers to explore fields with a high content of crude oil or natural gas liquids, helping to further cut oil imports. The United States has traditionally been a net importer of natural gas, thus lacking liquefaction facilities for export. However, the administration has granted LNG export approvals to two companies this year and is expected to make decisions on additional export applications in the near future.

5. Most forecasters expect substantial increases in the unconventional production of oil and gas, although forecasts differ substantially (Figure 1). In the EIA's central scenario, production of crude oil and natural gas could increase by some 15 percent over the next decade,

but forecasts by some analysts are substantially more optimistic. The differences reflect a variety of uncertainties related to both technology and policy:²

- *Scalability.* The shale fields typically exhibit rapid declines of production over time (in some cases, output can drop 70–80 percent without further investment after the first year). At the same time, production will at some point need to move from “sweet spots” to less-productive or less-profitable areas.
- *Environmental concerns.* Hydraulic fracturing is a process involving injections of large quantities of water, sand, and chemicals into wells. Opponents of “fracking” point to limited water resources in some areas, the environmental risks from toxic chemicals, including drinking water pollution, and more frequent earthquakes. Several U.S. states (California, New York, New Jersey, and parts of Colorado) have placed moratoria on hydraulic fracturing. Overseas, several countries including Bulgaria, France, and the Netherlands do not permit fracking at present (The Economist, 2013), although the United Kingdom recently lifted its moratorium, choosing to focus on strong regulations rather than an outright ban. On the positive side, the continued displacement of coal in electricity generation has helped to reduce U.S. carbon emissions to a 20-year low in 2012 (but the net global effect was diminished by greater exports of U.S. coal).
- *Infrastructural bottlenecks and regulatory issues.* The lack of liquefaction facilities prevents natural gas exports overseas. Exports of domestically produced crude oil are legally prohibited except to Canada and Mexico.³ Transportation of U.S. crude oil among U.S. ports is allowed only on the (more expensive) U.S.-flagged vessels. U.S. oil refineries are not well suited to process light tight oil, although bartering with Mexico helps mitigate this problem.

B. Impact on the Energy Balance—Partial Equilibrium Analysis⁴

6. The combination of higher energy output and greater efficiency has led to a significant narrowing of the U.S. energy trade deficit. In nominal terms, the energy deficit (comprising of the oil, gas, and coal trade) shrank from 2.7 percent of GDP in 2008 to 1.9 percent of GDP in 2012. At the same time, the net volume of imported oil liquids has fallen from over 13 mbd in 2005 to 6–7 mbd at present, and the net volume of imported natural gas has halved as well.

7. This section assesses the likely path of future energy balances under alternative assumptions about production, consumption, and prices. The calculations are prepared in a

² Existing studies include Barclays (2013), British Petroleum (2012), Citigroup (2012), EIA (2013a), Goldman Sachs (2013), IEA (2012), and NERA (2012).

³ Refined products such as gasoline can be exported. The United States has become a net exporter of refined petroleum products in recent years. Due to this integration with the world market, the U.S. and global gasoline prices have co-moved, despite the large wedge between the U.S. (WTI) and global crude oil benchmarks (Brent).

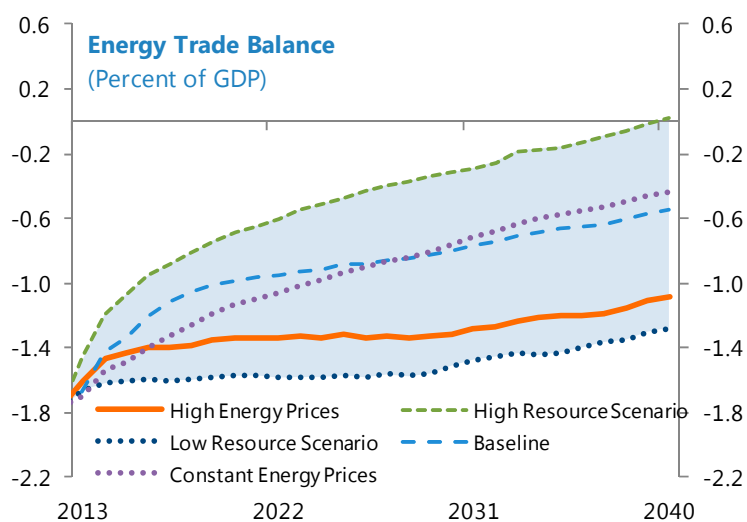
⁴ Calculations in this section were prepared by Gabriel Di Bella.

“partial equilibrium” framework, i.e., without taking into account the second-round effects of higher energy output on the economy such as exchange rate appreciation and higher consumer demand. The analysis rests on the production and consumption forecasts prepared by the U.S. Energy Information Administration (EIA, 2013a) supplemented by price assumptions from the EIA, IMF’s World Economic Outlook, and the International Energy Agency (IEA, 2012). The specifications of baseline and alternative scenarios are as follows:

- **Baseline Scenario.** Energy production, consumption (including its composition), exports, and efficiency are assumed to evolve as in the EIA’s Reference Case. GDP and energy price projections are those of the April 2013 *World Economic Outlook* (WEO).⁵
- **Constant Energy Prices.** Assumptions are as in the baseline, but energy prices are assumed to remain constant in nominal terms at their 2012 level.
- **High Price Scenario (EIA Reference Case).** Assumptions are as those in the baseline, but energy prices are assumed to follow the EIA’s Reference Case.
- **Low Production Scenario.** Energy production, demand, exports, efficiency, and prices evolve according to the EIA’s Low Oil and Gas Resource Case. U.S. GDP projections are as in the baseline.
- **High Production Scenario.** Energy production, demand, exports, efficiency, and prices follow the EIA’s High Oil and Gas Resource Case. U.S. GDP projections are as in the baseline.

8. In all scenarios, the U.S. energy balance is projected to continue improving as a share of GDP thanks to higher domestic production and expected efficiency gains.

- **Under the baseline, the energy balance improves by 0.7 percentage points of GDP by 2018, 0.9 percentage points of GDP by 2025 and 1.2 percentage points of GDP by 2040** (compared with the 1.9 percent of GDP energy deficit in 2012). Growing unconventional energy production will be an



Source: EIA, IMF staff estimates.

⁵ The WEO includes energy price projections through 2018. For the period after 2018, energy prices are assumed for the purposes of this chapter to grow at 2 percent per year (the oil price is assumed at \$84 a barrel in 2018, \$97 a barrel in 2025, and \$130 in 2040), and GDP is assumed to grow at its trend rate.

important driver of the improving energy balance over the next decade (contributing 0.3–0.4 percentage points of GDP), but its effect greatly diminishes by the end of the projection period because the EIA expects the domestic production of “tight oil” to peak in the early 2020s. Subsequently, much of the long-run improvement in the energy balance in this scenario is due to higher efficiency. An expected substitution in the composition of energy consumption from oil and coal into gas also explains some of the improvement in the energy balance. **The results are broadly similar in the Constant Energy Price scenario.**

Change in Energy Trade Balance by 2018					
(with respect to 2012, in percent of GDP)					
	Constant Baseline	Constant Energy Prices	High Energy Prices	High Resource Scenario	Low Resource Scenario
Change to Oil Trade Balance	0.72	0.51	0.39	0.96	0.18
Contributing factors:					
Production	0.20	0.20	0.20	0.62	0.05
<i>of which, Unconventional</i>	0.40	0.40	0.40	1.17	0.24
Consumption Efficiency	0.43	0.43	0.43	0.39	0.44
Demand Composition	0.03	0.03	0.03	0.05	0.03
Price Effects	0.22	0.00	-0.13	-0.04	-0.15
Energy Demand 1/	-0.78	-0.78	-0.78	-0.77	-0.78
Nominal Growth 2/	0.45	0.45	0.45	0.45	0.46
Cross terms	0.15	0.17	0.17	0.25	0.13
Sources: EIA; IMF staff estimates.					
1/ An increase in real energy demand holding constant efficiency.					
2/ A mechanical improvement in the energy balance-to-GDP ratio due to higher nominal GDP.					

- **In the High Price Scenario, improvement in the energy balance is about 0.4 percentage points of GDP in 2018 and 0.7 percentage points of GDP by 2040.** This is because the EIA oil price is rising rapidly over the long term (to \$110 a barrel in 2018, \$145 a barrel in 2025, and \$264 in 2040), while the WEO price initially follows the futures markets (and thus is falling during the first five years) and is then assumed for the purposes of this chapter to grow at the pace of consumer price inflation.
- **In the High Production Scenario, the energy balance would improve by 1 percentage point of GDP in 2018, and the United States would achieve net energy self-sufficiency by 2040.** Higher unconventional energy production would contribute about 1.2 percentage points of GDP to the improvement in energy balance by 2018 and about 0.7 percentage points of GDP by the end of the projection period.

- **In the Low Production Scenario, the improvement in the oil trade balance would be modest, but still tangible.** It would be mostly driven by improvements in energy efficiency and changes in the composition of energy consumption.

Change in Energy Trade Balance by 2025 (with respect to 2012, in percent of GDP)					
	Baseline	Constant Energy Prices	High Energy Prices	High Resource Scenario	Low Resource Scenario
Change to Oil Trade Balance	0.88	0.84	0.45	1.29	0.20
Contributing factors:					
Production	0.06	0.06	0.06	0.57	-0.06
<i>of which</i> , Unconventional	0.28	0.28	0.28	1.15	0.12
Consumption Efficiency	0.69	0.69	0.69	0.61	0.70
Demand Composition	0.13	0.13	0.13	0.17	0.12
Price Effects	0.04	0.00	-0.43	-0.30	-0.47
Energy Demand 1/	-1.20	-1.20	-1.20	-1.19	-1.20
Nominal Growth 2/	0.79	0.79	0.79	0.79	0.80
Cross terms	0.37	0.37	0.41	0.64	0.31

Sources: EIA; IMF staff estimates.
 1/ An increase in real energy demand assuming constant efficiency.
 2/ A mechanical improvement in the energy balance-to-GDP ratio due to higher nominal GDP.

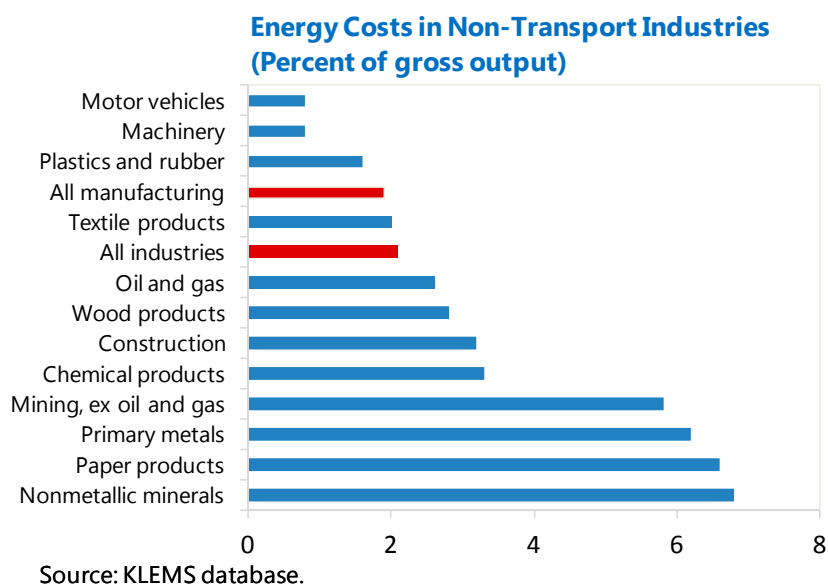
Change to Oil Trade Balance by 2040 (with respect to 2012, in percent of GDP)					
	Baseline	Constant Energy Prices	High Energy Prices	High Resource Scenario	Low Resource Scenario
Change to Oil Trade Balance	1.22	1.34	0.69	1.79	0.50
Contributing factors:					
Production	0.00	0.00	0.00	0.37	-0.05
<i>of which</i> , Unconventional	0.05	0.05	0.05	0.67	-0.02
Consumption Efficiency	0.71	0.71	0.71	0.67	0.71
Demand Composition	0.17	0.17	0.17	0.19	0.16
Price Effects	-0.15	0.00	-0.84	-0.69	-0.87
Energy Demand 1/	-1.53	-1.53	-1.53	-1.52	-1.53
Nominal Growth 2/	1.26	1.26	1.26	1.26	1.26
Cross terms	0.76	0.73	0.93	1.50	0.82

Sources: EIA; IMF staff estimates.
 1/ An increase in real energy demand assuming constant efficiency.
 2/ A mechanical improvement in the energy balance-to-GDP ratio due to higher nominal GDP.

C. Macroeconomic Impact—General Equilibrium Analysis⁶

9. This section attempts to tackle the difficult question of broader macroeconomic implications of the unconventional energy boom. In addition to the direct effects of higher energy-related production on output and trade balance, the U.S. economy could be affected through a number of other indirect channels:

- Corporations may take advantage of lower input costs to employ more labor and capital in both tradable and nontradable sectors. In the tradable sector, U.S. corporations would enjoy a permanent advantage over their international competitors because natural gas prices may not fully catch up to prices in other major markets even in the long run given the liquefaction and transport costs. Over time, corporations could choose to relocate some production to the United States, especially in the energy-intensive sectors such as chemical industry, aluminum, steel, and paper.⁷ Higher capital accumulation would help boost productivity and potential output. U.S. companies could also benefit from exporting their technology for extracting unconventional oil and gas, although expansion of overseas unconventional energy production would in turn reduce the relative cost advantage of U.S. manufacturers. There is also the risk that should U.S. natural gas prices remain low and global oil prices fall, investment in the unconventional energy sector would falter and expected production growth would not materialize.



⁶ Simulations in this section were prepared by Dirk Muir.

⁷ However, the savings from lower energy costs would be tangible only in a handful of industries, which make up a small fraction of U.S. GDP. For example, the four non-transport industries with the energy cost share greater than 5 percent of output account for just 1¼ of GDP. The entire durable manufacturing sector (including low energy-intensity industries) accounts for 6½ percent of GDP. Certain industries also use natural gas as feedstock and could in principle benefit from low U.S. natural gas prices to a greater degree than suggested by the data on energy shares—however, sufficiently detailed input-output tables are not readily available.

- Consumers will benefit from lower energy prices and higher value of their equity wealth holdings, thus boosting domestic demand.
- Higher domestic production could lower sensitivity of GDP to oil shocks, because any given increase in prices would generate higher profits in the energy sector.

10. Analysis in this section rests on the IMF’s Global Economy Model (GEM), a six-region general equilibrium model of the world economy. The model includes a simple energy sector which combines oil, gas, coal, and other energy sources. Energy is produced by combining labor and capital inputs with a fixed factor that proxies the discovery of unconventional energy and related extraction technologies. For simplicity, each country’s household sector is represented by a representative agent. As a result, countries are neither net creditors nor net debtors in the long-run. Given the stylized nature of the model, simulation results should be considered only as illustrative.

11. Model simulations are calibrated using a simplified baseline scenario from the previous section. Specifically, higher energy production and efficiency improvements are assumed to reduce the net energy trade deficit before any second-round effects by 0.9 percentage points of GDP during 2012–2025. It is also assumed that this improvement in the energy balance is attained linearly over the next 12 years, and is evenly split between the contributions of higher production and efficiency (each factor, therefore, contributes 0.45 percentage points of GDP).

12. Several modeling scenarios are considered to highlight the range of possible macroeconomic outcomes from the energy boom and efficiency gains. The key modeling assumptions are related to:

- The degree of forward-looking behavior among households and firms with respect to the future path of energy production and efficiency;
- The degree of initial economic slack and short-run monetary policy response;
- Private-sector saving behavior;
- The technological feasibility of energy exports.

13. The simulation results suggest that the macroeconomic benefits for the United States are positive, but may be modest. In a scenario with only production gains (and no efficiency improvements), the U.S. real GDP *level* gradually increases by about 0.3 percent over the next 10 years. In a scenario with both production increases and efficiency gains, the GDP level increases by ½–1 percent during the next decade. In the short run, the impact on GDP is largest when the boom in energy production and efficiency are fully anticipated and the economy exhibits economic slack (and thus monetary policy does not need to lean against the resulting increase in aggregate demand). The real exchange rate tends to appreciate and energy prices fall in all scenarios, helping to boost private consumption and investment. In the medium run, the U.S. current account balance as a share of GDP deteriorates slightly, but the adjustment path is highly sensitive to assumptions

about expectations and private saving behavior—the current account can either improve or deteriorate. Specifically:

- **Fully-anticipated production boom without efficiency gains** (Figure 2). When the future increases in energy production are fully anticipated, firms understand that the cost of energy will remain low or be declining for an extended period of time and be permanently lower in the long run. Given the decline in the cost of production, firms will move along their supply curve, employing more capital and labor to increase output. Adjustment costs encourage firms to start investing before all the declines in energy prices materialize. Private consumption increases as well since real incomes rise due to lower energy prices, higher employment, and appreciation of the dollar which reduces import prices, and consumers benefit from the higher value of equity holdings in the energy sector. The U.S. current account balance initially deteriorates as U.S. households and corporations temporarily increase borrowing from abroad to support higher consumption and investment. However, owing to the representative household structure of the GEM, the net foreign assets (NFA) and the current account will return to the baseline in the long run.⁸ The U.S. dollar appreciates reflecting the improved competitive position of the U.S. economy.
- **Unanticipated production boom without efficiency gains** (Figure 2). When firms and households do not anticipate future production increases (or, similarly, when they consider the uncertainties about future energy production as very high), the initial increase in GDP is smaller. Firms do not envisage the future declines in energy prices and households do not anticipate the magnitude of the increase in their wealth and real income. Since domestic demand responds much more gradually, the increase in non-energy imports is also smaller. The current account balance improves slightly relative to the baseline even as the U.S. dollar appreciates.
- **Segmented energy markets without efficiency gains** (Figure 3). Should export constraints keep U.S. gas prices substantially lower than overseas, the increase in non-energy investment would be larger than under the baseline. However, consumption would not respond as strongly as in the base case. This is because the dollar would appreciate by less (and thus consumers would benefit less from lower import prices), and the value of household equity holdings in the energy sector would also be lower. The market segmentation would lead to slightly higher U.S. GDP than under the baseline, but welfare measured in terms of consumer utility would be lower since consumption is weaker and labor input is higher (working more brings disutility in the model). The global economy would be worse off compared with scenario with full trade.

⁸ In a representative agent model, the steady states for the current account and net foreign asset position are indeterminate. A number of approaches have been applied to ensure that these types of models have a stable steady state. In GEM, a term is added to the exchange rate equity to force NFA and the current account to return to baseline in the long run in the absence of any change in any country or region's ration of public debt to GDP.

- **Economic slack and role of monetary policy** (Figure 4). In the baseline scenario, monetary policy leans against the short-term demand boom and its inflationary consequences. In practice, however, monetary policy may not need to respond if there was substantial slack in the economy. In a scenario with full anticipation, the initial increases in consumption and investment are much more pronounced, as higher inflation reduces the real interest rate and the dollar temporarily depreciates. In the unanticipated case, however, the extent of economic slack plays little role since demand expands roughly in line with supply and there are essentially no inflation consequences that require a monetary policy response.
- **Higher private saving** (Figure 5). This scenario assumes that higher profits from unconventional energy production are largely saved, for example, because households who own the equity in the energy sector may have lower-than-average marginal propensities to consume out of wealth. With households now opting to increase savings, real consumption remains close to the baseline for several years before gradually rising. This results in a more modest acceleration in GDP relative to the baseline scenario, lower demand pressures, and less tightening of monetary policy.
- **Higher efficiency** (Figure 6). Higher energy efficiency combined with the production boom help raise the cumulative positive GDP effect to about $\frac{1}{2}$ –1 percent after 10 years.⁹ In a stylized (and unrealistic) scenario in which only the United States benefits from higher energy efficiency, capital flows attracted by higher domestic productivity boost domestic investment and consumption, and the current account deteriorates. In a scenario with global efficiency gains, the U.S. benefits from a sharper drop in global energy prices.

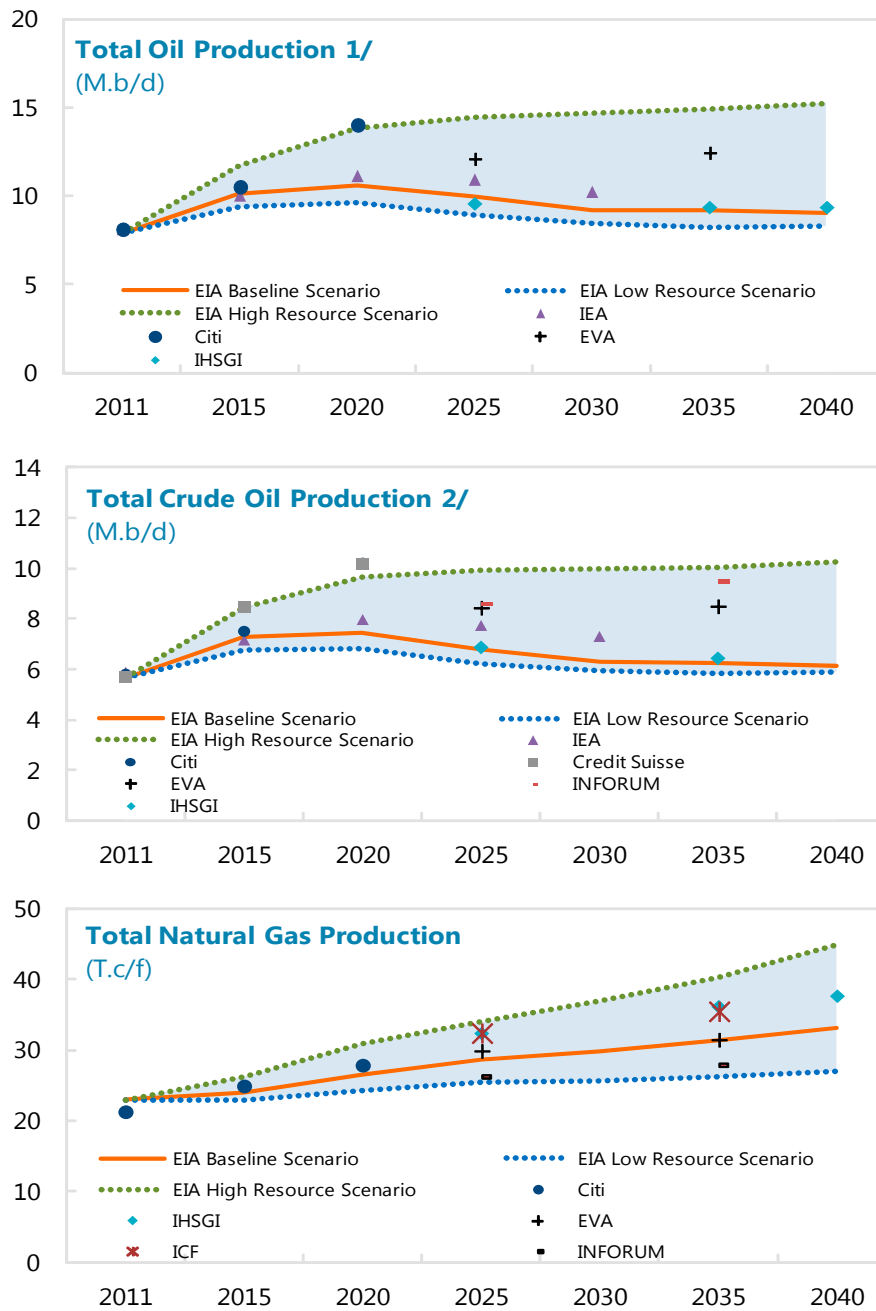
D. Conclusions

14. This chapter explored potential implications of the U.S. unconventional energy boom.

Most analysts agree that U.S. energy output will continue rising going forward, although there is a wide range of views about the possible outcomes. For plausible parameter values, model simulations suggest that the macroeconomic effects will be positive for the United States but may be modest. Under the baseline, the increase in real GDP level attributable to higher domestic energy production could be less than 1 percent after 10 years, although energy production growth has tended to surprise on the upside, and the official production forecasts could prove too pessimistic. The energy boom could put some appreciation pressure on the U.S. dollar, while the current account implications appear ambiguous. Although the U.S. macroeconomic effects appear modest due to the small share of mining and energy-intensive industries in the economy, the energy boom could yet have important implications for the rest of the world, including the major energy exporters especially if accompanied by a more aggressive pursuit of unconventional energy sources in other economies.

⁹ For simplicity, the simulation assumes that the long-standing trend toward higher production efficiency is not yet reflected in the behavior of households and corporations—this assumption would tend to exaggerate the positive GDP effects in the scenario.

Figure 1. Oil and Gas Production Forecasts



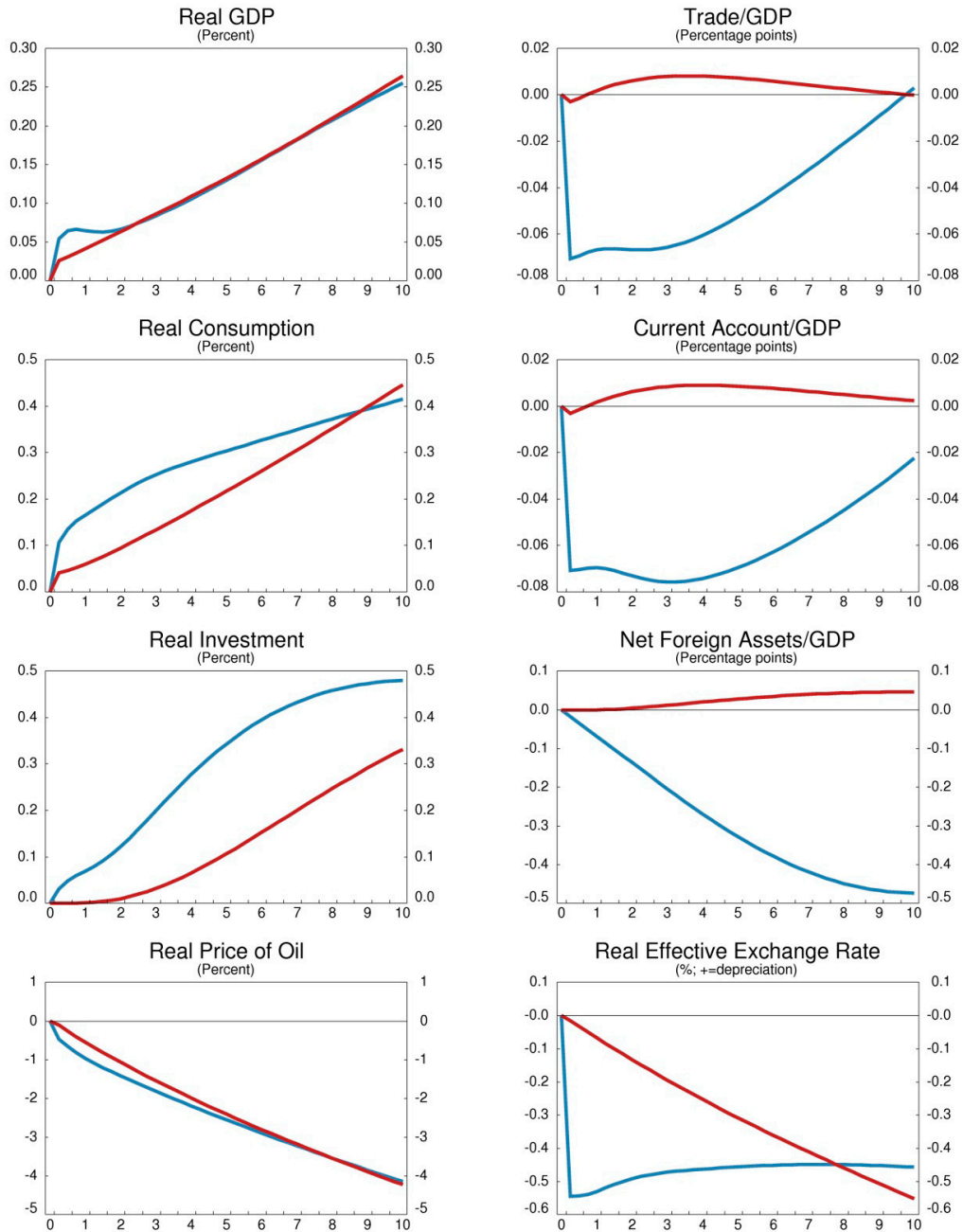
Sources: Citi, Credit Suisse, EIA, ICF International (ICF), IEA, Evatane (EVA), IHS Global Insight (IHSGI), Interindustry Forecasting Project at the University of Maryland (INFORUM); and IMF staff estimates.

1/ Includes NGL and unconventional oil.

2/ Includes unconventional oil and excludes NGL.

Figure 2. GEM Simulation Results: Global Market
United States
Permanent 0.45% of GDP Increase in U.S. Oil Supply over 12.5 years in a Global Market

— is Anticipated Increase (Deviation from control, unless otherwise stated) — is Unanticipated Increase



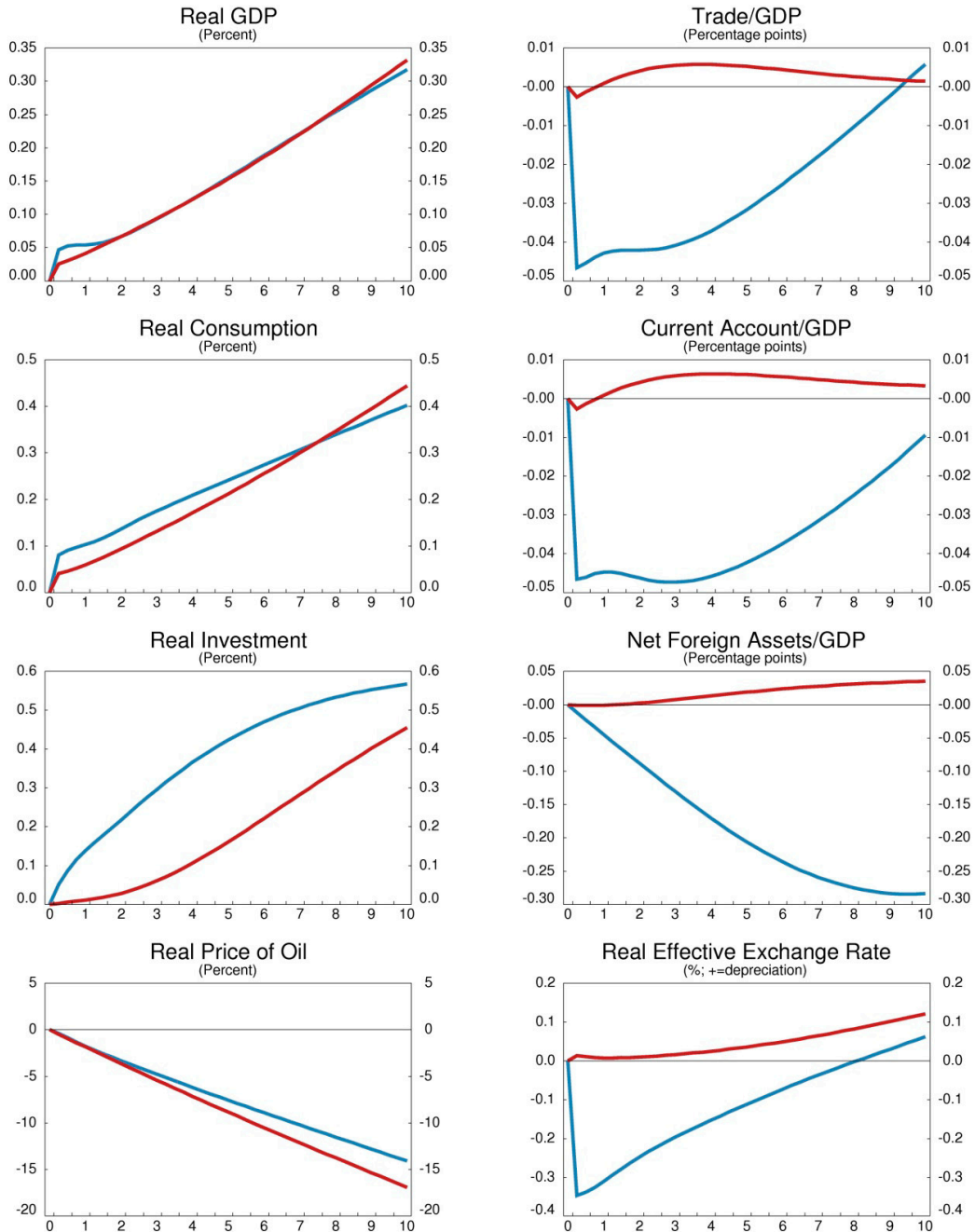
Source: IMF staff simulations using the GEM.

Note: "Oil" stands for the entire energy sector.

Figure 3. GEM Simulation Results: Segmented Market

United States
Permanent 0.45% of GDP Increase in U.S. Oil Supply over 12.5 years in a Segmented Market

— is Anticipated Increase (Deviation from control, unless otherwise stated) — is Unanticipated Increase



Source: IMF staff simulations using the GEM.

Note: "Oil" stands for the entire energy sector.

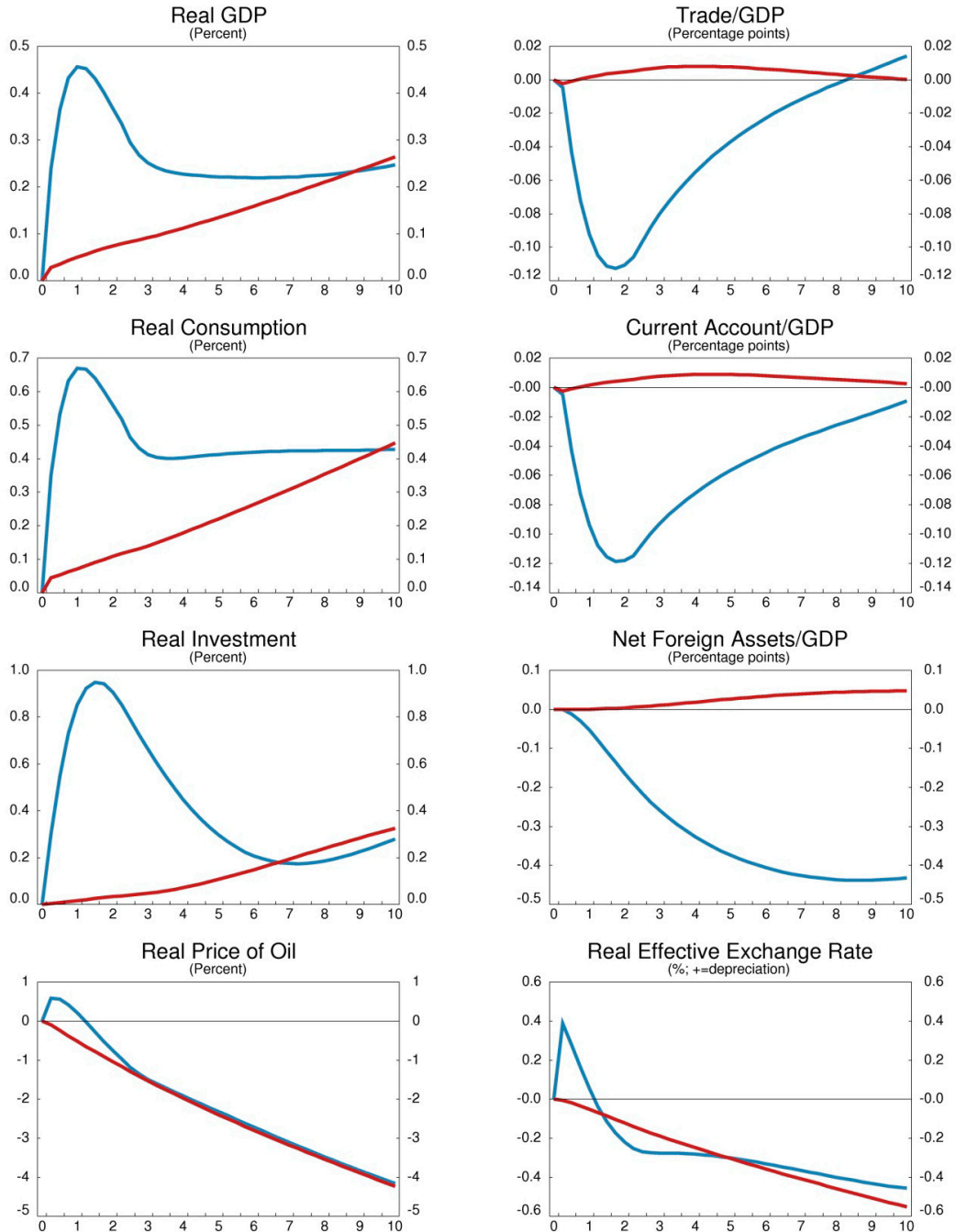
Figure 4. GEM Simulation Results: Monetary Accommodation

United States
 Permanent 0.45% of GDP Increase in U.S. Oil Supply over 12.5 years with 2 Years of Monetary Accommodation

— is Anticipated Increase

(Deviation from control, unless otherwise stated)

— is Unanticipated Increase



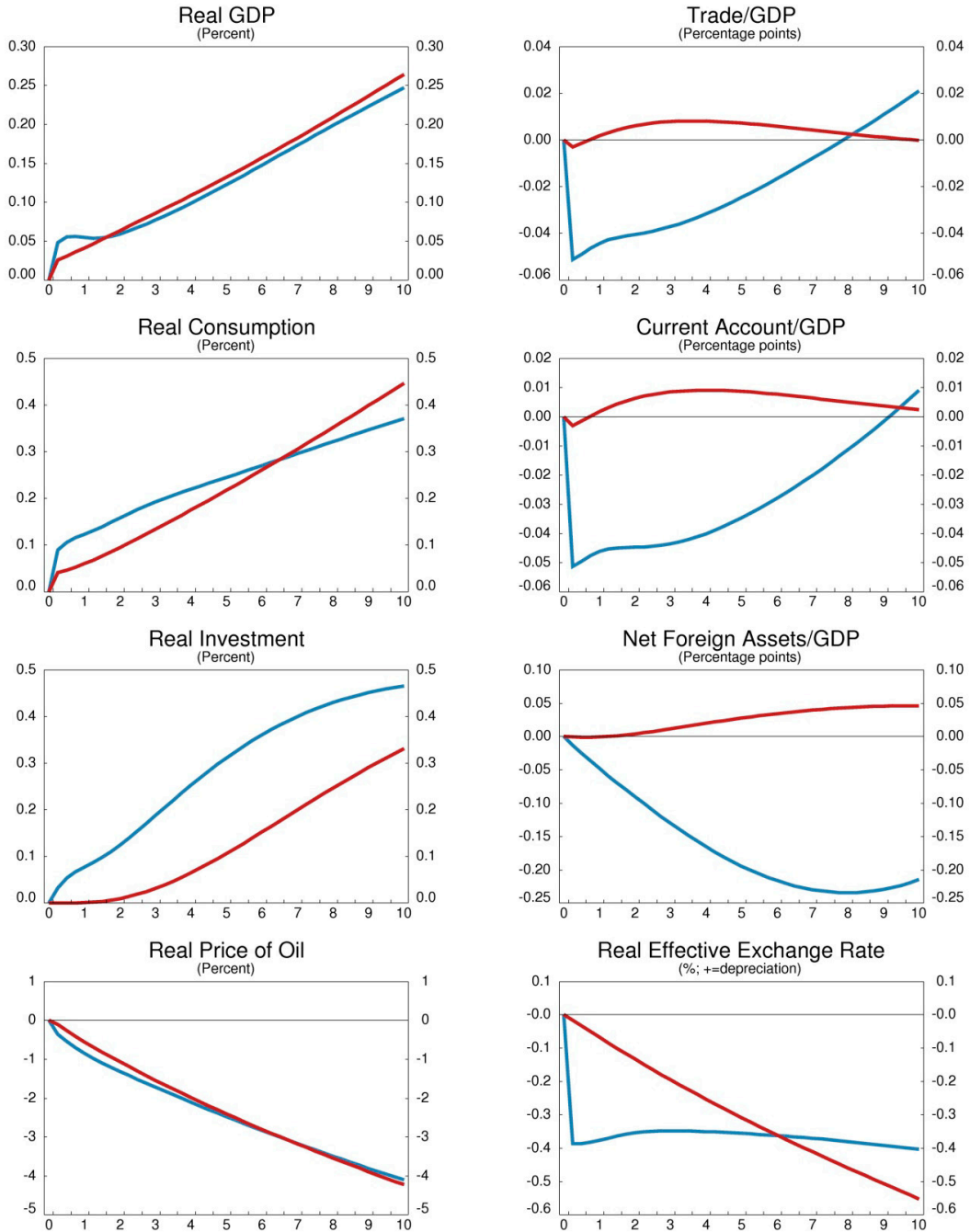
Source: IMF staff simulations using the GEM.

Note: "Oil" stands for the entire energy sector.

Figure 5. GEM Simulation Results: Increased Private Savings

United States
Permanent 0.45% of GDP Increase in U.S. Oil Supply over 12.5 years with Increased Private Saving

— is Anticipated Increase (Deviation from control, unless otherwise stated) — is Unanticipated Increase



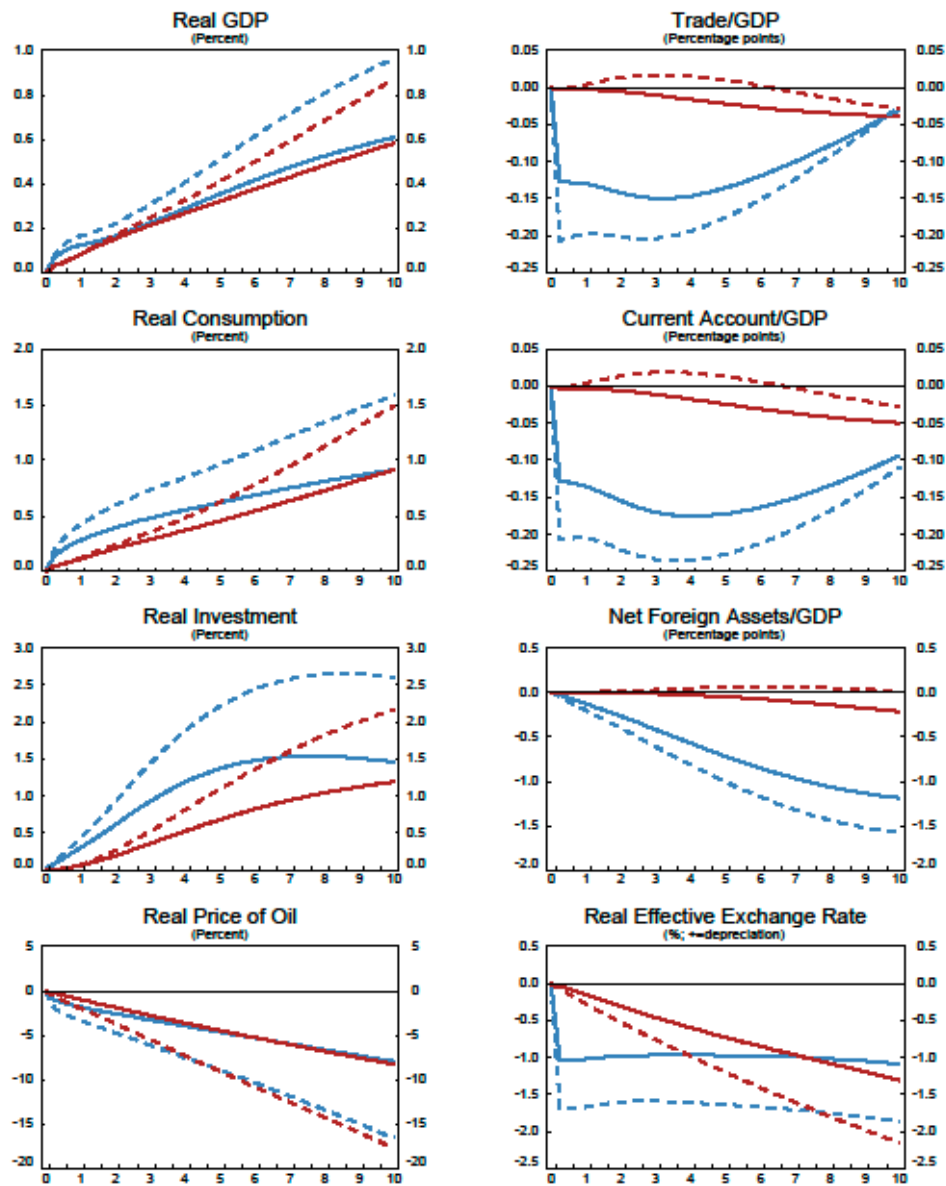
Source: IMF staff simulations using the GEM.

Note: "Oil" stands for the entire energy sector.

Figure 6. GEM Simulation Results: Higher Efficiency

United States
Permanent 0.45% of GDP Increase in U.S. Oil Supply over 12.5 years with Higher Efficiency

— is Anticipated Increase (U.S. only for Efficiency) — is Unanticipated Increase (U.S. only for Efficiency)
 - - - is Anticipated Increase (Global for Efficiency) - - - is Unanticipated Increase (Global for Efficiency)
 (Deviation from control, unless otherwise stated)



Source: IMF staff simulations using the GEM.

Note: "Oil" stands for the entire energy sector.

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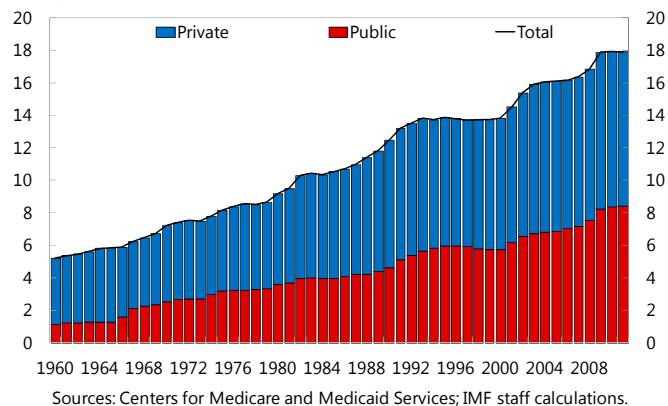
RISKY BUSINESS: THE UNCERTAINTY IN U.S. HEALTH CARE SPENDING¹

A. Introduction

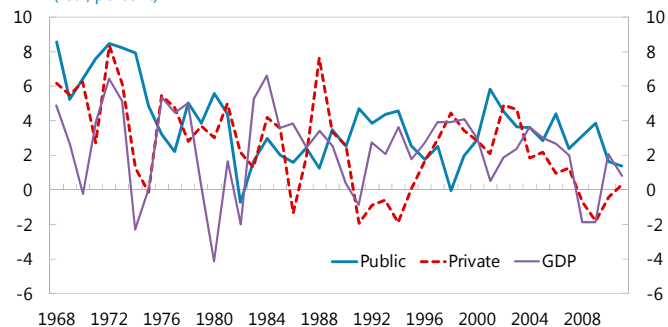
1. Health care spending in the United States has risen considerably during the past 50 years and is a major threat to the sustainability of U.S. public finances. In 2011, national health care spending accounted for 18 percent of GDP, up from 5 percent in 1960 (Chart). The share of public expenditures increased from 22 percent to 47 percent over the same period. Today public health care expenditure (federal and state and local governments combined) stands at about 8 percent of GDP but is projected to increase to almost 15 percent in 2037 (CBO, 2012; GAO, 2013). Calls for containing the risks posed by this large increase have gained momentum as the higher public debt levels—a legacy of the 2007–08 crisis—brought fiscal consolidation to the forefront of policy discussions (e.g., Emanuel et al., 2012; Orszag, 2013).

2. More recently however, health care expenditure growth has slowed (Chart).² Private health care spending growth closely mimicked GDP growth during the 2003–11 period, declining sharply in 2008 and then slightly increasing in 2010 and 2011. Growth of public health care spending started declining in the early 2000s, increased in 2009 when GDP plunged, and

United States: Evolution of Health Care Spending
(percent of GDP)



Health Care Spending and GDP Growth
(real, percent)



¹ Prepared by Deniz Igan, Kenichiro Kashiwase, and Baoping Shang.

² In the 1990s, national health spending grew largely in line with GDP thanks to the growing dominance of managed care plans (Cutler and Sheiner, 1998). This trend, however, did not last as the social and legal backlash against the cost-containment practices of managed care organizations (particularly, Health Maintenance Organizations—HMOs) led to restrictions on such practices (Pinkovskiy, 2013).

has been declining since then.³

3. The objective of this chapter is three-fold:

- First, we assess whether the recent slowdown is permanent or temporary. Understanding the nature of the decline in health care spending growth has key implications for the forecasts. To the extent that the recent slowdown is reflecting fundamental changes in health care delivery and payment practices, one can be confident that the more moderate growth in expenditure can be sustained going forward. If the slowdown is primarily driven by the economic cycle, it must be treated as temporary and appropriately discounted in the projections.
- Second, based on this assessment, economic and demographic trends, and the anticipated impact of the Patient Protection and Affordable Care Act of 2010 (ACA) and other current policy initiatives, we draw inferences for future health care spending.
- Third, we discuss the policy options going forward.

4. The chapter concludes that, even under optimistic assumptions about the growth health care costs, spending will rise due to population aging, requiring measures that lower per capita spending or raise additional revenues. We find that cyclical factors explain some but not all of the slowdown, in line with recent studies, with the unexplained portion of the slowdown likely to be related to recently implemented policies. Even if these savings were to persist going forward, pressure from population aging will increase health care spending as a share of GDP. Hence, new, revenue-raising measures that increase the degree to which beneficiaries share the costs related to the provision of health care should also be considered, in addition to the cost-bending initiatives already in the pipeline.

B. What Explains the Recent Slowdown in Health Care Spending Growth?

5. There are five major drivers of health care spending growth (BPC, 2012).

- Income growth: rising income leads to higher spending on health care while falling income and job losses may lead to less demand for health care as dispensable needs are deferred⁴;

³ The increase in public health care spending growth in 2006 reflects the introduction of Medicare Part D under the Medicare Prescription Drug, Improvement, and Modernization Act of 2003 (MMA).

⁴ Estimates for income elasticity of demand vary considerably with studies using data at the individual level delivering much lower estimates compared to studies at the aggregate level (Getzen, 2000; Feldstein, 2011). Earlier studies have even found elasticity coefficients exceeding one while more recent studies report coefficients less than unity (Frag et al., 2012). One explanation for the estimated elasticity to be above unity is that spending on health to extend life allows individuals to escape diminishing marginal utility of consumption within a period by purchasing additional periods of utility (Hall and Jones, 2007). It is unlikely that income growth alone can explain the health care spending growing as a share of GDP but, in general equilibrium, health care spending growth may outpace economic growth

(continued)

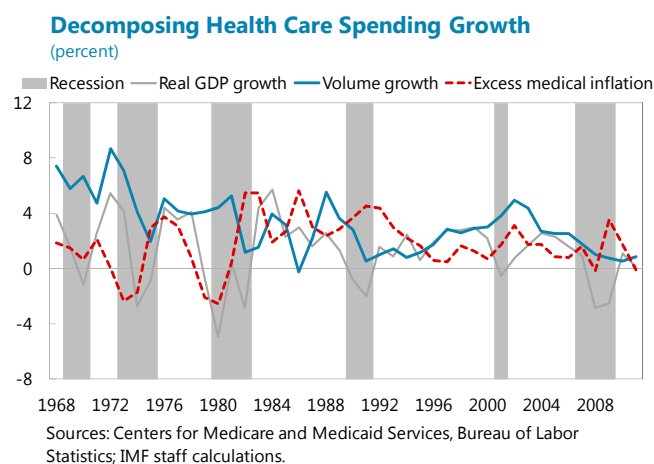
- Relative inflation: in sectors where productivity gains are more difficult to achieve, such as health care and education, unit costs rise faster (the “Baumol effect”) and thus may drive a gap between health care inflation and general inflation;
- Institutional framework and policies determining the way health care is provided and financed;
- Advances in medical technology⁵;
- Demographic factors affecting the health profile of the population, in particular, longer life expectancy and the rising prevalence of chronic conditions due to aging and lifestyles.

6. A few studies have focused on the relationship between health care spending and income growth to assess whether the recent slowdown can be explained by cyclical factors.

Estimates of the portion attributable to cyclical factors range from about one third (Cutler and Sahni, 2013) to three-quarters (KFF, 2013). Others argue that falling real incomes had a role but so did changes in insurance coverage (Holahan and McMorrow, 2013). All agree that there is at least the potential that secular trends—greater provider efficiency, slower diffusion of technology, increased cost sharing—have also contributed and that these trends may continue to generate savings. Indeed, studies using disaggregated data show that changing practices by providers (e.g., a shift away from treating terminal-stage diseases to preventive care) and insurers (e.g., less generous benefits) helped reduce health care spending growth over the last decade (Shapiro, 2013; Ryu et al., 2013).

7. Decomposing health care spending growth into price and volume components shows that both have played a role in the moderation observed since the early 2000s (Chart).⁶

- The relative price of health care (estimated as medical care CPI adjusted)



through the effect economic growth has on technological change and institutional features such as insurance coverage (Smith, Newhouse, and Freeland, 2009).

⁵ Experts believe that technological change is the most important driver of health care spending over time (see CBO, 2008, and references therein). Of course medical innovations could actually reduce spending (e.g., vaccines) but most technological advances to date have increased health care spending because they create new therapies that make it possible to treat previously-untreatable conditions (e.g., renal replacement therapy for kidney failure) and improve capabilities to make treatments available to a wider population (e.g., joint replacements).

⁶ Of course this is not an orthogonal decomposition. It may well be the case that the relative price of health care has increased and, hence, there is less demand for it.

for overall CPI) has grown at a generally slower pace.⁷ The slower pace was not in a single category but was observed in prices for inpatient services, outpatient services, and medical products.

- The volume component shows a stronger co-movement with real GDP growth, and reveals a steady decline over the last decade, which has accelerated during the Great Recession.⁸ Part of the continued drop can be explained by the fact that recessions tend to affect health care spending with a lag, as insurance contracts are often negotiated a year or more in advance and individuals may become eligible for insurance coverage under Medicaid.⁹

8. Breaking down the aggregate spending also reveals that the slowdown has been widespread across different financing programs and spending categories (Table). An

interesting observation is that the slowdown occurred even in Medicare, a program that is relatively insensitive to cyclical changes in the economy as it covers older (mostly retired) beneficiaries. This suggests that the slowdown cannot be entirely due to cyclical factors (Orszag, 2013).

9. Interestingly, slower growth in health care spending was not limited to the United States and occurred broadly across OECD countries. This may be interpreted as an indication that macroeconomic developments may have

driven the slowdown at a global level. Indeed, health care expenditure as a share of GDP is positively related to the rate of GDP growth in the post-crisis period. However, the common factor at work may also be related to changes in policies. Many countries have recently adopted policies intended to reduce health care spending growth, including by cutting national health budgets, increasing user charges, introducing non-price rationing, and controlling medical prices (Mladovsky et al., 2012; Morgan and Astolfi, 2013).

Health Care Expenditures by Source and Category
(real annual change, percent)

	1968-2002	2003-11	2008-11
Federal government	6.4	5.1	4.7
State and local governments	5.4	2.5	1.5
Medicare	7.3	6.1	4.3
Medicaid	8.6	3.3	3.7
Other public	3.7	3.4	3.3
Private insurance	7.2	2.8	1.5
Out-of-pocket	2.4	1.2	-0.2
Hospital services	5.0	3.9	3.2
Physician and clinical services	5.6	2.8	2.0
Prescription drugs	6.0	3.3	0.7
Other	5.7	2.9	1.5

Sources: Centers for Medicare and Medicaid Services; IMF *International Financial Statistics*; IMF staff calculations.

⁷ The medical care CPI may be a poor proxy for the price paid for health care, especially under public programs because both Medicaid and Medicare have controls on how much reimbursement rates increase. Note that the temporary spike in 2009 reflects the drop in energy prices.

⁸ One could further break down the volume component into the number of people receiving health care (extensive margin) and the intensity of care received (intensive margin). Unfortunately, the data to compute these sub-components are not available. One option is to use population growth as a proxy for the extensive margin, which suggests a big drop on the intensive margin given the persistence in population growth rate (Martin et al., 2012).

⁹ Also, they may be able to maintain coverage after losing a job by means of a spouse's policy or under the Consolidated Omnibus Budget Reconciliation Act of 1985 (COBRA).

10. Econometric analysis suggests that the slowdown can be only partially explained by cyclical factors (Appendix). A regression specification with only country-specific trends and aging indicator does *not* predict the low rates of health care spending growth in 2008–11. When macroeconomic indicators (such as real GDP growth) are added to the specification, the model predicts significantly lower growth rates. To see what the counterfactual would have been if the Great Recession had not happened, we replace the actual values of the economic indicators in 2008–11 with their average values observed in 2005–07. Growth rates of health care spending simulated in this way are in line with the pre-recession levels. Similarly, the decline in 2002–04 could also be partly explained by the economic slowdown in 2001–02. The results hold for both total and public health care expenditures. Yet, the model fails to explain a considerable portion of the slowdown, indicating a role for factors other than macroeconomic developments.

11. Structural changes (including policies) also have played a role. Excess cost growth (ECG), a catch-all term for all drivers of health care spending other than income growth and population aging, has decreased sharply over the last few years (CBO, 2013). This may be a consequence of a series of recent developments, such as:

- Increased user charges in the private sector between 2009 and 2011 and high-deductible plans being more widely adopted (Ryu et al., 2013);
- Greater provider efficiency as a result of quality improvement and cost-cutting initiatives focusing on patient safety, which may have been incentivized by recent and scheduled changes to Medicare policies under the ACA, such as elimination of payments for hospital-acquired conditions in 2009, financial penalties for high readmission rates in 2013 and for hospital-acquired conditions in 2015 (Cutler and Sahni, 2013);
- Changes in payment policies under the Deficit Reduction Act of 2005 (DRA), which reduced payment rates for imaging, home health services, and durable medical equipment, and the Medicare Improvements for Patients and Providers Act of 2008 (MIPPA), which made substantial cuts to Medicare Advantage plans (White and Ginsburg, 2012);
- Patent expiration on popular brand-name drugs, and greater availability of lower-cost generics (IMS, 2013);
- More moderate use of high-cost medical technologies such as magnetic resonance imaging (Cutler and Sahni, 2013).

C. Projecting Health Care Spending: Population Aging is the Key Driver

12. Based on these results, some caution should be used in extrapolating recent health care spending trends into the future. The findings from our analysis are consistent with the general view that the slowdown may have been partly driven by cyclical developments. But even if changes in policies had an impact, some of these changes were a reaction to the recession, and high

growth rates could return once the economy fully recovers, or if these policies were reversed or proved to have diminishing returns.

13. In particular, there is some uncertainty on the extent to which ACA will affect health care spending going forward. Expected savings from cost containment provisions and increasing receipts from new taxes within the ACA will have to counter the costs of coverage expansion, as well the costs associated with faster growth in Medicare enrollment due to population aging. Of course, savings from the ACA may prove to be larger than anticipated, but this remains to be seen. Further uncertainty on future dynamics of health care stems from a series of issues related to the ACA implementation (see Box).

14. In light of the recent slowdown, the Congressional Budget Office (CBO) has revised downward its projections of Medicare and Medicaid spending over the next decade.¹⁰ For example, in February 2013, the estimates of federal spending for the two programs in 2020 were reduced by about \$200 billion—by \$126 billion for Medicare and by \$78 billion for Medicaid, or by roughly 15 percent for each program—relative to the March 2010 baseline. About two-thirds of the reduction can be attributed to the extrapolation in the future of the slower growth rates observed in the past few years (CBO, 2013). This revision roughly translates to an implicit assumption that expenditures per beneficiary will grow at approximately the rate of growth of per capita GDP over the next decade (that is, ECG is assumed to be close to zero) (Kronick and Po, 2013). In comparison, the weighted average ECG over the 1985–2010 period was 1.5 percent for Medicare and 0.9 percent for Medicaid.¹¹

15. While staff's health care projections over the next 10 years use CBO assumptions on ECG and factor in additional cost saving measures, health care spending is still expected to increase rapidly. Staff's forecasts are based on CBO projections, which already incorporate the estimated savings from ACA implementation, and also assume that additional cost saving measures from the administration's current budget proposal will be implemented, such as drug rebates. Still, public health spending growth is projected to accelerate from historically slow rates starting in 2014, owing to the expansion of coverage under ACA and an increase in the number of baby-boomers becoming eligible for Medicare starting from 2019. As a result, federal health care spending is

¹⁰ Similar adjustments were made by the Centers for Medicare and Medicaid Services (CMS). CMS attributes the downward revisions to lower-than-expected expenditure growth in recent years, changes in the macroeconomic projections (including state budget pressures), legislative and regulatory changes that occurred since their previous projection in April 2010, and structural changes (such as health insurance plan offerings and health care delivery process improvement initiatives on the part of health care providers, including the associated behavioral changes on the consumers' part) (CMS, 2012).

¹¹ Projections over the next 10 years are based on a bottom-up program-based approach that includes forecasts of spending per beneficiary reflecting recent trends. In its longer-term projections, CBO assumes that health care spending will evolve so that the underlying ECG will decline to zero for Medicaid and to 1 percent for Medicare over the next 75 years. ECG at the start of the projection period is calculated as a weighted average of historical ECG rates over a 25-year window, placing twice as much weight on the latest years compared to the earliest years.

projected to continue to rise rapidly after 2018, reaching 7 percent of GDP by early in the next decade up from about the current level of 5 percent of GDP.

16. Over the longer term, federal health care spending is projected to increase to about 10 percent of GDP by 2037. Beyond 2023, population aging will add about 3 percent annually to the number of Medicare beneficiaries. The dynamics of ECG are subject to significant uncertainty. In the absence of any anchors to pin down these dynamics, the past is taken as the guide and ECG is assumed to gradually revert back to its historical norm. Overall, ECG is estimated to account for 40 percent of the projected increase of health care spending over the next 25 years, while population aging accounts for the remaining 60 percent (CBO, 2012).

D. Policy Options to Bend the Cost Curve

17. Compared to most other advanced economies, pressures from escalating health care spending is relatively stronger in the United States. Many advanced countries, with very different health care systems, face similar pressures (Clements et al., 2012). Yet, the United States spends much more per capita on health care—18 percent of GDP in 2011 compared to the OECD average of 9½ percent. The discrepancy between the level of health care spending the United States and that in other OECD countries was smaller in the 1970s but widened in the 1980s and persisted in the 1990s and 2000s. Comparison of the long-term (1970–2002) rates of growth in health spending per capita in the United States and a other high-income OECD countries reveals that, although rates of population aging and overall economic growth were similar, ECG was much higher in the United States: 2 percent versus the 1.1 percent OECD average (White, 2007).

18. This mainly reflects the specific U.S. institutional and policy framework. Given that technological advances and health care inflation are likely to be relevant in other countries too, the discrepancy in ECG between the United States and other advanced countries might reflect specific features of the U.S. health care delivery and payment system. These could include:

- Generous insurance benefit designs that encompass tax deductibility of health insurance costs and low cost-sharing, as measured by out-of-pocket expenses (Furman, 2007);
- High administrative burden and waste due to fragmentation of care delivery, and distorted incentives because of the reimbursement structure which often is fee-for-service rather than bundled or value-based (Cutler and Ly, 2011);
- Lack of transparency about the cost and quality of health care and about clinical “best practice” guidelines, which might prevent patients from comparing different hospitals or providers and thus making informed decisions (Kane, 2012).

19. ACA is an important, multipronged step forward towards targeting inefficiencies in the U.S. health care delivery and payment systems and controlling both the level and the growth rate of health care spending.

Overall, ACA aims to reform the health care system by improving the infrastructure, information flow, and incentives. The law encompasses a range of potential cost containment measures, targeting some of the institutional features that have been identified as sources of inefficiencies (see Table and Box for a more detailed description of some of these measures). For example, while administrative simplification (through coordination of care and more widespread use of uniform, standard electronic records) and elimination of unnecessary costs (including fraud and abuse) aim to reduce the level of spending, an excise tax on “Cadillac” insurance plans seeks to bend the cost curve by creating incentives for employers and health insurers to devise more cost-effective plans with lower premiums.¹² Additionally, the prices that hospitals charge to Medicare for common inpatient procedures have been released for the first time, in an effort to improve transparency and facilitate informed decision making starting in May 2013.

20. But more can be done. In particular, additional efforts could target prevention as well as better management of chronic conditions and discourage overuse of medical technology.

Major Cost-Saving Measures under the ACA

	Expected annual savings (billion dollars)
(A) Care Coordination	
Establish Accountable Care Organizations (ACOs) in Medicare to provide high-quality coordinated care	0.2
Introduce the Bundled Payments for Care Improvement Initiative that encourages health care providers to work together to improve health outcomes and lower costs	n.a.
Encourage coordinated care for individuals enrolled in both Medicare and Medicaid (dual eligibles)	n.a.
(B) Market-Based Competition	
Competitive bidding program for some durable medical equipment for Medicare	2.6
Medicare Data Sharing for Performance Measurement Program to help consumers get more information regarding their local health care providers	n.a.
(C) Regulatory Reform	
Permit licensed health care professionals (e.g. dieticians) to practice without requiring approval of a physician	0.7
(D) Accessibility Enhancement	
Introduce Prevention and Public Health Fund to facilitate community-based prevention	n.a.
Promote community-based health services through public-private partnerships	n.a.
(E) Waste, Abuse, and Fraud Reduction	
Reduce preventable inpatient hospitalizations among residents of nursing facilities	7.5
Introduce Medicaid Recovery Audit Contractors (RACs) to reduce improper payments for Medicaid health care claims	
Establish Health Care Fraud Prevention and Enforcement Action Team (HEAT) to help prevent waste, fraud, and abuse in the Medicare and Medicaid programs	4.2
Prohibiting States from making payments to providers for conditions that are reasonably preventable	n.a.
(F) Price Control	
Align Medicare drug payment policies with Medicaid policies for low-income beneficiaries	12.3

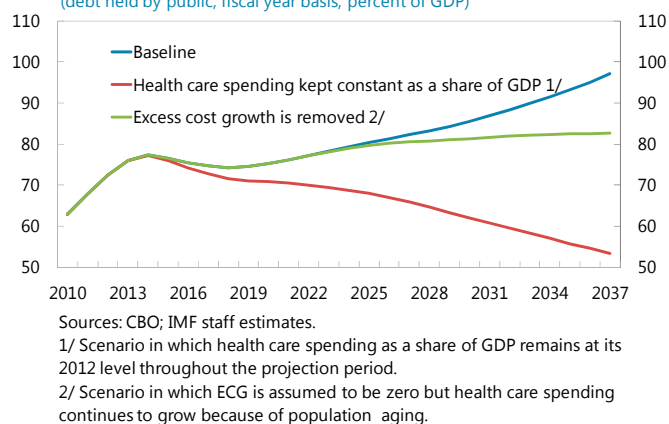
Sources: Centers for Medicare & Medicaid Services; IMF staff estimates.

¹² The “Cadillac” plans are those that, in 2018, will charge more than \$27,500 for families and \$10,200 for individuals, excluding vision and dental benefits. Beginning in 2018, a 40-percent tax will be imposed on the portion of health insurance that is over these thresholds. After 2020, the premium threshold will increase at the rate of overall inflation in the economy. This excise tax is expected to lower premiums and help bend the cost curve, as the premium threshold increases with overall inflation rather than with the growth of health care costs.

- Relative to other countries, the prevalence of chronic conditions is higher in the United States (Thorpe et al., 2007). Moreover, patients with chronic conditions face problems with access and care efficiency, compared to other countries (Schoen et al., 2009). Measures that help gradually reduce the prevalence of chronic conditions and enhance coordination of services to these patients can lead to reductions in future health care spending (RWJF, 2010; Thorpe et al., 2010; Wagner et al., 2001). Such measures can be designed based on international experience.¹³
- Intense use of medical technology and rapid diffusion of new advances is one of the features that separate the U.S. health care system from those in other advanced countries (Kane, 2012). Payment frameworks that better align incentives (e.g., bundled payments rather than fee-per-service) and initiatives to encourage informed decisions by patients could reduce overuse of medical technology (e.g., publication by physicians' associations of cost-benefit analyses and general recommendations on the utilization of imaging technology).¹⁴

21. It is important to expedite implementation of the cost-saving measures under the ACA and look for additional ways to contain the rapid rise in health care expenditures in case the current policies fail to provide durable savings. Critically, past reforms have had only temporary effects on health care costs (Altman and Levitt, 2002). Continuous monitoring and successive reforms may be necessary to preserve the savings achieved through the control of ECG.¹⁵ Moreover,

Federal Debt under Different Health Care Scenarios
(debt held by public, fiscal year basis, percent of GDP)



¹³For instance, the redesign of primary care delivery may be necessary (Schoen et al., 2011). In Germany, some savings and improvement in the quality of care provided to people with diabetes were reached through the Disease Management Programs, implemented in 2002. These programs emphasized primary care as a vehicle to promote adherence to treatment goals and self-management of the patients' conditions, through coordinated care tailored to patients' specific conditions (Stock et al., 2010). In the United Kingdom, the government implemented a flagship Expert Patient Program which emphasizes self-management of chronic illnesses, as well as a new pay-for-performance contract with primary care physicians (Ham, 2009; Schoen et al., 2009). Current measures under the ACA provide some incentives (through state grants) to evidence-based programs encouraging healthy behavior (e.g., tobacco cessation, weight control) among Medicaid beneficiaries, but these measures do not directly involve primary care delivery.

¹⁴ The Patient-Centered Outcomes Research Institute (PCORI) that was created by the ACA is a step in this direction. PCORI aims to provide physicians and patients with new information on the effectiveness of various medical technologies and interventions and, hence, improve decisions on diagnostic tests and treatment methods.

¹⁵ In addition to the PCORI, another initiative to ensure continuity of savings is the establishment of the Independent Payment Advisory Board (IPAB), charged with the mandate under the ACA to develop a proposal to reduce Medicare spending if the projected per capita growth rate exceeds the target growth rate. In addition, the CMS Innovation Center will be developing and evaluating pilot programs to enhance the quality of care for Medicare beneficiaries

(continued)

even if ECG was fully eliminated, an aging population would imply that health care spending as a share of GDP continues to increase and put upward pressure on public debt (Chart). Facing the obligation to serve more beneficiaries (who potentially have higher per capita health care costs because of aging), the health care system will require more financing in order to be able to maintain the same level and quality of benefits. Further measures to bring the costs in line with the benefits (such as through the elimination of health-related tax preferences and enhanced cost-sharing with the beneficiaries) should be part of the discussion on how to tame fiscal pressures from health care spending.

and reduce the cost of their care (the Secretary of the Department of Health and Human Services is authorized to expand successful pilot programs without the need for additional legislation).

Box 1. ACA Implementation: Uncertainties and Risks

The Patient Protection and Affordable Care Act (ACA) was signed into law by President Obama on March 23, 2010. The Act primarily focuses on three goals: expanding coverage, controlling health care costs, and improving health care delivery system.

The ACA is designed to reduce the uninsured population and improve access to care. All citizens and legal residents are required to have health coverage through one of three options, otherwise they would have to pay a penalty:

- Employers, who must offer coverage if they have 50 or more full-time workers;
- Health Insurance Marketplaces, which provide premium credits and cost-sharing subsidies to those whose income is between 133 and 400 percent of the federal poverty level (FPL);
- Medicaid, a primary health insurance program run jointly by the federal government and states covering nearly 60 million low-income individuals today (eligibility criteria vary across states), will be expanded to offer coverage to those with income below 133 percent of FPL. This portion of the insurance coverage expansion (a.k.a. “the Medicaid expansion”) was originally mandatory for all states, but later became optional following the Supreme Court ruling in June 2012.

The cost of coverage expansion would be partially financed with savings generated from cost containment measures. Financing sources also involve an excise tax on high-premium health insurance plans and an increase in the Medicare Part A tax rate for those with high incomes. The cost-saving measures include:

- Restructuring of payments to Medicare Advantage plans to bring them more in line with those under traditional Medicare,
- Reduction of payments for hospital-acquired preventable conditions and Disproportionate Share Hospital payments to hospitals that serve a significantly disproportionate number of low-income patients,
- Implementation of measures advocated by an Independent Payment Advisory Board (IPAB),
- Increase in the Medicaid rebate percentage for brand name drugs,
- Reduction of waste, fraud, and abuse in Medicare, Medicaid, and all other public programs.

ACA plans to improve the health care delivery system via a range of measures including:

- Reductions in preventable inpatient hospitalizations among residents of nursing facilities,
- A new payment system where hospitals are reimbursed based on performance and quality,

Box 1. ACA Implementation: Uncertainties and Risks (concluded)

- A new bundled payment system under Medicaid for episodes of care,
- Increased Medicaid payments to primary care physicians to improve access to care,
- Increased funding for community health centers as part of prevention programs.

Whether the ACA will be able to improve the fiscal outlook is uncertain. Benefits from expanded coverage (such as prevention of catastrophic medical expenses and gains from improved health status) are hard to quantify and predict. How ECG will evolve under the new measures is difficult to tell while Medicaid projections carry additional uncertainty because of the provisions governing: (i) the size of eligible population and the take-up decisions, (ii) access to and utilization of primary care, and (iii) reimbursements to health care providers.

It remains to be seen which states will expand Medicaid, with implications for the size of eligible population and, hence, the fiscal burden. Currently, 26 states and the District of Columbia have “opted in” to expand while 13 states are “opting out”, although these decisions are not necessarily binding. The number of total new enrollments depends on individual take-up decisions because of the considerable variation across states in terms of income level and distribution. As a result, the number of potential new enrollments ranges from 2 percent of the state population (Vermont) to 12 percent (New Mexico). CBO makes several assumptions in its projections to capture “the middle of a range of possible outcomes” (CBO, 2012), but there is no guarantee that the estimates will not miss the mark with a high margin.

Another source of uncertainty is related to the payments to primary care physicians in the effort to enhance access to these services. To boost physician participation in Medicaid, ACA raises Medicaid reimbursement rates for primary care to at least 100 percent of Medicare rates. The federal government will fully fund the increase in 2013–14. But, there is ambiguity as to how the increased rates will be implemented and the complexities arising from differences in state policies, claims systems, and provider databases have already led to delays. It is also unclear what will happen beyond 2014. The increase is intended to be temporary but there will be tremendous political pressure to maintain the higher rates with the burden resting on both the federal government and the state government finances.

Last but not least, burden sharing arrangements between the federal government and states for reimbursement of health care providers may prove unsustainable. The cost of coverage for the newly eligible will be entirely covered by the federal government through 2016. Federal funding will be reduced gradually and reach 90 percent in 2020 and thereafter. This is still substantially higher than the Federal Medical Assistance Percentages (FMAP)—the matching rate for the currently eligible beneficiaries—which averages 59 percent. Hence, keeping the matching rate for newly eligible beneficiaries at the promised level may turn out to be more difficult than predicted. Given the states’ own fiscal woes, cutting back of the federal funds on Medicaid would have significant ramifications.

Appendix I. Health Spending Growth and Economic Conditions: A Cross-Country Analysis

This appendix presents the trends in the growth of health care spending among OECD countries and estimates the relationship between health care spending growth and macroeconomic conditions. In particular, it analyzes how much of the recent slowdown in health care spending in the United States could be explained in a cross-country model of macroeconomic factors.

Data sources

Health care spending data are drawn from OECD health database. The database provides comparable data for various types of health care spending for OECD countries between 1980 and 2011, including total health care spending as a share of GDP and public health care spending as a share of total health care spending. Total health care spending as a share of GDP is only available for seven countries in the OECD health database. For the United States, total health care spending as a share of GDP in 2011 is imputed based on National Health Expenditure Accounts data from the Centers for Medicare and Medicaid Services. The annual growth rate of per capita health care spending is constructed, by combining with data on GDP in constant prices and the total population estimates as described below. Macroeconomic indicators, including GDP growth, gross debt as a share of GDP, output gap, and unemployment rate, are derived from the World Economic Outlook (WEO) database. We construct total population estimates and share of population aged above 65 based on the World Population Prospects, the 2010 Revision, from the United Nations.

Econometric model

Rising income contributes to health care spending growth. As a large share of health care spending is funded by public sources, fiscal conditions would also matter in determining health care spending growth. Here we use a fixed effects model, in the following form, to assess the relationship between health care spending growth and macroeconomic conditions:

$$h_{i,t} = \beta_0 + \beta_1 * g_{i,t} + \beta_2 * x_{i,t} + \beta_3 * t + \beta_{4,i} * \mu_i + \beta_{5,i} * \mu_i * t + \varepsilon_{i,t}$$

where $h_{i,t}$ denotes real per capita health spending growth; $g_{i,t}$ denotes macroeconomic indicators and their lags, including GDP growth, unemployment rate and gross public debt; $x_{i,t}$ denotes the share of the population aged 65 or above; t denotes a time trend; and μ_i denotes country fixed effects.

Results

As expected, the estimates indicate that GDP growth is positively associated with health care spending growth while unemployment rate and gross public debt are negatively associated with health care spending growth (Appendix Table 1).

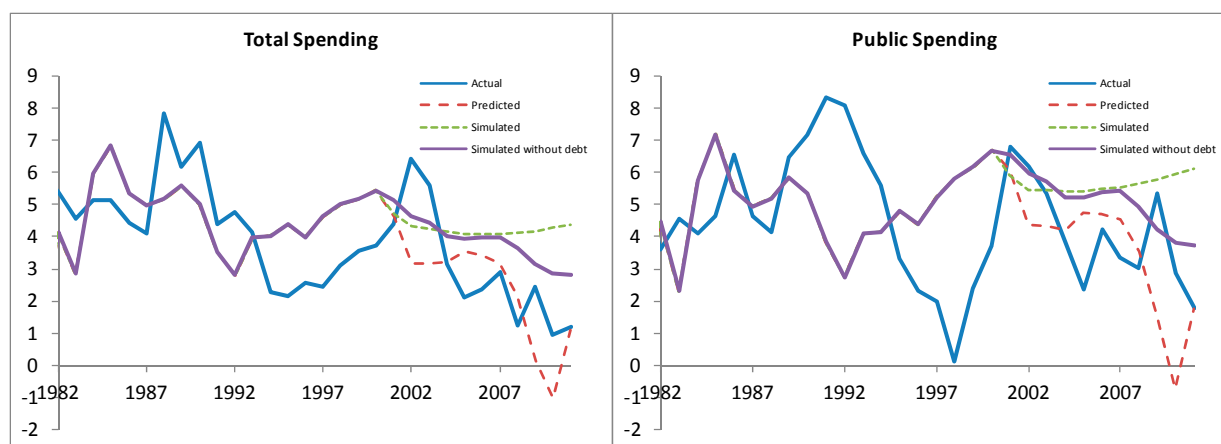
Appendix Table 1. Cross-Country Regression Estimates

	Total spending		Public spending	
	Specification I	Specification II	Specification I	Specification II
GDP growth	0.182 **	0.269 ***	0.164	0.314 ***
Lagged GDP growth	0.429 ***	0.333 ***	0.524 ***	0.480 ***
Unemployment rate	0.041	-0.082	0.179	0.107
Lagged unemployment rate	-0.216	-0.308	-0.377	-0.527 **
General government gross debt	-0.042 **	-	-0.063 **	-
Share of population aged 65 or above	0.864	0.046	0.822	0.196
N	713	859	696	824
Adjusted R-squared	0.188	0.133	0.193	0.199

Sources: IMF staff estimates.

The model predicts lower growth rate than actual for 2009 while the predicted growth rates in 2010 and 2011 are more in line with the actual rates (Appendix Chart 1). The simulation exercise assumes that the average GDP growth rates, unemployment rates, and general government gross debt between 2003 and 2011 are the same as the average between 1995 and 2000. The simulated rates are well above the actual growth rates, indicating the slowdown in health care spending growth can in part be explained by the macroeconomic developments. The “simulated without debt” scenario assumes the average GDP growth rates and unemployment rates, but keeps the general government debt at its actual level (note that one might actually argue that public debt is structural rather than cyclical). These exercises indicate that slower GDP growth, high unemployment rates, and high general government debt have all contributed to the observed slowdown. Yet, the predicted growth rates are slightly higher than the actual rate prior to the recession, suggesting that there is an unexplained portion of the slowdown that is perhaps attributable to structural changes in the health care system.

Appendix Figure 1. Actual, Predicted, and Simulated Total and Public Spending Growth



Sources: IMF staff estimates.

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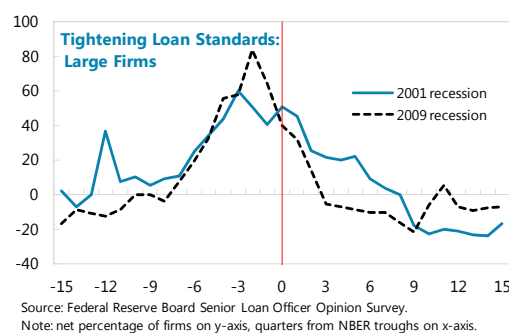
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ARE U.S. SMALL BUSINESSES CREDIT CONSTRAINED?¹

A. Introduction

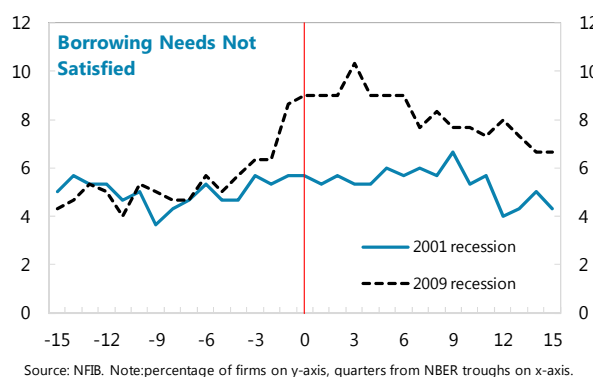
1. The evolution of financial conditions in the United States over the past few years has differed greatly across institutional sectors:

- Large corporates have enjoyed particularly easy financial conditions. Corporates are flush with cash, the corporate credit market has expanded rapidly, and terms and conditions of bank commercial and industrial loans to large firms have been easing since 2010 (Chart).



- By contrast, households still face relatively tight access to mortgages. Notably, credit scores for new borrowers (for both prime and FHA mortgages) continue to be much higher than pre-crisis years (see Duke, 2013).

- Credit conditions for small and medium-sized enterprises (SMEs) are more difficult to assess.² Small businesses face higher interest rates than larger firms and have benefited less from easier loan standards in 2012. The volume of credit to SMEs has declined sharply since 2008, although the National Federation of Independent Business survey on small businesses suggests that SMEs remain mostly concerned about the sale outlook, rather than access to credit. However, controlling for the stage of the cycle, the share of SMEs reporting unsatisfied borrowing needs remains higher than in the 2000–01 recession (Chart).



2. The objective of this chapter is to assess whether SMEs face tighter credit conditions relative to pre-crisis levels. To separate demand versus supply factors and mitigate identification

¹ Prepared by Francesco Columba with research assistance by Madelyn Estrada. We thank the Kauffman Foundation for granting access to the restricted-access data from the Kauffman Firm Survey, Roberto Cardarelli and Gian Maria Milesi-Ferretti for useful comments.

² In the rest of the chapter SMEs are firms with less than 500 employees, in line with the United States Small Business Administration (USSBA) definition USSBA, 2010.

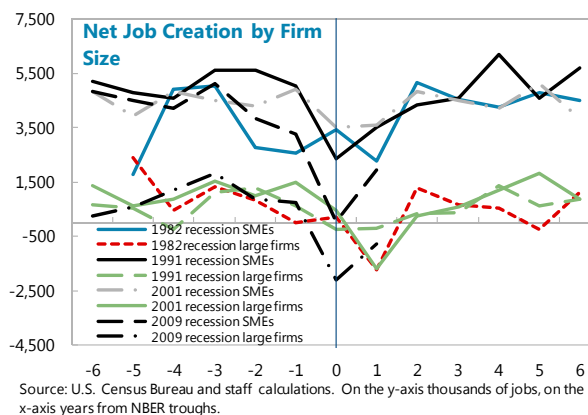
problems, it uses firm-level data. In particular, the chapter tries to control for changes in credit supply conditions using loan applications data, exploiting the difference in housing markets developments across states and their effect on housing collateral values—a key determinant of SMEs access to credit. By doing so, we are able to assess whether firms that operate in states where house prices experienced a sharper decline also face more difficulty in accessing credit—a sign that they are experiencing tighter credit conditions. To do this we use a database of nearly 5,000 new businesses or startups that are being tracked annually since 2004 from the Kaufmann Firm Survey (KFS). Data currently are available through the year 2011.

3. The chapter finds that access to credit for small businesses is still impaired, mainly as the value of housing as collateral has weakened. Over the 2007–2011 period firms in the KFS reduced their application rate for loans, suffered an increase in the rejection rate of their applications, and were increasingly discouraged from applying for a loan when they needed it.³ These trends manifested themselves more strongly for firms in states that were hardest hit by the decline in house prices and much more weakly in the five states that went relatively unscathed from the housing price collapse. A very large percentage of the firms whose loan application was rejected indicated as a reason tighter restrictions on lending, especially in hardest hit states.

4. The rest of the Chapter is structured as follows: Section B presents stylized facts on the U.S. SMEs. Section C presents stylized facts on the start-ups in the KFS and results from regression analyses seeking to establish a link between difficulties to secure funding and the use of real estate collateral. Section D concludes with a description of the main takeaways.

B. SMEs in the U.S. Economy

5. Small businesses have been hit particularly hard in the Great Recession. As of 2010, they employ almost half of private sector employees, and generate about 60 of net new private sector jobs. Over the last 35 years SMEs have displayed remarkable resilience as jobs generators, as they continued to generate jobs on a net basis since 1977. Interestingly, in contrast to large firms, SMEs have continued to create jobs during recessions over the past three decades (Chart). However, the Great Recession is an exception, as net job creation dropped dramatically for both large firms and SMEs.

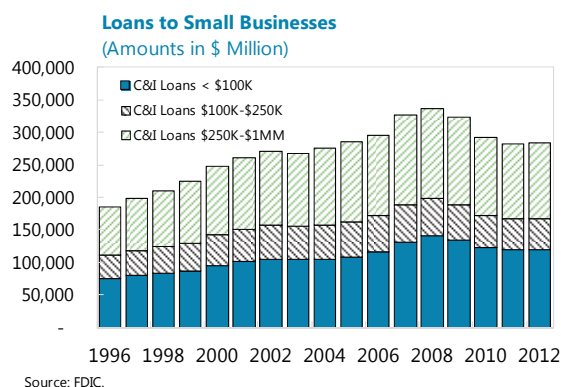


³ Data on loan applications are available from 2007.

6. This reflects their concentration in the construction sector. Almost one third of SMEs and of their employment are concentrated in the construction, real estate and leasing sectors, which have felt the brunt of the crisis with the collapse of housing prices. Moreover, SMEs account for more than 80 percent of output and employment of the construction sector, and about three quarters of the output and half of the employment in the real estate and leasing sectors. Firms with less than 50 employees, in particular, account for more than half of the employed in the construction sector and almost one third in the real estate sector.

7. It also reflects the fact that SMEs typically rely only on bank credit, often secured with real estate collateral. Commercial banks institutions traditionally have been the most important providers of credit to small businesses.⁴ According

to the most recent NFIB survey in 2011 almost 90 percent of small businesses had a commercial bank as primary financial institution. Additionally, small businesses have traditionally relied on personal residence as collateral.⁵ Loans to SMEs have declined strongly in this crisis, and have been contracting since the trough in 2009: as of 2012, loans below one hundred thousand dollars, normally extended to small firms, are 15 percent below their pre crisis peak in 2008 (Chart). Loans of less than 1 million dollars are down by 16 percent. While non-mortgage bank credit has rebounded mortgages are still contracting. Moreover, for smaller firms the share of loans that had to be secured by collateral—typically real estate of the family owning the business—has trended up after the crisis to above 90 percent, while that for larger firms has decreased significantly. For all the size of loans, the share of loans secured by collateral is higher in this crisis than in the previous one.



C. Are SMEs Credit Constrained? Some Evidence from Start-ups

8. A large literature has tried to disentangle supply and demand drivers of credit conditions, but the identification of their relative role is complicated by a number of confounding micro and macro factors (Jimenez et al., 2011). Policy implications are very different according to which effect prevails, and policies to ease access to credit may be appropriate if supply effects are found to be significant. This is particularly relevant for SMEs as they depend on bank credit and are exposed to informational asymmetries that may make credit constraints difficult to overcome without adequate collateral or credit history (Petersen and Rajan, 1994; Berger and Udell, 2006).

⁴ Federal Reserve Board (2012).

⁵ In the first quarter of 2012 more than two thirds of total small business debt was represented by mortgages.

9. To assess whether lower credit to SMEs reflect supply factors, we looked at financing conditions for small young businesses. We used the restricted-access data from the Kaufmann Firm Survey (KFS), a panel study of nearly 5,000 new businesses nationally representative of startups that are being tracked annually since 2004.⁶ The KFS dataset provides data on how businesses are financed; which products, services, and innovations they develop in their early years of existence; and what are the characteristics of those who own and operate them. Data currently are available through the year 2011.

10. Small young businesses experienced increasing difficulties in accessing bank credit during the crisis, especially in states where housing prices declined the most.

- The percentage of firms that *applied for a loan* declined from 12.5 percent in 2007 to 10.8 percent in 2011. In the five states hit hardest by the house price collapse, the percentage of firms applying for a loan declined 4 percentage points to 9.1 in 2011, while in the five states that performed better in terms of housing prices the ratio increased 0.4 points to 12.9 percent in 2011 (Table 1).
- The percentage of firms whose *loan application was always accepted* decreased from 72.4 percent in 2007 to 70.3 in 2011. The decline was much greater (about 5 percentage points) in the states which suffered the most from the housing bust, while the acceptance ratio actually increased (8 percentage points) in states with the most favorable house price dynamics. In these states the percentage of firms *whose application was always rejected* increased by 2.5 pp, compared to 8 pps in the states most hit by the crisis.
- The share of firms *who thought about applying for a loan but did not do so for fear of rejection* increased to 16.5 in 2011. But again this result mask significant difference across states, as the share of “discouraged” firms increased about 5 pps in the states with the largest house price decline, while it actually decreased by 3.2 percentage points in the other states.

11. Credit supply constraints seem to be still at work. The percentage of firms that pointed to restrictions on lending as the reason why their application was denied was still 78.7 percent in 2011 (Table 2). Moreover, it has been increasingly difficult to post personal real estate as collateral for loans (Table 3). The percentage of young firms that posted personal real estate as collateral decreased to 30.8 percent in 2011 from 42.6 in 2009. The ratio declined significantly more (18 pps) in the five states hardest hit from the housing bust, while it remained constant in the other states. At a national level, however, constraints seem to be relaxing: about 30 percent of firms said lack of collateral was the reason for loan rejection in 2011, down from 43.3 percent in 2007.

12. Empirical exercises suggest the existence of constraints for small young businesses trying to access credit using real estate collateral. We estimated the probability that a loan

⁶ Robb and Reedy (2012).

application of a young business was submitted, discouraged and approved during the crisis over the 2009–2011 period. The models were estimated with a panel probit regression of the following form:

$$L_{i,t} = \alpha_i + \delta X_{i,t} + \varepsilon_{i,t}$$

where $L_{i,t}$ takes respectively the value of one if a loan application of firm i in year t is discouraged when a firm needs the loan, submitted or approved. $X_{i,t}$ is a vector of variables that captures the following firm's characteristics: sales, real estate collateral value, non-real estate collateral, bank debt, non-bank debt. The main results are:

- The probability that a firm applies for a loan when using real estate as collateral is lower in states that were hardest hit by the housing bust (Table 4).
- The probability that a loan application is approved increases when the collateral assisting the application is represented by real estate than when it is represented by other assets. However, the coefficients are not statistically significant in either of the two sub-samples (Table 5).

D. Conclusions

13. The chapter provides some evidence that access to credit for small businesses is still impaired, mainly as the value of housing as collateral has weakened. Using a dataset on start-ups suggests that small young businesses may face difficulties in accessing bank credit, especially when located in areas most affected by housing price shocks, in line with recent literature.⁷ Our results suggest that a credit channel may be at work, akin to the home equity to financing channel suggested by the literature.

14. The case for policies supporting small business finance seems stronger than before the crisis. The U.S. Small Business Administration provides a number of financial assistance programs for small businesses that have been specifically designed to meet key financing needs, including debt financing, surety bonds, and equity financing. Policies to overcome these difficulties could include a bolstering of the SBA financial assistance programs aimed at easing the access to debt financing. Such policies might have a beneficial effect on job creation, 60 percent of which is done by small businesses, and probably a higher effect if targeted to ease the constraints faced by new businesses, that have the potential to enhance the employment and growth prospects of the economy with new products and technologies.⁸

⁷ Fort et al. (2012).

⁸ Fort et al. (2012), Robb and Robinson (2010).

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Table 1. Financing Experiences of Start-Ups
(Percentage of firms)

	2007	2008	2009	2010	2011
Applied for new loan or renewed lines of credit					
States with largest house price decline (AZ, CA, FL, NV, RI)	13.1	11.3	13.4	9.4	9.1
States with smallest house price decline (IA, ND, OK, SD, TX)	12.5	16.7	17.5	13.4	12.9
All States	12.5	13.1	12.8	11.3	10.8
Loan application outcomes					
Always approved					
States with largest house price decline (AZ, CA, FL, NV, RI)	58.0	51.9	45.6	65.7	53.1
States with smallest house price decline (IA, ND, OK, SD, TX)	61.1	65.9	81	64.3	69.2
All States	72.4	67.6	65.0	65.3	70.3
Sometimes approved sometimes denied					
States with largest house price decline (AZ, CA, FL, NV, RI)	24.6	30.8	22.8	14.3	21.9
States with smallest house price decline (IA, ND, OK, SD, TX)	22.2	18.2	11.9	17.9	11.5
All States	16.9	17.5	n.a.	14.9	n.a.
Always denied					
States with largest house price decline (AZ, CA, FL, NV, RI)	17.4	17.3	31.5	20	25
States with smallest house price decline (IA, ND, OK, SD, TX)	16.7	15.9	7.1	17.9	19.2
All States	10.4	14.9	18.7	19.8	18.3
Did not apply for loan for fear of denial					
States with largest house price decline (AZ, CA, FL, NV, RI)	17.8	21.6	27.0	23.9	22.5
States with smallest house price decline (IA, ND, OK, SD, TX)	19.7	16.2	n.a.	16.3	n.a.
All States	15.4	17.6	19.4	18.2	16.5

Source: Kauffman Firm Survey, Haver. Note: FHFA house price indexes, States house price changes since the peak of the federal FHFA house price index in Q12007 to the trough in 2011Q2. Arizona, California, Florida, Nevada and Rhode Island registered the strongest declines in house price; Iowa, North Dakota, Oklahoma, South Dakota and Texas registered the smallest declines, if any.

Table 2. Reasons for Denial of Loan Application or Renewal of Credit Line
(Percentages of firms)

	2007	2008	2009	2010	2011
Banks putting tighter restrictions on lending					
States with largest house price decline (AZ, CA, FL, NV, RI)	n.a.	n.a.	87.1	75.0	85.7
States with smallest house price decline (IA, ND, OK, SD, TX)	n.a.	n.a.	n.a.	90.0	n.a.
All states	n.a.	n.a.	90.8	90.4	78.7
Insufficient collateral					
States with largest house price decline (AZ, CA, FL, NV, RI)	53.6	52.0	45.1	41.7	14.3
States with smallest house price decline (IA, ND, OK, SD, TX)	35.7	33.3	n.a.	50.0	n.a.
All states	43.3	42.2	39.4	40.9	29.3
Business credit history					
States with largest house price decline (AZ, CA, FL, NV, RI)	32.1	40.0	32.2	18.1	60.0
States with smallest house price decline (IA, ND, OK, SD, TX)	35.7	33.3	n.a.	50.0	n.a.
All states	31.6	33.3	29.8	25.6	40.7
Personal credit history					
States with largest house price decline (AZ, CA, FL, NV, RI)	25.0	36.0	45.1	25.0	26.7
States with smallest house price decline (IA, ND, OK, SD, TX)	42.8	53.3	n.a.	50.0	n.a.
All states	44.9	45.0	38.8	32.5	39.7
Loan too large					
States with largest house price decline (AZ, CA, FL, NV, RI)	28.6	24.0	22.6	0.0	40.0
States with smallest house price decline (IA, ND, OK, SD, TX)	14.3	7.1	n.a.	40.0	n.a.
All states	25.5	28.0	20.9	16.8	20.7
Inadequate documentation					
States with largest house price decline (AZ, CA, FL, NV, RI)	3.6	12.0	9.7	0.0	6.7
States with smallest house price decline (IA, ND, OK, SD, TX)	0.0	20.0	n.a.	0.0	n.a.
All states	7.1	15.6	8.6	6.2	8.6
Business too new					
States with largest house price decline (AZ, CA, FL, NV, RI)	37.0	16.0	12.9	8.3	6.7
States with smallest house price decline (IA, ND, OK, SD, TX)	35.7	13.3	n.a.	10.0	n.a.
All states	35.1	15.7	11.5	8.7	10.3
Other					
States with largest house price decline (AZ, CA, FL, NV, RI)	3.6	20.0	3.2	9.1	7.1
States with smallest house price decline (IA, ND, OK, SD, TX)	7.1	13.3	n.a.	10.0	n.a.
All states	8.1	14.5	3.9	7.4	7.0

Source: Kauffman Firm Survey, Haver. Note: FHFA house price indexes, States house price changes ranked with respect to the decline since the peak of the federal FHFA house price index in Q12007 to the trough in 2011Q2. Arizona, California, Florida, Nevada and Rhode Island are the states that registered the strongest declines; Iowa, North Dakota, Oklahoma, South Dakota and Texas registered the smallest declines, if any.

Table 3. Type of Collateral Posted for Loans
(Percentages of firms)

	2009	2010	2011
Business real estate			
States with largest house price decline (AZ, CA, FL, NV, RI)	9.3	6.9	13.3
States with smallest house price decline (IA, ND, OK, SD, TX)	19.4	15.2	n.a.
All states	18.1	n.a.	22.5
Personal real estate			
States with largest house price decline (AZ, CA, FL, NV, RI)	58.1	43.3	40.0
States with smallest house price decline (IA, ND, OK, SD, TX)	27.8	20.6	n.a.
All states	42.6	35.0	30.8
Accounts receivable			
States with largest house price decline (AZ, CA, FL, NV, RI)	37.2	41.4	43.3
States with smallest house price decline (IA, ND, OK, SD, TX)	47.2	52.9	n.a.
All states	45.2	50.9	46.7
Vehicle/equipment			
States with largest house price decline (AZ, CA, FL, NV, RI)	27.9	34.5	37.9
States with smallest house price decline (IA, ND, OK, SD, TX)	63.9	66.6	n.a.
All states	40.0	48.7	49.2
Security deposit			
States with largest house price decline (AZ, CA, FL, NV, RI)	18.6	17.2	13.3
States with smallest house price decline (IA, ND, OK, SD, TX)	25.0	20.6	n.a.
All states	18.3	19.3	18.6
Intellectual property			
States with largest house price decline (AZ, CA, FL, NV, RI)	7.0	0.0	6.7
States with smallest house price decline (IA, ND, OK, SD, TX)	32.4	0.6	n.a.
All states	3.1	4.6	3.5
Other personal assets			
States with largest house price decline (AZ, CA, FL, NV, RI)	18.6	26.7	13.3
States with smallest house price decline (IA, ND, OK, SD, TX)	5.4	20.6	n.a.
All states	19.6	23.4	19.7
Other			
States with largest house price decline (AZ, CA, FL, NV, RI)	2.3	0.7	0.0
States with smallest house price decline (IA, ND, OK, SD, TX)	5.4	0.0	8.0
All states	4.5	1.7	2.5

Sources: Kauffman Firm Survey, Haver Analytics. Note: FHFA house price indexes, States house price changes ranked with respect to the decline since the peak of the federal FHFA house price index in Q12007 to the trough in 2011Q2. Arizona, California, Florida, Nevada and Rhode Island are the states that registered the strongest declines; Iowa, North Dakota, Oklahoma, South Dakota and Texas registered the smallest declines, if any.

Table 4. Panel Regression Estimates for Probability of a Firm Loan Application

	(1)	(2)	(3)
	All States	5 States with worst house prices developments during the Great Crisis	5 States with best house prices developments during the Great Crisis
Explicative variables			
Sales	0.001 <i>0.001</i>	0.001 <i>0.001</i>	0.001 * <i>0.001</i>
Bank debt	0.001 <i>0.001</i>	-0.001 <i>0.001</i>	0.001 ** <i>0.001</i>
Nonbank debt	0.001 ** <i>0.001</i>	0.001 <i>0.001</i>	0.001 <i>0.001</i>
Real estate collateral	1.488 *** <i>0.107</i>	1.484 *** <i>0.222</i>	1.539 *** <i>0.321</i>
Other collateral	1.601 *** <i>0.107</i>	1.291 *** <i>0.245</i>	1.166 *** <i>0.237</i>
Costant (α)	-1.821 *** <i>0.131</i>	-1.680 *** <i>0.095</i>	-1.615 *** <i>0.177</i>
Wald Chi ²	358.5	59.9	58.9
Number of observations	4,619	837	448

Note: The dependent variable is the probability that a firm does apply for a new loan. Panel probit model with random effects. Standard errors with white correction are in italics. *** 1 percent significance. ** 5 percent. * 10 percent.

Table 5. Panel Regression Estimates for Probability that a Firm Loan Application is Approved

Explicative variables	(1)	(2)	(3)
	All States	5 States with worst house prices developments during the Great Crisis	5 States with best house prices developments during the Great Crisis
Sales	0.001 <i>0.001</i>	0.001 <i>0.001</i>	0.001 <i>0.001</i>
Bank debt	0.001 * <i>0.001</i>	0.001 <i>0.001</i>	0.001 <i>0.001</i>
Nonbank debt	-0.001 <i>0.001</i>	0.000 <i>0.001</i>	0.001 <i>0.001</i>
Real estate collateral	2.385 *** <i>0.641</i>	2.500 <i>1.710</i>	n.a. <i>n.a.</i>
Other collateral	1.386 *** <i>0.491</i>	-0.559 <i>1.054</i>	-3.086 <i>4.002</i>
Costant (<i>a</i>)	2.443 *** <i>0.331</i>	0.642 <i>0.637</i>	2.524 <i>2.222</i>
Wald Chi ²	22.2	3.0	4.2
Number of observations	612	86	70

Note: The dependent variable is the probability that a firm does apply for a new loan. Panel probit model with random effects. Standard errors with white correction are in italics. *** 1 percent significance. ** 5 percent. * 10 percent.

EXITING FROM UNCONVENTIONAL MONETARY POLICY: POTENTIAL CHALLENGES AND RISKS¹

A. Introduction

1. Ensuring an orderly exit from ultra-accommodative monetary conditions is likely to be accompanied by a range of operational and other policy challenges. The Staff Report cites three: containing abrupt, sustained moves in long-term interest rates; managing an effective pass-through from policy tightening to short-term market rates; and coping with potential balance sheet losses.

2. This paper analyzes the first two of these challenges.² First, the paper discusses potential challenges to raising short-term market rates as the Fed embarks on its tightening cycle. Second, it examines the historical behavior of long-term interest rates and term premia during the last three rounds of monetary tightening in the United States. These episodes suggest that long-term interest rates and term premia may move sharply and unexpectedly during tightening phases, and this can generate uncertainty and complicate calibration of monetary policy. Third, the paper presents a reduced-form empirical model to study the relationship between term premia and macroeconomic and financial fundamentals, as well as a proxy for the Federal Reserve's unconventional monetary policy measures since late 2008. A series of illustrative simulation exercises quantify the possible responses of term premia to different macroeconomic and financial shocks during the exit process.

3. The chapter's main conclusions are: (i) relying exclusively on passive run-off will result in a balance sheet that includes larger holdings of MBS than would otherwise be the case; (ii) the transmission of increases in the interest rate on excess reserves to short-term market rates may be less than one-to-one until excess reserve balances normalize; and (iii) term premia may jump abruptly as the Fed begins to wind down its LSAP program, potentially disrupting the transmission channel and endangering a smooth exit. While the Fed has various tools to help manage the exit from its current highly accommodative policy stance, enhanced policy agility, careful calibration of the timing, and effective communication will be key during the exit.

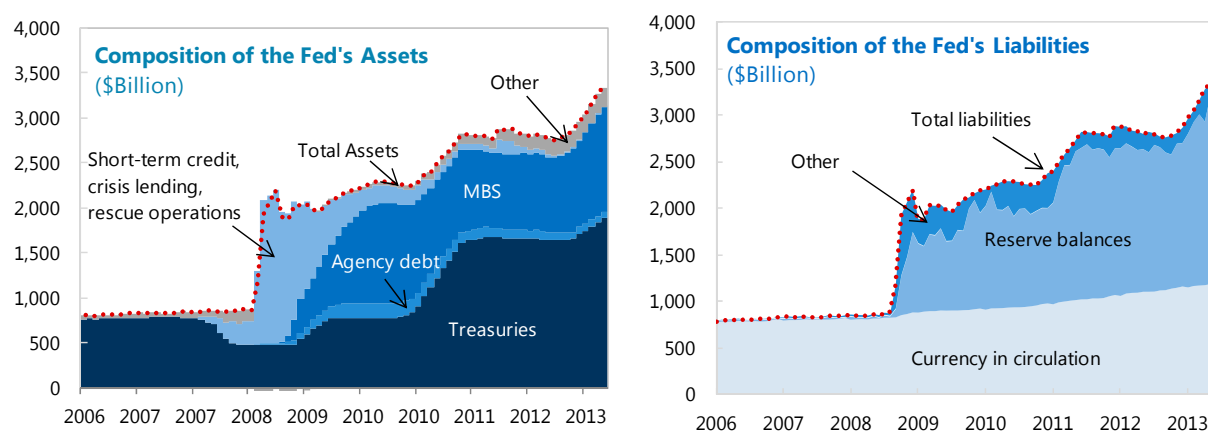
B. Exit Strategy: Operational Challenges

4. At just over \$3 trillion, the Fed's balance sheet is already more than twice as large as it was before the financial crisis (Chart). The composition has also changed. Pre-crisis, the portfolio was comprised almost exclusively of Treasury securities more or less consistent with the maturity

¹ Prepared by Rebecca McCaughrin (MCM) and Tao Wu (ICD).

² On the third challenge, see Box 2 in IMF (2013), which estimates potential losses on a net present value basis under different macro scenarios, ranging from 1 to 4.5 percent of GDP.

distribution of the stock of outstanding marketable Treasury securities and liabilities mostly comprised of costless currency in circulation. Currently, assets include a mix of Treasuries, agency mortgage-backed securities (MBS), as well as agency debt. The overall duration of the portfolio is also longer, partly due to Operation Twist (whereby the Fed sold short-term securities from its portfolio and bought long-term securities), while liabilities are dominated by bank reserves on which the Fed pays interest.



5. The Federal Open Market Committee (FOMC) initially discussed its planned exit strategy at its June 2011 monetary policy meeting. The strategy entails the following steps:

- First, the Fed plans to cease reinvesting principal payments.
- At the same time or sometime thereafter, the Fed intends to modify its forward guidance and start draining reserves.
- Then, the Fed plans to raise the fed funds target and increase the IOER as needed, while continuing to allow securities in its portfolio to mature.

When the Fed first outlined this strategy, the committee had expected to start unwinding its portfolio via outright sales of agency debt and agency MBS sometime thereafter over a 3–5 year period. But since then, the Fed has put less emphasis on asset sales, owing to concerns about market disruptions.³

6. Forward guidance and clear, effective communications are also an important part of the exit strategy. Enhancing its communications has been a long-term objective for the Fed in an

³ Chairman Bernanke indicated in his Congressional testimony to the Joint Economic Committee (May 22, 2013) and in his comments during the June 2013 FOMC meeting press conference that the Committee does not anticipate selling MBS from the Fed's portfolio, except perhaps to reduce or eliminate residual holdings.

effort to bolster its policy effectiveness.⁴ At its December 2012 meeting the FOMC established a threshold-based forward guidance for the policy rate, though explicitly emphasized that thresholds would not be used mechanically.⁵ With respect to its asset purchase program, the FOMC indicated in its post-meeting statements that asset purchases will continue until the outlook for the labor market improves substantially in the context of price stability, and that the size, pace and composition of the purchases will take into account the extent of progress toward its economic objectives as well as the likely efficacy and costs of the program. The FOMC also indicated that it is prepared to increase or reduce the pace of purchases to maintain appropriate policy accommodation as the outlook for the labor market or inflation changes.

7. Following its June 2013 FOMC meeting, Chairman Bernanke provided additional clarity both in terms of the timing and conditions for scaling back the asset purchase program.⁶

Specifically, if the economic data remain in line with current expectations, the FOMC expects to moderate the monthly pace of purchase “later this year...[and] continue...in measured steps through the first half of next year,” which is expected to be consistent with an unemployment rate “in the vicinity of 7 percent.” Although the Fed’s forward guidance with respect to the future path of the federal funds rate has not changed, interest rate futures markets appear to have interpreted the clarification of the economic circumstances that might be expected to lead the Committee to scale back the LSAP program as a signal that the policy tightening process is nearing, shifting forward the first hike to mid-2014 or about a year earlier than FOMC participants’ projections suggest.⁷

8. In principle, it is possible for the Fed to allow its portfolio to shrink exclusively through passive run-off, but it will take a long time for the overall portfolio to normalize both in terms of size and composition.

Assuming that QE-related purchases continue through June 2014, it would likely take about five years for the treasury portfolio to revert to its historical norm.⁸ Based on this simulation, the duration of the portfolio will remain above the historical average for some time.⁹ The MBS portfolio will take much longer to wind down if the Fed relies only on passive pay-downs, since prepayment speeds will likely slow as interest rates rise. Even under aggressive assumptions for prepayment speeds, the MBS portfolio will likely take roughly 30 years to fully run

⁴ See speech by Janet Yellen, “Communication in Monetary Policy,” April 4, 2013.

⁵ The Fed committed to keep the federal funds rate close to zero at least as long as the unemployment rate remains above 6½ percent, inflation projected 1–2 years ahead is not above 2½ percent, and longer-term inflation expectations remain well-anchored. The Fed’s forecasts suggest that macroeconomic indicators are consistent with keeping the federal funds rate exceptionally low at least through mid-2015.

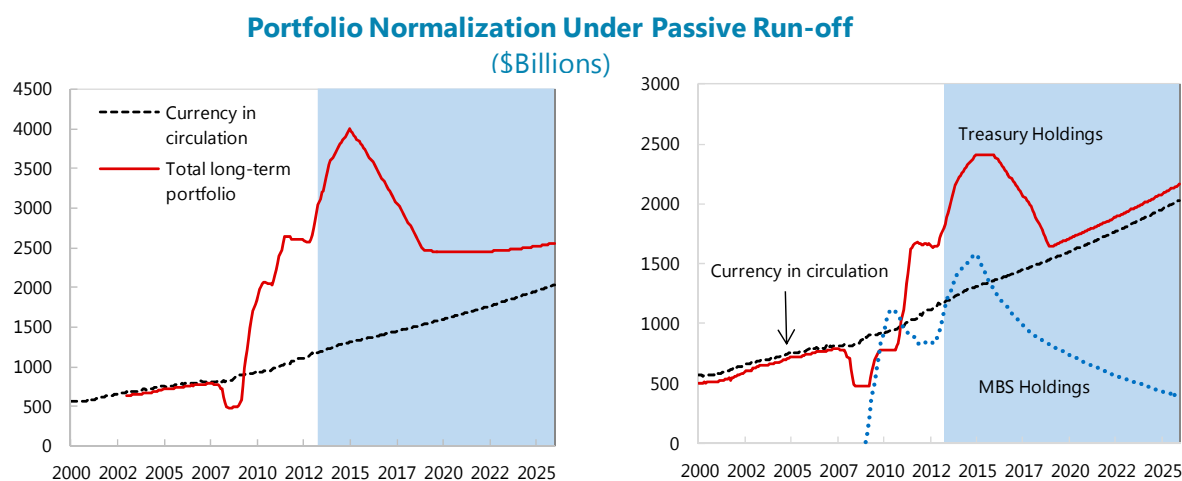
⁶ See [FOMC: Press Conference on June 19, 2013](#).

⁷ Some of the repricing may also reflect an increase in term premia as well as increased margin requirements on Eurodollar interest rate futures by the Chicago Mercantile Exchange.

⁸ The historical norm is defined as a growth rate consistent with growth in estimated currency in circulation.

⁹ The Fed has already allowed to run-off or sold all treasuries under 3-year tenors, so it will take a few years before passive run-off starts to reduce Treasury holdings significantly.

off.¹⁰ An alternative scenario, which assumes that the pace of asset purchases initially slows before the program is fully completed, has only a marginal quantitative impact on the timing for normalization.¹¹ For instance, if the pace of asset purchases diminishes over the period October–December 2013 before the program is discontinued in mid-2014, the treasury portfolio would return to trend growth only a few months earlier than under a scenario that assumes no tapering. A passive normalization of the size of the balance sheet does not necessarily rule out subsequent MBS sales, which could be conducted once the MBS portfolio has been substantially wound down to the point where limited sales would not have a disruptive market impact.¹² In the event the Fed opts to conduct outright sales of its existing portfolio holdings, the normalization process would occur more quickly.



9. While during prior tightening cycles the Fed relied on open market operations to fine-tune monetary policy, the toolkit is much broader this time. First, the Fed has the ability to pay interest on excess reserves. A higher IOER is expected to drive other short rates higher, as banks arbitrage the spread between a lower market rate and a higher IOER, eventually eliminating the difference between the two rates. The Fed also has two reserve-draining tools at its disposal—*large-scale reverse repos* and a *term deposits facility*. In the case of the former, the Fed could continuously roll over its reverse repos until the underlying asset matures, effectively resulting in a permanent reserves drain.¹³ The term deposit facility offers interest-bearing term deposits to depository institutions through a competitive auction process. While an increase in term deposits and reverse

¹⁰ Mortgage conditional prepayment rates of 15–20 percent are assumed in the near-term before returning to 10 percent in the longer run, based on Bank of America Merrill Lynch's prepayment model estimates.

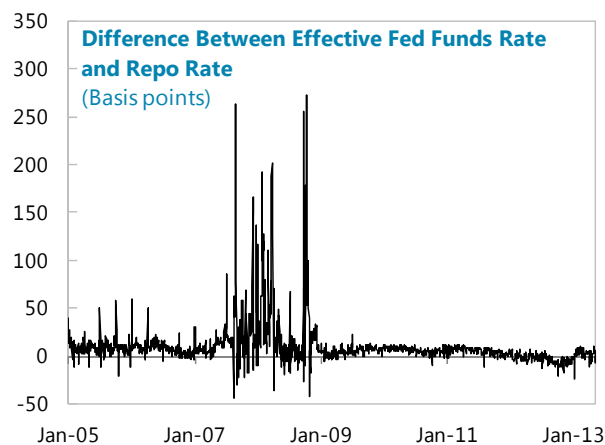
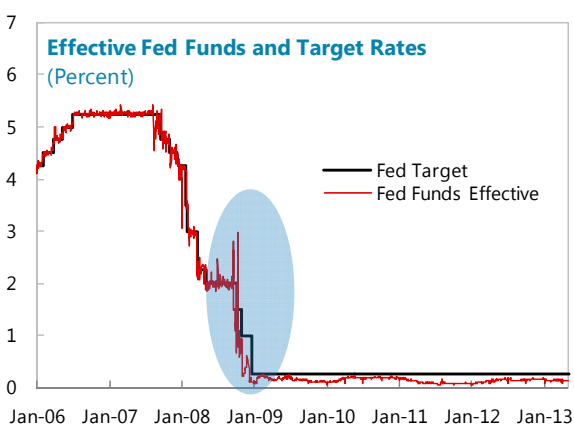
¹¹ Assumptions on the pace of tapering are based on median market expectations.

¹² During his press conference remarks following the [June 2013 FOMC meeting](#), Chairman Bernanke noted that "in the longer run, limited sales could be used to reduce or eliminate residual MBS holdings."

¹³ The Fed has also expanded its counterparties for reverse repo operations beyond its usual set of primary dealers to include banks, money market mutual funds, and the GSEs.

repos will have no impact on the overall level of Federal Reserve liabilities, such operations will reduce the aggregate level of reserve balances over the term of the repurchase agreement or term deposit.¹⁴ The Fed could also opt to sell assets if there is a need to reduce reserve balances more quickly. While the expansion in the Fed's toolkit can provide additional levers for reducing accommodation, institutional factors may complicate the coordination of the exit strategy, given different jurisdictions: the FOMC determines the target rate and oversees the large-scale reverse repos, the Federal Reserve Board sets the IOER and oversees the term-deposit facility.

10. The Federal Reserve has faced challenges in controlling the level of the federal funds rate during the crisis. Prior to the financial crisis, the fed funds effective rate traded in tandem with the target rate, as the Fed carefully controlled the supply of reserves using its open market operations. During the initial phase of the crisis, the Fed generally continued to control the supply of reserves carefully, in part by allowing its holdings of Treasury bills to runoff to offset the reserve effect of increased lending, although there were brief intervals in August 2007 when the effective federal funds rate traded below the FOMC's target. In the fall of 2008, however, the Fed's direct



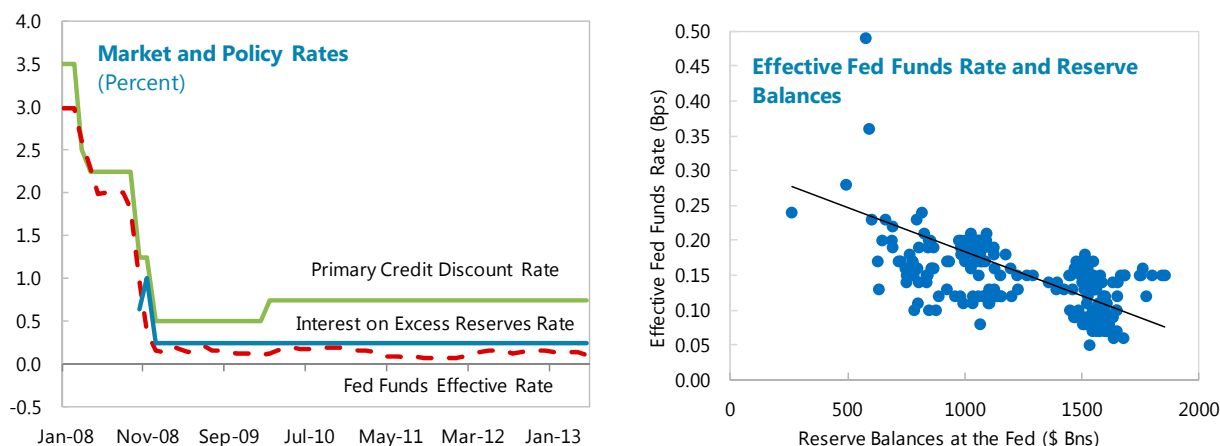
lending in response to the crisis grew too large to be sterilized by the runoff of securities holdings and the fed funds effective rate deviated from the target rate (Chart). Congress passed legislation in 2008 that authorized the Fed to fast-track its planned introduction interest on reserves. While interest on reserves was helpful as a tool to support the implementation of monetary policy during the crisis, the effective federal funds rate fell and remained below the target and below the IOER rate toward the end of 2008, until the FOMC lowered its target to a range of 0 to 25 basis points in December 2008. The fed funds and the repo markets came under significant stress during the financial crisis, pressuring rates higher and constraining volumes. While repo and fed funds rates traded within a few basis points of each other in the run-up to the crisis, the spreads widened as much as 270 basis points during the crisis, as demand for secured funding rose exponentially

¹⁴ The Fed has already conducted reserve-draining operations to test out the functionality of these tools on a limited basis, and will likely step up its test transactions as the exit period nears.

(Chart). In contrast to the fed funds market, repo rates and volumes normalized more quickly once the peak of the crisis had passed (Bech, Klee, and Stebunovs, 2012).

11. The effective fed funds rate has remained below the IOER since its inception (Chart).

This means that some institutions effectively lend funds at a rate below that paid by the Fed. This is partly because not all participants are eligible to receive interest on their reserve balances. The GSEs, in particular, which are significant lenders of cash in the fed funds market, are not eligible to receive interest on balances held with Fed.¹⁵ At the same time, the Fed's LSAP programs have led to a steady increase in excess reserve balances, in turn reducing interbank trading volumes (since a primary reason for banks to borrow fed funds is to ensure that they maintain sufficient reserves).¹⁶



Prior research (Bech and Klee, 2009) suggests that in an environment of elevated excess reserves, the pass-through from a rise in the IOER to the effective fed funds rates may be less than 1 to 1. To keep the effective fed funds rate near the FOMC's target rate, the Fed may need to drain a large volume of reserve balances (Chart). Since the Fed originally laid out its exit strategy in June 2011, the balance sheet has grown even larger, with the securities portfolio expanding by an additional \$500 billion (18 percent), which further increases the challenge for managing draining operations and exerting control over short-term rates.

12. But the Fed has a few options to strengthen the pass-through from a rise in IOER to the fed funds rate.

First, the Fed could raise the IOER, possibly to a level above the FOMC's target

¹⁵The FDIC asset-based fee levied on depository institutions has reduced the incentive for banks to arbitrage away the difference. At around 10 bps, this fee lowers the returns gained from borrowing in the fed funds market from the GSEs and then depositing the funds at the Fed. Some banks that are exempt from the FDIC fee (e.g., foreign-owned branches and other banks with small deposit bases) have sought to arbitrage the difference, but not enough to diminish the spread.

¹⁶ Fed funds effective trading volumes were around \$250 billion pre-crisis and have fallen to approximately \$50 billion per day currently. Repo (GC treasury, tri-party) volumes have fallen as well, but by much less: pre-crisis volumes were around \$450 billion per day versus \$350 billion currently. See [Bech and Klee \(2009\)](#).

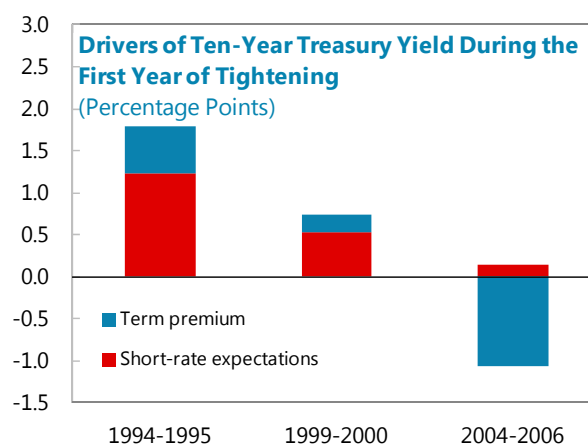
rate, to try to keep short-term market interest rates close to the FOMC's target rate. Second, the Fed could step up its reserve-draining operations, though there may be constraints on the capacity or willingness of the counterparties, especially if the money market funds continue to shrink or if broker-dealer balance sheets remain constrained.¹⁷ Third, if the stickiness is only apparent in the fed funds effective market and if other short-term rates remain close to the FOMC's target rate, the Fed could focus on guiding other short-term money market rates as the dominant policy variable. To reduce downward pressure on the fed funds market, another (albeit unlikely) alternative is to enact legislation that would enable the GSEs to earn interest on their reserves and/or lead the GSEs to downsize their balance sheets and or somehow reduce their dominance in the fed funds market.

C. Exit Strategy and Long-Term Bond Yields

13. Long-term bond yields behaved differently during recent episodes of monetary tightening, largely due to different responses in the term premium (Chart). The

1994-1995 tightening episode—which saw policy rates rise 300 bps over a 13-month period—was accompanied by a substantial increase in the term premium, reflecting concerns among bond investors over inflation and a lack of policy transparency from the Fed, which in turn caused undesirable market volatility and reinforced the increase.¹⁸ During the 1999-2000 episode, when policy rates rose by a more

modest 175 bps over a similar timeframe as in 1994-5, there was a more subdued rise in the term premium. In contrast, the 2004-06 cycle, which saw policy rates rise by 425 bps in 25 bps increments over a two-year period, was accompanied by a substantial decline in the term premium, arguably leading to a somewhat more accommodative policy stance than intended by the Fed.¹⁹



15. A rapid change in the term premium might complicate the exit from QE and normalization of monetary policy.

Various factors could potentially exert sudden upward pressure on the term premium in the forthcoming cycle, including, for instance, uncertainty about the U.S. or global economic recovery and inflation outlook or general policy uncertainty as the Fed seeks to re-

¹⁷ If reverse repos occur in large size, there is the potential to cause repo rates to rise notably relative to other money market rates, which could have adverse effects on other large repo borrowers. Such spillover effects could increase the cost of reserve-draining via a large-scale reverse repo program.

¹⁸ Pakko and Wheelock (1996).

¹⁹ Rudebusch, Swanson, and Wu (2006).

normalize monetary policy conditions. If protracted, such pressures could weigh on the recovery and have negative international spillovers.

16. To assess this risk, we rely on an econometric model of the term premium. In particular, we explore the statistical relationship between the ten-year term premium (estimated using the model described in Kim-Wright, 2010) and a set of variables closely associated with its movement (described in Table 1), including changes in macroeconomic fundamentals, macro uncertainty, financial market volatility, and changes in the Fed’s LSAP program. The methodology follows Gagnon, Raskin, Remache, and Sack (2010) and Wu (2011).

17. To investigate the effect of QE on long-term bond yields and term premia, we construct a measure of market’s expectations of the size and persistence of the LSAP program. Using the methodology of Chung, Laforde, Reifschneider, and Williams (2012), we calculate the present discounted value of the current and expected future SOMA (System Open Market Account) balance in excess of its historical normal level, expressed as a ratio to potential GDP, after each major policy announcement from the FOMC since late 2008 (Chart). Market expectations of the future path of SOMA holdings are formulated based on the evolution of the LSAP program since late 2008 as announced by the FOMC, as well as the Fed’s exit principles, as outlined in the June 2011 FOMC meeting minutes and subsequently clarified following the June 2013 FOMC meeting. The chart displays the evolution of the projected excess SOMA holdings over time. The red line tracks real-time market expectations of future excess SOMA holdings, the present discount value of which is our measure of the magnitude of QE. This measure also reflects the influence of the FOMC’s forward guidance on the market’s expectations of the Fed’s portfolio holdings. For instance, on January 25, 2012, the FOMC extended its guidance on the low interest rate from “at least through mid-2013” to “at least through late 2014.” Even though there were no explicit changes to the LSAP program on the day, the projected path of SOMA balance moved upward (the green dotted line in the chart), as the delay in the first rate hike by more than a year led markets to speculate on a similar delay in the LSAP unwinding schedule. There was a moderate change in this measure following the June 2013 FOMC meeting.

18. The model estimation suggests that term premia are closely related to macroeconomic fundamentals, in particular labor market conditions, financial market volatility, and unconventional monetary policy measures as well as uncertainty on future policy actions. Detailed coefficient estimates are reported in Table 2. Term premia are countercyclical, increasing when the unemployment rate, financial market volatility, or monetary policy uncertainty rise. An expansion in the Fed’s holdings effectively lowers the term premium.

19. Estimation results suggest that QE has lowered the ten-year term premium by over 100 basis points since September 2008. More than half of the 210 bps decline in the ten-year Treasury bond yield between September 2008 and March 2013 can be attributed to the decline in term premium. A decomposition of the changes in the term premium provides some insight into the driving forces behind its observed decline (Table 3). In particular:

- Changes in *macroeconomic fundamentals* during this period increased the ten-year term premium by 30 basis points, largely due to an increase in the unemployment rate;
- Declines in *macroeconomic volatility* had a negligible effect on the term premium, amounting to only 10 basis points;
- Reduced *financial market volatility* and near-term short-rate uncertainty since late 2008 helped lower the term premium substantially, by more than 70 basis points;
- Changes in *market expectations of the Fed's balance sheet size* caused by the various LSAP programs and forward guidance announcements lowered the ten-year term premium by about 100 basis points.

20. Building on the model it is possible to construct a series of simulations on the movement in the term premium prior to and during the exit. In particular, three scenarios are constructed over the next few years starting in the second half of 2013:

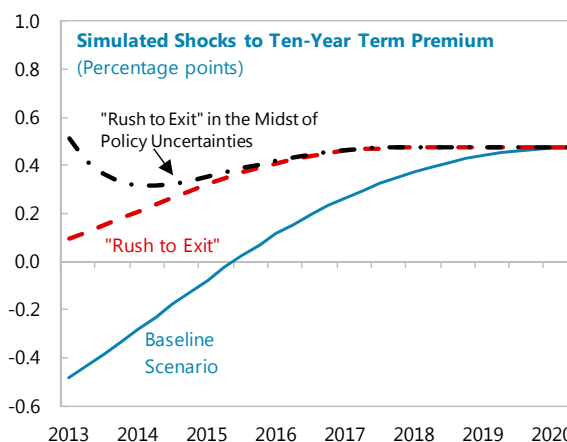
- **Baseline:** this scenario is consistent with the assumptions laid out in the staff report, projecting a gradual and steady economic recovery; macroeconomic fundamentals and financial market volatility will gradually revert to their historical (pre-crisis) average in the first quarter of 2016; purchases of long-term Treasury bonds and agency MBS are projected to continue at the current pace through late-2013 and then are gradually scaled back over the course of 2014; the first federal funds rate increase is expected to occur in early 2016.
- **“Rush to Exit”:** this scenario involves increased sensitivity among bond investors to the unwinding of LSAP assets, combined with a misperception of the Fed’s LSAP unwinding schedule. In particular, it assumes that market participants mistakenly assume that the LSAP unwinding will occur two quarters sooner than in the baseline scenario, and will be completed in three instead of five years. The elasticity of the term premium to changes in the present discounted value of the SOMA balance sheet also rises by two standard deviations, to capture the associated changes in market sentiment.²⁰
- **“Rush to Exit” in the midst of heightened policy uncertainty and financial market volatility.** Under this scenario, a misperception of the Fed’s forward guidance and QE policy lead the market to believe that the LSAP unwinding may occur two quarters earlier and will be finished in three instead of five years. In addition, elevated policy uncertainty generates higher

²⁰ The substantial variations and possible non-linearity in the bond market’s response to the Fed’s unconventional monetary policy measures suggest that changes of such a magnitude are plausible. For reference, the estimated elasticity in Table 2 implies a total effect of -35 basis point of QE I on the ten-year term premium, while the literature has provided a wide range of estimated effects of QE I, from 30 basis points to 100 basis points. Increasing the elasticity by two standard deviations raises the magnitude of the estimated effect from -35 to -51 basis points, almost identical to the -50 basis points as assumed by Chung, Laforte, Reifschneider, and Williams (2012).

volatility in stock and bond markets, amounting to a two-standard-deviation shock to each variable, lasting one quarter, respectively.²¹ Moreover, the response of the term premium to the LSAP unwinding also becomes stronger, as the elasticity rises by two standard deviations, as in the “Rush to Exit” scenario above.

21. The term premium reacts differently under each scenario (chart).

Under the baseline scenario, the ten-year term premium gradually rises from the current level of -48 basis points to positive territory in early 2016, and back to its pre-crisis level of around 50 basis points by 2020. However, if market participants suddenly become overly sensitive and begin to speculate that the LSAP unwinding will begin in the second half of 2013 (“Rush to Exit” scenario), the term premium jumps immediately by about 60 basis points, despite the fact that the actual exit will not occur for at least two more years.



22. The initial increase in the long-term bond yield is even greater in the presence of more general uncertainty over the monetary policy stance and elevated financial market volatility.

Events that lead the market to expect an earlier unwind of the LSAP may also trigger a change in the expected timing of short-term rate increases, thereby driving 10-year bond yields higher. A simple calculation suggests that expectations of an earlier federal funds rate “lift-off” of two quarters may increase the ten-year bond yield by at least 25 basis points. Changes in market sentiment may also be accompanied and further reinforced by heightened financial market volatility. In our third scenario (“Rush to Exit” in the midst of heightened policy uncertainty and market volatility), higher financial market volatility leads to an additional 40 basis point increase in the ten-year term premium, resulting in an overall jump in the term premium of almost 100 basis points and an increase of more than 125 basis points in ten-year Treasury bond yields. The magnitude and persistence of such increases would be comparable to those of Greenspan’s “long-term bond yield conundrum” during 2004–2006—but in reverse—and would likely generate pervasive effects on the U.S. economy and global financial markets.

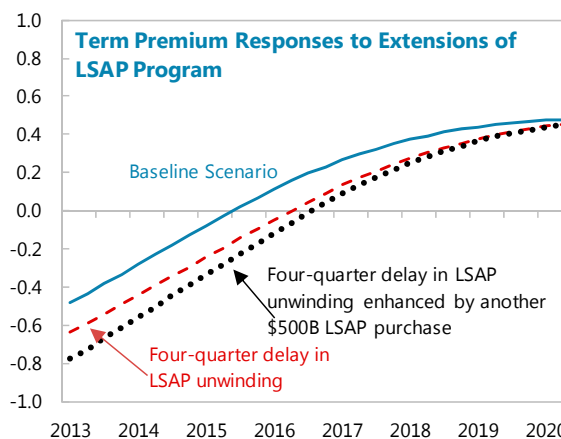
23. Enhanced policy communications with the public are vitally important prior to and during the exit. Improved transparency will be able to effectively reduce the associated policy uncertainty and misperceptions about both the forward guidance on short-term interest rates and

²¹ The sizes of such volatility increases are slightly smaller than those as observed in the first two quarters of the 1994–1995 tightening; therefore shocks of such sizes are quite possible.

the LSAP unwinding schedule, which directly target the expectations component and term premium component of long-term bond yields. Moreover, it will also help ease market jitters and guide the public through the “unchartered waters”, given their unfamiliarity of the policy environment.

24. The flexibility to adjust the LSAP unwinding schedule is another important policy tool to accommodate a more persistent shock to term premium and long-term interest rates.

If the market suddenly learns that the LSAP unwinding will be postponed by another four quarters, the ten-year term premium will immediately decline by more than 15 basis points, and the declines will be quite persistent (Chart). This is already more than enough to offset the two standard deviation shock to bond- and stock-market volatilities as simulated above. Moreover, if such a delay is accompanied by an increase in the current pace of asset purchases to the tune of \$500 billion in additional purchases through the first half of 2014, the term premium will decline by another 14 basis points.



25. In sum, designing and executing a smooth withdrawal of the monetary policy stimulus over the next few years may present challenges.

While the Fed has a range of tools to help manage the exit from its current highly accommodative policy stance, the Fed may face challenges associated with the responsiveness of market rates as monetary policy accommodation is unwound. Heightened uncertainty in macroeconomic fundamental and financial market conditions, market sentiment over the LSAP unwinding timing and magnitude, a lack of familiarity of the new policy environment, may further complicate the implementation of monetary policy. Improved public communications and transparency, as well as enhanced policy agility and flexibility, will be critical in guiding a smooth transition during the exit process.

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Figure 1. Shifts in Projected Path of Excess SOMA Holding (Percent of potential GDP)

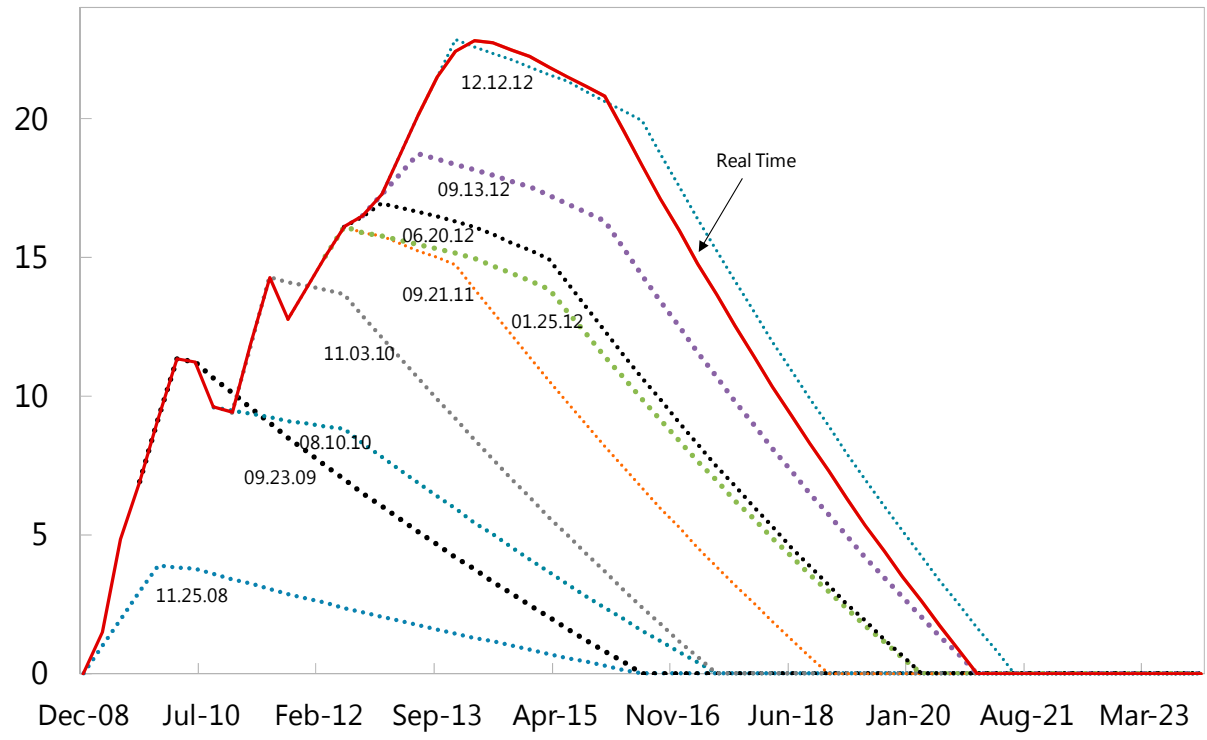


Table 1. Variable Included in Ten-Year Term Premium Model

- I. Macroeconomic fundamentals:
 - a. Unemployment rate gap based on the U.S. CBO's estimates of potential unemployment rate;
 - b. The expectations component of Conference Board's Consumer Confidence index;
 - c. Ten-year-ahead CPI inflation forecast from Survey of Professional Forecasters (SPF);
 - d. Four-quarter change in the core PCE price index;

- II. Macroeconomic uncertainties:
 - e. Growth uncertainty, measured by the forecast dispersions among SPF respondents on four-quarter-ahead real GDP;
 - f. Labor market uncertainty, measured by the forecast dispersions among SPF respondents on four-quarter-ahead unemployment rate;
 - g. Inflation uncertainty, measured by the forecast dispersions among SPF respondents on four-quarter-ahead CPI inflation;

- III. Financial market volatilities:
 - h. The implied volatility in the longer-term U.S. Treasury market, measured by the the Merrill Lynch MOVE index;
 - i. The uncertainty in the stock market, measured by the VIX index of implied volatility from options on the S&P 500 index;
 - j. The uncertainty regarding the near-term path of monetary policy rate, measured by the implied volatility from six-month-ahead Eurodollar futures options.

Table 2. Determination of Ten-Year Treasury Term Premium

	Pre-crisis sample (92:Q1-08:Q2)	Whole sample (92:Q1 to 13:Q1)
Macro fundamentals		
Unemployment rate gap	0.1693 ^{***} (2.8596)	0.1824 ^{***} (4.9959)
Consumer confidence	0.0216 ^{***} (7.7650)	0.0184 ^{***} (6.8836)
Ten-year-ahead CPI inflation forecast	1.0185 ^{***} (10.4957)	1.0230 ^{***} (12.1075)
Core PCEPI inflation	0.1080 (0.8827)	-0.0480 (-0.4767)
Macro uncertainties		
Real growth uncertainty	0.2830 ^{**} (2.1718)	0.3123 ^{***} (2.7533)
Unemployment rate uncertainty	0.5503 ^{**} (2.2565)	0.5376 ^{**} (2.4483)
Inflation uncertainty	-0.3067 (-1.4637)	-0.2371 [*] (-1.4978)
Financial market volatility and policy-rate uncertainty		
Implied volatility on long-term Treasuries	0.0056 (1.6319)	0.0037 (1.5321)
Implied volatility on S&P 500	0.0055 (0.5800)	0.0009 (0.1273)
Implied volatility on Eurodollar futures	0.0043 [*] (1.7319)	0.0064 ^{***} (3.4822)
PDV of SOMA balance/GDP ratio		-0.0026 ^{***} (-4.3090)
Adj. R ²		

Source: IMF staff estimates. ^{***}, ^{**} and ^{*} denote 1, 5, and 10 percent significance level, respectively.

**Table 3. Decomposition of Changes in Ten-Year Term Premium:
September 2008 to March 2013**

Changes in Ten-year Treasury Bond Yield (bps)	-213.7
Of which	
Changes in Ten-year Term Premium	-117.4
Of which	
Changes in Macroeconomic Fundamentals	30.0
Changes in Macroeconomic Uncertainties	-9.7
Changes in Financial Market Volatilities and Policy-Rate Uncertainty	-70.3
Changes in the PDV of SOMA Balance	-102.4
Of which	
"QE I" phase	-34.6
"QE II" phase	-12.0
"Operation Twist" phase	-30.0
"QE III" phase	-25.8
Residual	35.0

Source: IMF staff estimates.