CHAPTER 3

DEALING WITH HOUSEHOLD DEBT

Does household debt amplify downturns and weaken recoveries? Based on an analysis of advanced economies over the past three decades, we find that housing busts and recessions preceded by larger run-ups in household debt tend to be more severe and protracted. These patterns are consistent with the predictions of recent theoretical models. Based on case studies, we find that government policies can help prevent prolonged contractions in economic activity by addressing the problem of excessive household debt. In particular, bold household debt restructuring programs such as those implemented in the United States in the 1930s and in Iceland today can significantly reduce debt repayment burdens and the number of household defaults and foreclosures. Such policies can therefore help avert self-reinforcing cycles of household defaults, further house price declines, and additional contractions in output.

Household debt soared in the years leading up to the Great Recession. In advanced economies, during the five years preceding 2007, the ratio of household debt to income rose by an average of 39 percentage points, to 138 percent. In Denmark, Iceland, Ireland, the Netherlands, and Norway, debt peaked at more than 200 percent of household income. A surge in household debt to historic highs also occurred in emerging economies such as Estonia, Hungary, Latvia, and Lithuania. The concurrent boom in both house prices and the stock market meant that household debt relative to assets held broadly stable, which masked households' growing exposure to a sharp fall in asset prices (Figure 3.1).

When house prices declined, ushering in the global financial crisis, many households saw their wealth shrink relative to their debt, and, with less income and more unemployment, found it harder to meet mortgage payments. By the end of 2011, real house prices had fallen from their peak by about 41 percent in Ireland, 29 percent in Iceland, 23 percent in Spain and the United States, and 21 percent in Denmark. Household defaults, underwater mortgages (where the loan balance exceeds the house value), foreclosures, and fire sales are now endemic to a number of economies. Household deleveraging by paying off debts or defaulting on them has begun in some countries. It has been most pronounced in the United States, where about two-thirds of the debt reduction reflects defaults (McKinsey, 2012).

What does this imply for economic performance? Some studies suggest that many economies' total gross debt levels are excessive and need to decline.[1] For example, two influential reports by McKinsey (2010, 2012) emphasize that to "clear the way" for economic growth, advanced economies need to reverse the recent surge in total gross debt. Yet others suggest that the recent rise in debt is not necessarily a reason for concern. For example, Fatás (2012) argues that the McKinsey reports' focus on gross debt is "very misleading," since what matters for countries is net wealth and not gross debt.[2] A high level of private sector debt as a share of the economy is also often interpreted as a sign of financial development, which in turn is beneficial for long-term growth (see, for example, Rajan and Zingales, 1998). Similarly, Krugman (2011) notes that because gross debt is "(mostly) money we owe to ourselves," it is not immediately obvious why it should matter. However, Krugman also cautions that gross debt can become a problem. Overall, there is no accepted wisdom about whether and how gross debt may restrain economic activity.

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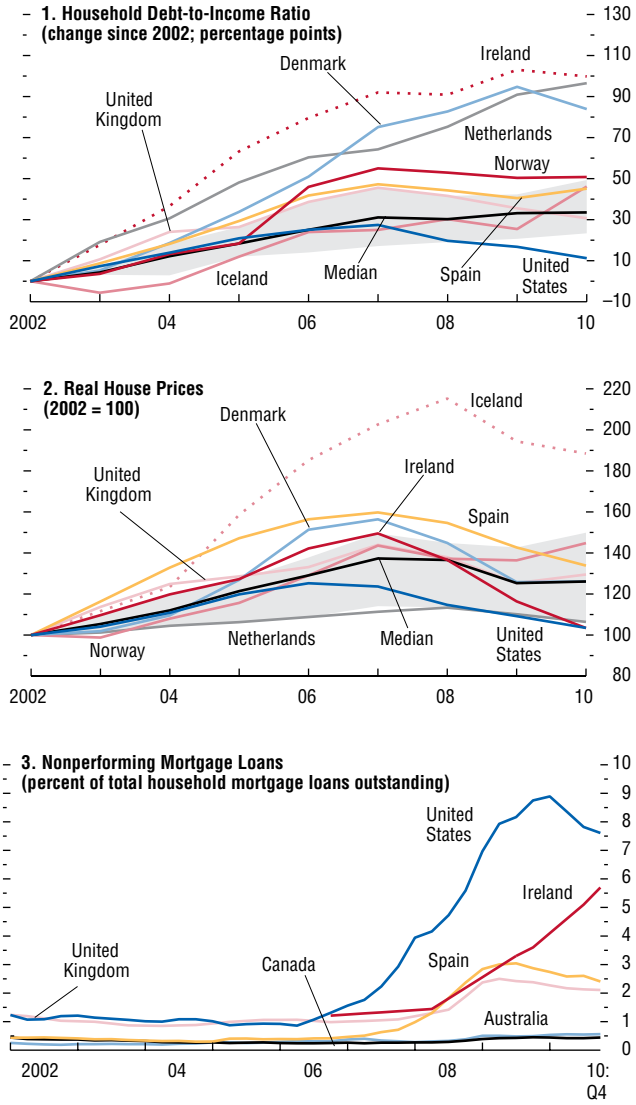
[1]Sovereign debt rose sharply in advanced economies as a result of the crisis, and overall gross debt has reached levels not seen in half a century.

[2]To illustrate this point, Fatás (2012) refers to Japan, where the gross-debt-to-GDP ratio is exceptionally high but where, reflecting years of current account surpluses, the economy is a net *creditor* to the rest of the world. Similarly, the elevated Japanese gross government debt stock corresponds to large private sector assets.

Figure 3.1. Household Debt, House Prices, and Nonperforming Mortgage Loans, 2002–10

Household debt and house prices soared in the years leading up to the Great Recession. When house prices declined, ushering in the global financial crisis, household nonperforming mortgage loans rose sharply in a number of economies.



Sources: Eurostat; Haver Analytics; Federal Reserve Bank of New York; Reserve Bank of Australia; Bank of Spain; U.K. Council of Mortgage Lenders; Central Bank of Ireland; Chapter 3 of the April 2011 *Global Financial Stability Report*; and IMF staff calculations.

Note: The shaded areas in panels 1 and 2 denote the interquartile range of the change in the household debt-to-income ratio since 2002 and the real house price index, respectively. Nonperforming loans are loans more than 90 days in arrears.

This chapter contributes to the debate over gross debt by focusing on the household sector. Previous studies have focused more on deleveraging by other sectors.[3] In particular, we address the following questions:

- What is the relationship between household debt and the depth of economic downturns? Are busts that are preceded by larger run-ups in gross household debt typically more severe?
- Why might gross household debt be a problem? What are the theoretical mechanisms by which gross household debt and deleveraging may restrain economic activity?[4]
- What can governments do to support growth when household debt becomes a problem? In particular, what policies have been effective in reducing the extent of household debt overhang and in averting unnecessary household defaults, foreclosures, and fire sales? How effective have recent initiatives been?[5]

To address these questions, we first conduct a statistical analysis of the relationship between household debt and the depth of economic downturns. Our purpose is to provide prima facie evidence rather than to establish causality. We focus on housing busts, given the important role of the housing market in triggering the Great Recession, but also consider recessions more generally. We then review the theoretical reasons why household debt might constrain economic activity. Finally, we use selected case studies to investigate which government policies have been effective in dealing with excessive house-

[3]For example, see Chapter 3 of the October 2010 *World Economic Outlook,* which assesses the implications of sovereign deleveraging (fiscal consolidation). Since deleveraging by various sectors—household, bank, corporate, and sovereign—will have different implications for economic activity, each is worth studying in its own right.

[4]A related question is what level of household debt is optimal, but such an assessment is beyond the scope of this chapter.

[5]We do not investigate which policies can help prevent the excessive buildup of household debt before the bust, an issue that is addressed in other studies. These two sets of policies are not mutually exclusive. For example, policies that prevent an excessive buildup in household debt during a boom can alleviate the consequences of a bust. See Crowe and others (2011), Chapter 3 of the September 2011 *Global Financial Stability Report,* and Dell'Ariccia and others (forthcoming) for policies designed to avert real estate price booms and restrain rapid growth in private sector debt.

hold debt. The episodes considered are the United States in the 1930s and today, Hungary and Iceland today, Colombia in 1999, and the Scandinavian countries in the early 1990s. In each case, there was a housing bust preceded by or coinciding with a substantial increase in household debt, but the policy responses were very different.

These are the chapter's main findings:

- Housing busts preceded by larger run-ups in gross household debt are associated with significantly larger contractions in economic activity. The declines in household consumption and real GDP are substantially larger, unemployment rises more, and the reduction in economic activity persists for at least five years. A similar pattern holds for recessions more generally: recessions preceded by larger increases in household debt are more severe.
- The larger declines in economic activity are not simply a reflection of the larger drops in house prices and the associated destruction of household wealth. It seems to be the *combination* of house price declines and prebust leverage that explains the severity of the contraction. In particular, household consumption falls by more than four times the amount that can be explained by the fall in house prices in high-debt economies. Nor is the larger contraction simply driven by financial crises. The relationship between household debt and the contraction in consumption also holds for economies that did not experience a banking crisis around the time of the housing bust.
- Macroeconomic policies are a crucial element of forestalling excessive contractions in economic activity during episodes of household deleveraging. For example, monetary easing in economies in which mortgages typically have variable interest rates, as in the Scandinavian countries, can quickly reduce mortgage payments and avert household defaults. Similarly, fiscal transfers to households through social safety nets can boost households' incomes and improve their ability to service debt, as in the Scandinavian countries. Such automatic transfers can further help prevent self-reinforcing cycles of rising defaults, declining house prices, and lower aggregate demand. Macroeconomic stimulus, however, has its limits. The zero lower bound on nominal interest rates can prevent sufficient rate cuts, and high government debt may constrain the scope for deficit-financed transfers.
- Government policies targeted at reducing the level of household debt relative to household assets and debt service relative to household repayment capacity can—at a limited fiscal cost—substantially mitigate the negative effects of household deleveraging on economic activity. In particular, bold and well-designed household debt restructuring programs, such as those implemented in the United States in the 1930s and in Iceland today, can significantly reduce the number of household defaults and foreclosures. In so doing, these programs help prevent self-reinforcing cycles of declining house prices and lower aggregate demand.

The first section of this chapter conducts a statistical analysis to shed light on the relationship between the rise in household debt during a boom and the severity of the subsequent bust. It also reviews the theoretical literature to identify the channels through which shifts in household gross debt can have a negative effect on economic activity. The second section provides case studies of government policies aimed at mitigating the negative effects of household debt during housing busts. The last section discusses the implications of our findings for economies facing household deleveraging.

How Household Debt Can Constrain Economic Activity

This section sheds light on the role of gross household debt in amplifying slumps by analyzing the experience of advanced economies over the past three decades. We also review the theoretical reasons gross household debt can deepen and prolong economic contractions.

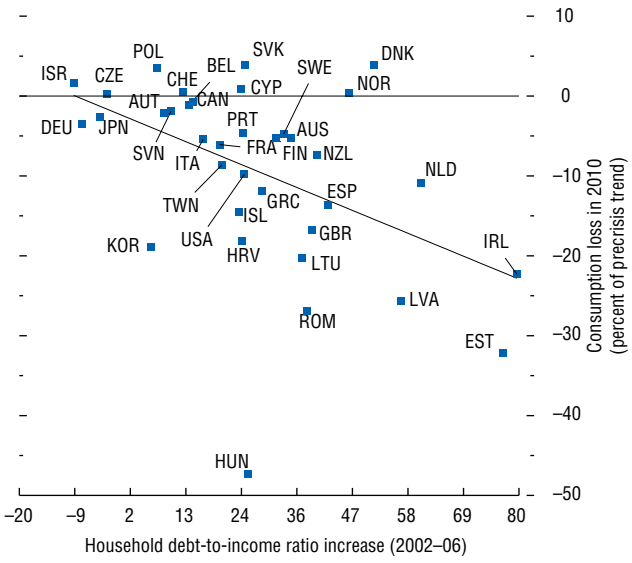
Stylized Facts: Household Debt and Housing Busts

Are housing busts more severe when they are preceded by large increases in gross household debt? To answer this question, we provide some stylized facts about what happens when a housing bust occurs in two groups of economies. The first has a

housing boom but no increase in household debt. The other has a housing boom and a large increase in household debt. We focus on housing busts, given how prevalent they were in advanced economies during the Great Recession.[6] But we also report results for recessions in general, whether or not they are associated with a housing bust. We start by summarizing how different economies fared during the Great Recession depending on the size of their household debt buildup. We then use a more refined statistical approach to consider the broader historical experience with housing busts and recessions and to distinguish the role of household debt from the roles of financial crises and house price declines.

Figure 3.2. The Great Recession: Consumption Loss versus Precrisis Rise in Household Debt
(Percent)

The Great Recession was particularly severe in economies that experienced a larger run-up in household debt prior to the crisis.



Sources: Eurostat; Haver Analytics; and IMF staff calculations.

Note: The consumption loss in 2010 is the gap between the (log) level of real household consumption in 2010 and the projection of where real household consumption would have been that year based on the precrisis trend. The precrisis trend is defined as the extrapolation of the (log) level of real household consumption based on a linear trend estimated from 1996 to 2004. AUS: Australia; AUT: Austria; BEL: Belgium; CAN: Canada; CHE: Switzerland; CYP: Cyprus; CZE: Czech Republic; DEU: Germany; DNK: Denmark; ESP: Spain; EST: Estonia; FIN: Finland; FRA: France; GBR: United Kingdom; GRC: Greece; HRV: Croatia; HUN: Hungary; IRL: Ireland; ISL: Iceland; ISR: Israel; ITA: Italy; JPN: Japan; KOR: Korea; LTU: Lithuania; LVA: Latvia; NLD: Netherlands; NOR: Norway; NZL: New Zealand; POL: Poland; PRT: Portugal; ROM: Romania; SVK: Slovak Republic; SVN: Slovenia; SWE: Sweden; TWN: Taiwan Province of China; USA: United States.

The Great Recession

The Great Recession was particularly severe in economies that had a larger buildup in household debt prior to the crisis. As Figure 3.2 shows, the consumption loss in 2010 relative to the precrisis trend was greater for economies that had a larger rise in the gross household debt-to-income ratio during 2002–06.[7] The consumption loss in 2010 is the gap between the (log) level of real household consumption in 2010 and the projection of where real household consumption would have been that year based on the precrisis trend. The precrisis trend is, in turn, defined as the extrapolation of the (log) level of real household consumption based on a linear trend estimated from 1996 to 2004, following the methodology of Chapter 4 of the September 2009 *World Economic Outlook*. The estimation of the precrisis trend ends several years before the crisis so that it is not contaminated by the possibility of an unsustainable boom during the run-up to the crisis or a precrisis slowdown. The slope of the regression line is –0.26, implying that for each additional 10 percentage point rise in household debt prior to the crisis, the consumption loss was larger by 2.6

[6]Housing-related debt (mortgages) comprises about 70 percent of gross household debt in advanced economies. The remainder consists mainly of credit card debt and auto loans.

[7]See Appendix 3.1 for data sources. Glick and Lansing (2010) report a similar finding for a smaller cross-section of advanced economies.

percentage points, a substantial (and statistically significant) relationship.[8]

Historical experience

Is the Great Recession part of a broader historical pattern—specifically, are busts that are preceded by larger run-ups in gross household debt usually more severe? To answer this question, we use statistical techniques to relate the buildup in household debt during the boom to the nature of economic activity during the bust. Given the data available on gross household debt, we focus on a sample of 24 Organization for Economic Cooperation and Development (OECD) economies and Taiwan Province of China during 1980–2011. First, we identify housing busts based on the turning points (peaks) in nominal house prices compiled by Claessens, Kose, and Terrones (2010).[9] For our sample of 25 economies, this yields 99 housing busts. Next, we divide the housing busts into two groups: those that involved a large run-up in the household debt-to-income ratio during the three years leading up to the bust and those that did not.[10] We refer to the two groups as "high-debt" and "low-debt" busts, respectively. Other measures of leverage (such as debt-to-assets and debt-to-net-worth ratios) are not widely available for our multicountry sample. Finally, we regress measures of economic activity on the housing bust dummies for the two groups using a methodology similar to that of Cerra and Saxena (2008), among others. Given our focus on the household sector, we start by considering the behavior of household consumption and then report results for GDP and its components, unemployment, and house prices.

Specifically, we regress changes in the log of real household consumption on its lagged values (to capture the normal fluctuations of consumption) as well as on contemporaneous and lagged values of the housing bust dummies. Including lags allows household consumption to respond with a delay to housing busts.[11] To test whether the severity of housing busts differs between the two groups, we interact the housing bust dummy with a dummy variable that indicates whether the bust was in the high-debt group or the low-debt group. The specification also includes a full set of time fixed effects to account for common shocks, such as shifts in oil prices, and economy-specific fixed effects to account for differences in the economies' normal growth rates. The estimated responses are cumulated to recover the evolution of the level of household consumption following a housing bust. The figures that follow indicate the estimated response of consumption and 1 standard error band around the estimated response.

The regression results suggest that housing busts preceded by larger run-ups in household debt tend to be followed by more severe and longer-lasting declines in household consumption. Panel 1 of Figure 3.3 shows that the decline in real household consumption is 4.3 percent after five years for the high-debt group and only 0.4 percent for the low-debt group. The difference between the two samples is 3.9 percentage points and is statistically significant at the 1 percent level, as reported in Appendix 3.2. These results survive a variety of robustness tests, including different estimation approaches (such as generalized method of moments), alternative specifications (changing the lag length), and dropping outliers (as identified by Cook's distance). (See Appendix 3.2 on the robustness checks.)

[8]The sharper fall in consumption in high-debt growth economies does not simply reflect the occurrence of banking crises. The relationship between household debt accumulation and the depth of the Great Recession remains similar and statistically significant after excluding the 18 economies that experienced a banking crisis at some point during 2007–11, based on the banking crises identified by Laeven and Valencia (2010). The sharper contraction in consumption also does not reflect simply a bigger precrisis consumption boom. The finding of a strong inverse relationship between the precrisis debt run-up and the severity of the recession is similar and statistically significant when controlling for the precrisis boom in consumption.

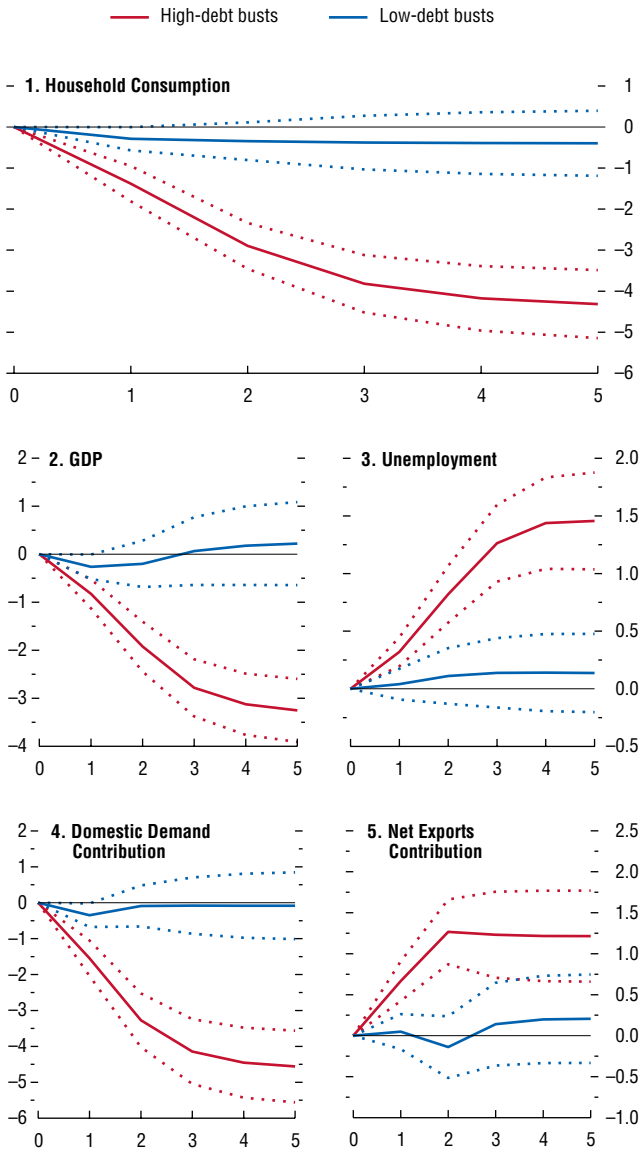
[9]Claessens, Kose, and Terrones (2010) identify turning points in nominal house prices using the Harding and Pagan (2002) algorithm.

[10]For our baseline specification, we define a "large" increase in debt as an increase above the median of all busts, but, as the robustness analysis in Appendix 3.2 reports, the results do not depend on this precise threshold. The median is an increase of 6.7 percentage points of household income over the three years leading up to the bust, and there is a wide variation in the size of the increase. For example, the household debt-to-income ratio rose by 17 percentage points during the period leading up to the U.K. housing bust of 1989 and by 68 percentage points before the Irish housing bust of 2006.

[11]Appendix 3.2 provides further details on the estimation methodology.

Figure 3.3. Economic Activity during Housing Busts

Real household spending and GDP fall more during housing busts preceded by a larger run-up in household debt, and the unemployment rate rises more. There is a greater fall in domestic demand, which is partly offset by a rise in net exports.



Source: IMF staff calculations.

Note: *X*-axis units are years, where $t = 0$ denotes the year of the housing bust. Dashed lines indicate 1 standard error bands. High- and low-debt busts are defined, respectively, as above and below the median increase in the household debt-to-income ratio during the three years preceding the bust. The unemployment rate and the contributions to GDP are in percentage points; all other variables are in percent.

Housing busts preceded by larger run-ups in household leverage result in more contraction of general economic activity. Figure 3.3 shows that real GDP typically falls more and unemployment rises more for the high-debt busts. Net exports typically make a more positive contribution to GDP—partially offsetting the fall in domestic demand—but this reflects a greater decline in imports rather than a boom in exports.[12]

A logical question is whether the larger decline in household spending simply reflects larger declines in house prices. Panel 1 of Figure 3.4 shows that real house prices do indeed fall significantly more after highly leveraged busts. The fall in real house prices is 10.8 percentage points larger in the high-debt busts than in the low-debt busts, and the difference between the two samples is significant at the 1 percent level. However, this larger fall in house prices cannot plausibly explain the greater decline in household consumption. Real consumption declines by more than 3.9 percentage points more in the high-debt busts, implying an elasticity of about 0.4, well above the range of housing wealth consumption elasticities in the literature (0.05–0.1). Based on this literature, the fall in house prices therefore explains at most one-quarter of the decline in household consumption. To further establish that the decline in consumption reflects more than just house price declines, we repeat the analysis while replacing the housing bust dummy variable with the decrease in house prices (in percent). The results suggest that for the same fall in real house prices (1 percent), real household consumption falls by about twice as much during high-debt busts as during low-debt busts. Therefore, it seems to be the *combination* of house price declines and the prebust leverage that explains the severity of the contraction of household consumption.

Moreover, household deleveraging tends to be more pronounced following busts preceded by a larger run-up in household debt. In particular, the household debt-to-income ratio declines by 5.4 per-

[12]Estimation results for investment also show a larger fall for the high-debt busts. Estimation results for residential investment (for which data are less widely available) also show a larger fall for the high-debt busts, but the responses are not precisely estimated due to the smaller sample size.

centage points following a high-debt housing bust (Figure 3.5). The decline is statistically significant. In contrast, there is no decline in the debt-to-income ratio following low-debt housing busts. Instead, there is a small and statistically insignificant increase. This finding suggests that part of the stronger contraction in economic activity following high-debt housing busts reflects a more intense household deleveraging process.

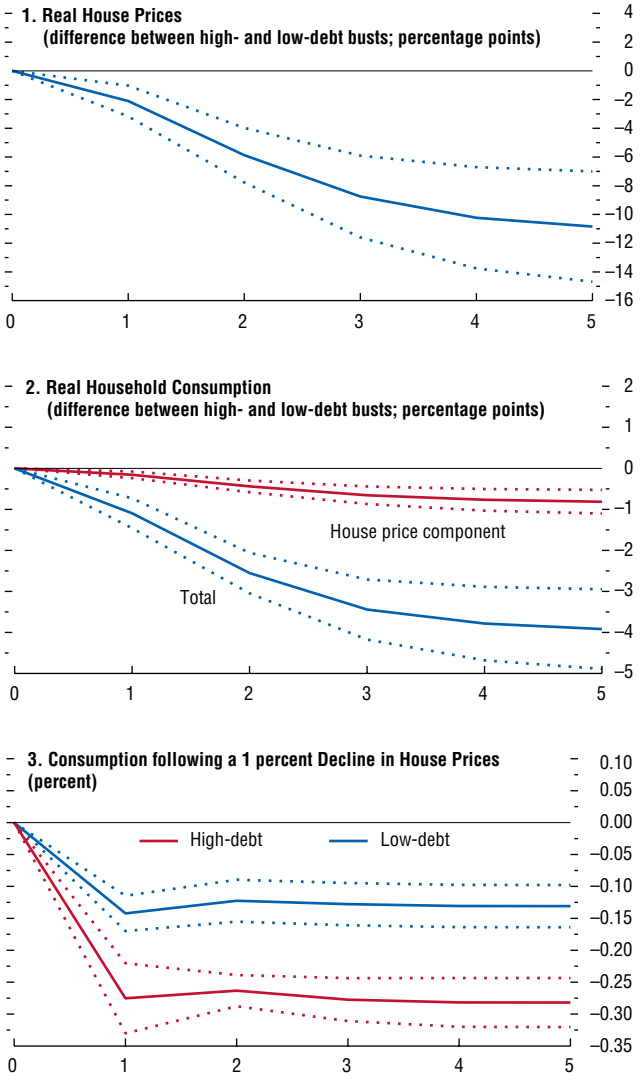
It is important to establish whether the results are driven by financial crises. The contractionary effects of such crises have already been investigated by previous studies (Cerra and Saxena, 2008; Chapter 4 of the September 2009 *World Economic Outlook*; and Reinhart and Rogoff, 2009, among others). We find that the results are not driven by the global financial crisis—similar results apply when the sample ends in 2006, as reported in Appendix 3.2. Moreover, we find similar results when we repeat the analysis but focus only on housing busts that were not preceded or followed by a systemic banking crisis, as identified by Laeven and Valencia (2010), within a two-year window on either side of the housing bust. For this limited set of housing busts, those preceded by a larger accumulation of household debt are followed by deeper and more prolonged downturns (Figure 3.6). So the results are not simply a reflection of banking crises.

Finally, it is worth investigating whether high household debt also exacerbates the effects of other adverse shocks. We therefore repeat the analysis but replace the housing bust dummies with recession dummies. We construct the recession dummies based on the list of recession dates provided by Howard, Martin, and Wilson (2011). Figure 3.6 also shows that recessions preceded by a larger run-up in household debt do indeed tend to be more severe and protracted.

Overall, this analysis suggests that when households accumulate more debt during a boom, the subsequent bust features a more severe contraction in economic activity. These findings for OECD economies are consistent with those of Mian, Rao, and Sufi (2011) for the United States. These authors use detailed U.S. county-level data for the Great Recession to identify the causal effect of household debt. They conclude that the greater decline in

Figure 3.4. Housing Wealth and Household Consumption

House prices fall more during housing busts preceded by a larger run-up in debt, but this alone cannot explain the sharper decline in consumption in the wake of such busts. The larger fall in house prices explains about a quarter of the greater decline in consumption based on a standard elasticity of consumption with respect to housing wealth. Also, a 1 percent decline in real house prices is typically associated with a larger decline in real household consumption when it is preceded by a larger run-up in household debt.

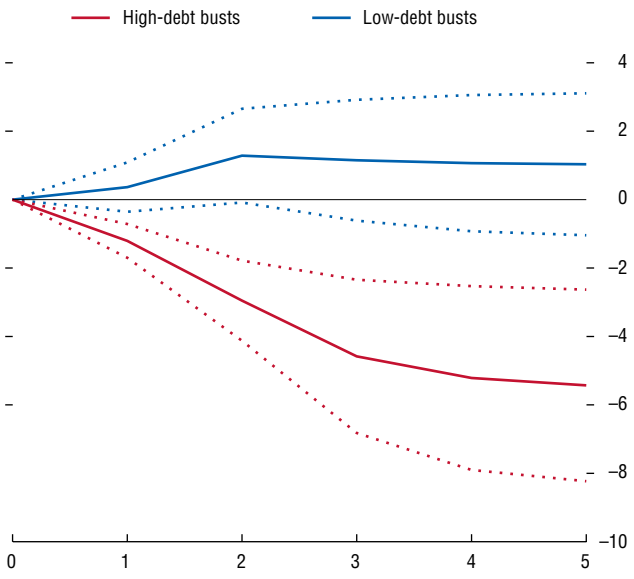


Source: IMF staff calculations.

Note: *X*-axis units are years, where $t = 0$ denotes the year of the housing bust. Dashed lines indicate 1 standard error bands. House price component is defined as the fall in real house prices multiplied by a benchmark elasticity of consumption relative to real housing wealth, based on existing studies (0.075). High- and low-debt are defined, respectively, as above and below the median increase in the household debt-to-income ratio during the three years preceding the fall in house prices.

Figure 3.5. Household Debt during Housing Busts
(Percentage points)

The reduction in household debt (deleveraging) is more pronounced during housing busts preceded by a larger buildup in indebtedness.



Source: IMF staff calculations.
Note: *X*-axis units are years, where $t = 0$ denotes the year of the housing bust. Dashed lines indicate 1 standard error bands. High- and low-debt busts are defined, respectively, as above and below the median increase in the household debt-to-income ratio during the three years preceding the bust.

consumption after 2007 in U.S. counties that accumulated more debt during 2002–06 is too large to be explained by the larger fall in house prices in those counties.[13] This is consistent with the cross-country evidence in Figure 3.4. They also find evidence of more rapid household deleveraging in high-debt U.S. counties, which underscores the role of deleveraging and is consistent with the cross-country evidence in Figure 3.5. In related work, Mian and Sufi (2011) show that a higher level of household debt in 2007 is associated with sharper declines in spending on consumer durables, residential investment, and employment (Figure 3.7). Based on their findings, they conclude that the decline in aggregate demand driven by household balance sheet weakness explains the majority of the job losses in the United States during the Great Recession (Mian and Sufi, 2012).

The findings are also broadly consistent with the more general finding in the literature that recessions preceded by economy-wide credit booms—which may or may not coincide with household credit booms—tend to be deeper and more protracted than other recessions (see, for example, Claessens, Kose, and Terrones, 2010; and Jordà, Schularick, and Taylor, 2011). This conclusion is also consistent with evidence that consumption volatility is positively correlated with household debt (Isaksen and others, 2011).

Why Does Household Debt Matter?

We have found evidence that downturns are more severe when they are preceded by larger increases in household debt. This subsection discusses how the pattern fits with the predictions of theoretical models. A natural starting point is to consider a closed economy with no government debt. In such an economy, net private debt must be zero, because one person's debt is another's asset. Some people may accumulate debt, but this would simply

[13]In particular, by comparing house price declines with consumption declines in counties with high and low levels of household debt, they obtain an *implicit* elasticity of consumption relative to house prices of 0.3 to 0.7, which is well above the range of estimates in the literature. This suggests that only 14 to 30 percent of the greater decline in consumption in high-debt counties is due to the larger falls in house prices in those counties.

represent "money we owe to ourselves" (Krugman, 2011) with no obvious macroeconomic implications. Nevertheless, even when changes in gross household debt imply little change in economy-wide net debt, they can influence macroeconomic performance by amplifying the effects of shocks. In particular, a number of theoretical models predict that build-ups in household debt drive deep and prolonged downturns.[14]

We now discuss the main channels through which household debt can amplify downturns and weaken recoveries. We also highlight the policy implications. In particular, we explain the circumstances under which government intervention can improve on a purely market-driven outcome.

Differences between borrowers and lenders

The accumulation of household debt amplifies slumps in a number of recent models that differentiate between borrowers and lenders and feature liquidity constraints. A key feature of these models is the idea that the distribution of debt within an economy matters (Eggertsson and Krugman, 2010; Guerrieri and Lorenzoni, 2011; Hall, 2011).[15] As Tobin (1980) argues, "the population is not distributed between debtors and creditors randomly. Debtors have borrowed for good reasons, most of which indicate a high marginal propensity to spend from wealth or from current income or from any other liquid resources they can command."[16] Indeed, household debt increased more at the lower ends

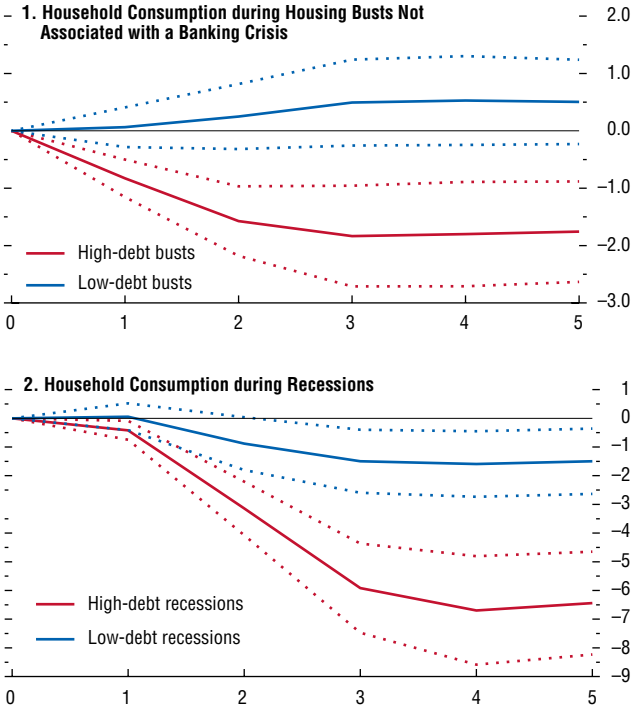
[14]In an open economy, gross household debt can have additional effects. In particular, a reduction in household debt could signal a transfer of resources from domestic to foreign households, implying even larger macroeconomic effects than in a closed economy.

[15]In an earlier theoretical sketch, King (1994) discusses how differences in the marginal propensity to consume between borrowing and lending households can generate an aggregate downturn when household leverage is high.

[16]Differences in the propensity to consume can arise for a number of reasons. Life-cycle motives have been emphasized as a source of differences in saving behavior across cohorts (see Modigliani, 1986, among others). Others have focused on the role of time preferences, introducing a class of relatively impatient agents (see Iacoviello, 2005; and Eggertsson and Krugman, 2010). Dynan, Skinner, and Zeldes (2004) find a strong positive relationship between personal saving rates and lifetime income, suggesting that the rich consume a smaller proportion of their income than the poor.

Figure 3.6. Household Consumption
(Percent)

The finding that consumption falls more during housing busts preceded by a larger run-up in household debt is not driven by banking crises. It holds for a subset of housing busts not associated with a systemic banking crisis within a two-year window. In addition, recessions are generally deeper if they are preceded by a larger run-up in household debt.

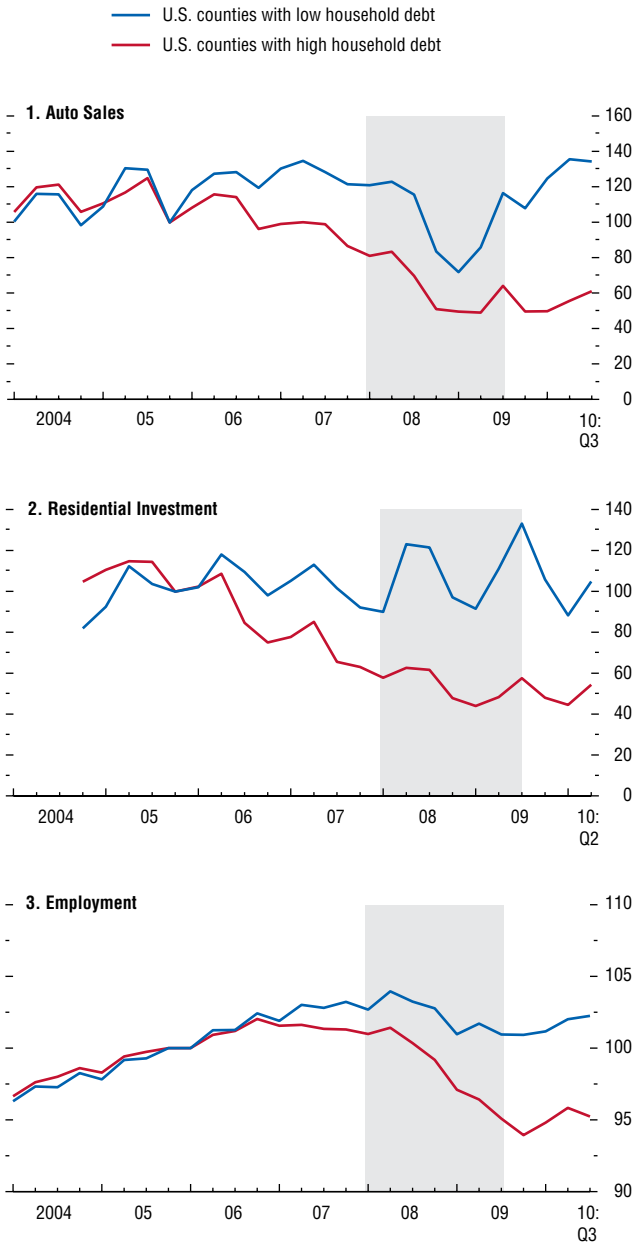


Source: IMF staff calculations.

Note: In panel 1, *x*-axis units are years, where $t = 0$ denotes the year of the housing bust. Housing busts associated with a systemic banking crisis within two years of the bust are not considered in the analysis. Systemic banking crisis indicators are from the updated Laeven and Valencia (2010) database. Dashed lines indicate 1 standard error bands. High- and low-debt busts are defined, respectively, as above and below the median increase in the household debt-to-income ratio during the three years preceding the housing bust. In panel 2, *x*-axis units are years, where $t = 0$ denotes the year of the recession. Dashed lines indicate 1 standard error bands. High- and low-debt recessions are defined, respectively, as above and below the median increase in the household debt-to-income ratio during the three years preceding the recession.

Figure 3.7. Economic Activity during the Great Recession in the United States
(Index; 2005:Q4 = 100)

Mian and Sufi (2011) find that in U.S. counties where households accumulated more debt before the Great Recession there was deeper and more prolonged contraction in household consumption, investment, and employment.



Source: Mian and Sufi (2011).
Note: Shaded area indicates U.S. recession based on National Bureau of Economic Research dates.

of the income and wealth distribution during the 2000s in the United States (Kumhof and Rancière, 2010).

A shock to the borrowing capacity of debtors with a high marginal propensity to consume that forces them to reduce their debt could then lead to a decline in aggregate activity. Deleveraging could stem from a realization that house prices were overvalued (as in Buiter, 2010; and Eggertsson and Krugman, 2010), a tightening in credit standards (Guerrieri and Lorenzoni, 2011), a sharp revision in income expectations, or an increase in economic uncertainty (Fisher, 1933; Minsky, 1986). Here, a sufficiently large fall in the interest rate could induce creditor households to spend more, thus offsetting the decline in spending by the debtors. But, as these models show, the presence of the zero lower bound on nominal interest rates or other price rigidities can prevent these creditor households from picking up the slack. This feature is particularly relevant today because policy rates are near zero in many advanced economies.

Consumption may be further depressed following shocks in the presence of uncertainty, given the need for precautionary saving (Guerrieri and Lorenzoni, 2011; Carroll, Slacalek, and Sommer, 2011). The cut in household consumption would then be particularly abrupt, "undershooting" its long-term level (as it appears to have done in the United States today; see Glick and Lansing, 2009). Such a sharp contraction in aggregate consumption would provide a rationale for temporarily pursuing expansionary macroeconomic policies, including fiscal stimulus targeted at financially constrained households (Eggertsson and Krugman, 2010; Carroll, Slacalek, and Sommer, 2011), and household debt restructuring (Rogoff, 2011).

Negative price effects from fire sales

A further negative effect on economic activity of high household debt in the presence of a shock, postulated by numerous models, comes from the forced sale of durable goods (Shleifer and Vishny, 1992; Mayer, 1995; Krishnamurthy, 2010; Lorenzoni, 2008). For example, a rise in unemployment reduces households' ability to service their debt, implying a rise in household defaults, foreclosures, and creditors

selling foreclosed properties at distressed, or fire-sale, prices. Estimates suggest that a single foreclosure lowers the price of a neighboring property by about 1 percent, but that the effects can be much larger when there is a wave of foreclosures, with estimates of price declines reaching almost 30 percent (Campbell, Giglio, and Pathak, 2011). The associated negative price effects in turn reduce economic activity through a number of self-reinforcing contractionary spirals. These include negative wealth effects, a reduction in collateral value, a negative impact on bank balance sheets, and a credit crunch. As Shleifer and Vishny (2010) explain, fire sales undermine the ability of financial institutions and firms to lend and borrow by reducing their net worth, and this reduction in credit supply can reduce productivity-enhancing investment. Such externalities—banks and households ignoring the social cost of defaults and fire sales—may justify policy intervention aimed at stopping household defaults, foreclosures, and fire sales.

The case of the United States today illustrates the risk of house prices "undershooting" their equilibrium values during a housing bust on the back of fire sales. The IMF staff notes that "distress sales are the main driving force behind the recent declines in house prices—in fact, excluding distress sales, house prices had stopped falling" and that "there is a risk of house price undershooting" (IMF 2011b, p. 20). And Figure 3.8 suggests that U.S. house prices may have fallen below the levels consistent with some fundamentals.[17]

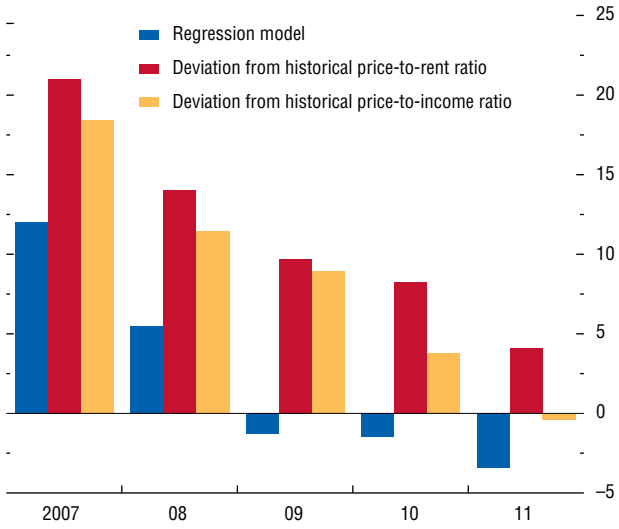
Inefficiencies and deadweight losses from debt overhang and foreclosures

A further problem is that household debt overhang can give rise to various inefficiencies. In the case of firms, debt overhang is a situation in which existing debt is so great that it constrains the ability to raise funds to finance profitable investment projects (Myers, 1977). Similarly, homeowners with debt overhang may invest little in their property. They may, for example, forgo investments that improve the net present value of their homes, such

[17]Slok (2012) and *The Economist* (2011) report that U.S. house prices are undervalued.

Figure 3.8. Estimated House Price Misalignment in the United States
(Percent)

U.S. house prices are now at or below the levels implied by regression-based estimates and some historical valuation ratios.



Sources: Federal Housing Administration; Organization for Economic Cooperation and Development; IMF, *International Financial Statistics*; and IMF staff calculations.

Note: The regression model measure indicates the implied house price misalignment when house price changes are modeled as a function of changes in personal disposable income, working-age population, credit and equity prices, interest rate levels, and construction costs. See Chapter 1 of the October 2009 *World Economic Outlook*, Box 1.4, and Igan and Loungani (forthcoming) for further details. The price-to-rent ratio and price-to-income ratio depict the percent deviation of these ratios from their historical averages, calculated over 1970–2000.

as home improvements and maintenance expenditures. This effect could be large. Based on detailed household-level U.S. data, Melzer (2010) finds that homeowners with debt overhang (negative equity) spend 30 percent less on home improvements and maintenance than homeowners without debt overhang, other things equal. While privately renegotiating the debt contract between the borrower and the lender could alleviate such debt overhang problems, renegotiation is often costly and difficult to achieve outside bankruptcy because of free-rider problems or contract complications (Foote and others, 2010).

Foreclosures and bankruptcy can be an inefficient way of resolving households' inability to service their mortgage debt, giving rise to significant "deadweight losses" (BGFRS, 2012). These deadweight losses stem from the neglect and deterioration of properties that sit vacant for months and their negative effect on neighborhoods' social cohesion and crime (Immergluck and Smith, 2005; 2006). Deadweight losses are also due to the delays associated with the resolution of a large number of bankruptcies through the court system.

Overall, debt overhang and the deadweight losses of foreclosures can further depress the recovery of housing prices and economic activity. These problems make a case for government involvement to lower the cost of restructuring debt, facilitate the writing down of household debt, and help prevent foreclosures (Philippon, 2009).

Dealing with Household Debt: Case Studies

Having established that household debt can amplify slumps and weaken recoveries, we now investigate how governments have responded during episodes of household deleveraging. We start by reviewing four broad policy approaches that can, in principle, allow government intervention to improve on a purely market-driven outcome. These approaches are not mutually exclusive and can be complementary. Each has benefits and limitations. The approach a government decides to use is likely to reflect institutional and political features of the economy, the available policy room, and the size of the household debt problem.

- *Temporary macroeconomic policy stimulus:* As discussed above, household deleveraging following a balance sheet shock can imply an abrupt contraction in household consumption to well below the long-term level (overshooting). The costs of the associated contraction in economic activity can be mitigated by an offsetting temporary macroeconomic policy stimulus. In an economy with credit-constrained households, this provides a rationale for temporarily pursuing an expansionary fiscal policy, including through government spending targeted at financially constrained households (Eggertsson and Krugman, 2010; Carroll, Slacalek, and Sommer, 2011).[18] For example, simulations of policy models developed at six policy institutions suggest that, in the current environment, a temporary (two-year) transfer of 1 percent of GDP to financially constrained households would raise GDP by 1.3 percent and 1.1 percent in the United States and the European Union, respectively (Coenen and others, 2012).[19] Financing the temporary transfer by a lump-sum tax on all households rather than by issuing government debt would imply a "balanced-budget" boost to GDP of 0.8 and 0.9 percent, respectively. Monetary stimulus can also provide relief to indebted households by easing the debt service burden, especially in countries where mortgages have variable rates, such as Spain and the United Kingdom. In the United States, the macroeconomic policy response since the start of the Great Recession has been forceful, going much beyond that of several other countries. It included efforts by the Federal Reserve to lower long-term interest rates, particularly in the key mortgage-backed-

[18]The presence of financially constrained households with a high marginal propensity to consume out of disposable income increases the effectiveness of fiscal policy changes—it renders the economy nonRicardian—in a wide range of models (see Coenen and others, 2012, for a discussion). The presence of the zero lower bound on interest rates further amplifies the multipliers associated with temporary fiscal policy changes (Woodford, 2010).

[19]The six policy institutions are the U.S. Federal Reserve Board, the European Central Bank, the European Commission, the OECD, the Bank of Canada, and the IMF. The simulations assume that policy interest rates are constrained by the zero lower bound—a key feature of major advanced economies today—and that the central bank does not tighten monetary policy in response to the fiscal expansion. See Coenen and others (2012) for further details.

security segment relevant for the housing market. Macroeconomic stimulus, however, has its limits. High government debt may constrain the available fiscal room for a deficit-financed transfer, and the zero lower bound on nominal interest rates can prevent real interest rates from adjusting enough to allow creditor households to pick up the economic slack caused by lower consumption by borrowers.

- *Automatic support to households through the social safety net:* A social safety net can automatically provide targeted transfers to households with distressed balance sheets and a high marginal propensity to consume, without the need for additional policy deliberation. For example, unemployment insurance can support people's ability to service their debt after becoming unemployed, thus reducing the risk of household deleveraging through default and the associated negative externalities.[20] However, as in the case of discretionary fiscal stimulus, allowing automatic stabilizers to operate fully requires fiscal room.[21]
- *Assistance to the financial sector:* When the problem of household sector debt is so severe that arrears and defaults threaten to disrupt the operation of the banking sector, government intervention may be warranted. Household defaults can undermine the ability of financial institutions and firms to lend and borrow by reducing their net worth, and this reduction in credit supply can reduce productive investment (Shleifer and Vishny, 2010). A number of policies can prevent such a tightening in credit availability, including recapitalizations and government purchases of distressed assets.[22] Such support mitigates the effects of household balance sheet distress on the financial sector. The U.S. Troubled Asset Relief Program established in 2008 was based, in part, on such considerations. Similarly, in Ireland, the National Asset Management Agency was created in 2009 to take over distressed loans from the banking sector. Moreover, assistance to the financial sector can enable banks to engage in voluntary debt restructuring with households. However, strong capital buffers may be insufficient to encourage banks to restructure household debt on a large scale, as is evident in the United States today. In addition, this approach does not prevent unnecessary household defaults, defined as those that occur as a result of temporary liquidity problems. Moreover, financial support to lenders facing widespread defaults by their debtors must be designed carefully to avoid moral hazard—indirectly encouraging risky lending practices in the future.
- *Support for household debt restructuring:* Finally, the government may choose to tackle the problem of household debt directly by setting up frameworks for voluntary out-of-court household debt restructuring—including write-downs—or by initiating government-sponsored debt restructuring programs. Such programs can help restore the ability of borrowers to service their debt, thus preventing the contractionary effects of unnecessary foreclosures and excessive asset price declines. To the extent that the programs involve a transfer to financially constrained households from less financially constrained agents, they can also boost GDP in a way comparable to the balanced-budget fiscal transfer discussed above. Such programs can also have a limited fiscal cost. For example, as we see later on, they may involve the government buying distressed mortgages from banks, restructuring them to make them more affordable, and later reselling them, with the revenue offsetting the initial cost. They also sometimes focus on facilitating case-by-case restructuring by improving the institutional and legal framework for debt renegotiation between the lender and the borrower, which implies no fiscal cost. However, the success of these programs depends on a combination of careful

[20]The generosity and duration of the associated welfare payments differ by country. In Sweden, for example, workers are eligible for unemployment insurance for up to 450 days, although at declining replacement rates after 200 days. By contrast, in the United States, unemployment insurance is normally limited to 26 weeks, and extended benefits are provided during periods of high unemployment. The maximum duration of unemployment insurance was extended to 99 weeks (693 days) in February 2009, and this extension was renewed in February 2012.

[21]Furthermore, to provide targeted support in a timely manner, the safety net needs to be in place before household debt becomes problematic.

[22]See Honohan and Laeven (2005) for a discussion of the various policies used for the resolution of financial crises.

design and implementation.[23] In particular, such programs must address the risk of moral hazard when debtors are offered the opportunity to avoid complying with their loan's original terms.

It is worth recognizing that any government intervention will introduce distortions and lead to some redistribution of resources within the economy and over time. The question is whether the benefits of intervention exceed the costs. Moreover, if intervention has a budgetary impact, the extent of intervention should be constrained by the degree of available fiscal room. The various approaches discussed above differ in the extent of redistribution involved and the associated winners and losers. For example, the presence and generosity of a social safety net reflect a society's preferences regarding redistribution and inequality. Government support for the banking sector and household debt restructuring programs may involve clearer winners than, say, monetary policy stimulus or an income tax cut. The social friction that such redistribution may cause could limit its political feasibility. Mian, Sufi, and Trebbi (2012) discuss the political tug-of-war between creditors and debtors and find that political systems tend to become more polarized in the wake of financial crises. They also argue that collective action problems—struggling mortgage holders may be less well politically organized than banks—can hamper efforts to implement household debt restructuring. Moreover, all policies that respond to the consequences of excessive household debt need to be carefully designed to minimize the potential for moral hazard and excessive risk taking by both borrowers and lenders in the future.

To examine in practice how such policies can mitigate the problems associated with household debt, we investigate the effectiveness of government action during several episodes of household deleveraging. We focus on policies that support household debt restructuring directly because of the large amount of existing literature on the other policy approaches. For example, there is a large literature on the determinants and effects of fiscal and monetary policy. There are also a number of studies on the international experience with financial sector policies.

[23]Laeven and Laryea (2009) discuss in detail the principles that should guide government-sponsored household debt restructuring programs.

The episodes we consider are the United States in the 1930s and today, Hungary and Iceland today, Colombia in 1999, and three Scandinavian countries (Finland, Norway, Sweden) in the 1990s. In each of these cases, there was a housing bust preceded by or coinciding with a substantial increase in household debt, but the policy response was different.[24] We start by summarizing the factors that led to the buildup in household debt and what triggered household deleveraging. We then discuss the government response, focusing on policies that directly address the negative effect of household debt on economic activity. Finally, we summarize the lessons to be learned from the case studies.[25]

Factors Underlying the Buildup in Household Debt

In each of these episodes, a loosening of credit constraints allowed households to increase their debt. This increase in credit availability was associated with financial innovation and liberalization and declining lending standards. A wave of household optimism about future income and wealth prospects also played a role and, together with the greater credit availability, helped stoke the housing and stock market booms.

The United States in the 1920s—the "roaring twenties"—illustrates the role of rising credit avail-

[24]We do not discuss the real estate bust in Japan in the 1990s because household leverage relative to both safe and liquid assets was low at the time and household deleveraging was not a key feature of the episode. As Nakagawa and Yasui (2009) explain: "The finances of Japanese households were not severely damaged by the mid-1990s bursting of the bubble. Banks, however, with their large accumulation of household deposits on the liability side of their balance sheets, were victims of their large holdings of defaulted corporate loans and the resulting capital deterioration during the bust; in response, banks tightened credit significantly during this period" (p. 82).

[25]Other economies today have also implemented measures to address household indebtedness directly. For example, in the United Kingdom, the Homeowners Mortgage Support Scheme aimed to ease homeowners' debt service temporarily with a government guarantee of deferred interest payments, the Mortgage Rescue Scheme attempted to protect the most vulnerable from foreclosure, while the expansion of the Support for Mortgage Interest provided more households with help in meeting their interest payments. Reforms currently being implemented in Ireland include modernizing the bankruptcy regime by making it less onerous and facilitating voluntary out-of-court arrangements between borrowers and lenders of both secured and unsecured debt. In Latvia, the authorities' efforts have focused on strengthening the framework for market-based debt resolution (see Erbenova, Liu, and Saxegaard, 2011).

ability and consumer optimism in driving household debt. Technological innovation brought new consumer products such as automobiles and radios into widespread use. Financial innovation made it easier for households to obtain credit to buy such consumer durables and to obtain mortgage loans. Installment plans for the purchase of major consumer durables became particularly widespread (Olney, 1999). General Motors led the way with the establishment of the General Motors Acceptance Corporation in 1919 to make loans for the purchase of its automobiles. By 1927, two-thirds of new cars and household appliances were purchased on installment. Consumer debt doubled from 4.5 percent of personal income in 1920 to 9 percent of personal income in 1929. Over the same period, mortgage debt rose from 11 percent of gross national product to 28 percent, partly on the back of new forms of lending such as high-leverage home mortgage loans and early forms of securitization (Snowden, 2010). Reflecting the economic expansion and optimism that house values would continue rising, asset prices boomed.[26] Real house prices rose by 19 percent from 1921 to 1925,[27] while the stock market rose by 265 percent from 1921 to 1929.

Rising credit availability due to financial liberalization and declining lending standards also helped drive up household debt in the more recent cases we consider. In the Scandinavian countries, extensive price and quantity restrictions on financial products ended during the 1980s. Colombia implemented a wave of capital account and financial liberalization in the early 1990s. This rapid deregulation substantially encouraged competition for customers, which, in combination with strong tax incentives to invest in housing and optimism regarding asset values, led to a household debt boom in these economies.[28] Similarly, following Iceland's privatization and liberalization of the banking system in 2003, household borrowing constraints were eased substantially.[29] It became possible, for the first time, to refinance mortgages and withdraw equity. Loan-to-value (LTV) ratios were raised as high as 90 percent by the state-owned Housing Financing Fund, and even further by the newly private banks as they competed for market share. In Hungary, pent-up demand combined with EU membership prospects triggered a credit boom as outstanding household debt grew from a mere 7 percent of GDP in 1999 to 33 percent in 2007. The first part of this credit boom episode was also characterized by a house price rally, driven by generous housing subsidies. In the United States in the 2000s, an expansion of credit supply to households that had previously been unable to obtain loans included increased recourse to private-label securitization and the emergence of so-called exotic mortgages, such as interest-only loans, negative amortization loans, and "NINJA" (no income, no job, no assets) loans.

Factors That Triggered Household Deleveraging

The collapse of the asset price boom, and the associated collapse in household wealth, triggered household deleveraging in all of the historical episodes we consider. The U.S. housing price boom of the 1920s ended in 1925, when house prices peaked. Foreclosure rates rose steadily thereafter (Figure 3.9), from 3 foreclosures per 1,000 mortgaged properties in 1926 to 13 per 1,000 by 1933. Another shock to household wealth came with the stock market crash of October 1929, which ushered in the Great Depression. A housing bust also occurred in the Scandinavian countries in the late 1980s and in Colombia in the mid-1990s. Similarly, the end of a house price boom and a collapse in stock prices severely dented household wealth in Iceland and the United States at the start of the Great Recession. In all these cases, household

[26]Regarding the reasons for this optimism, Harriss (1951) explains that "In the twenties, as in every period of favorable economic conditions, mortgage debt was entered into by individuals with confidence that the burden could be supported without undue difficulty … over long periods the value of land and improvements had often risen enough to support the widely held belief that the borrower's equity would grow through the years, even though it was small to begin with" (p. 7).

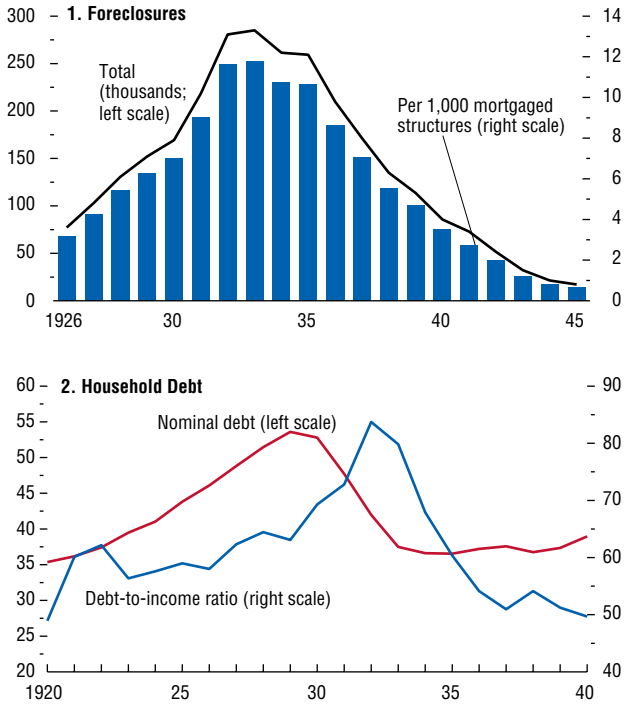
[27]In certain areas, such as Manhattan and Florida, the increase was much higher (30 to 40 percent).

[28]In Finland the ratio of household debt to disposable income rose from 50 percent in 1980 to 90 percent in 1989; in Sweden it rose from 95 percent to 130 percent. In Colombia bank credit to the private sector rose from 32 percent of GDP in 1991 to 40 percent in 1997.

[29]Financial markets in Iceland were highly regulated until the 1980s. Liberalization began in the 1980s and accelerated during the 1990s, not least because of obligations and opportunities created by the decision to join the European Economic Area in 1994. Iceland's three new large banks were progressively privatized between the late 1990s and 2003, amid widespread accusations of political favoritism (see OECD, 2009).

Figure 3.9. Foreclosures and Household Debt during the Great Depression in the United States

After the peak in house prices in 1925, foreclosure rates rose steadily for the following eight years. While widespread defaults lowered the stock of outstanding nominal debt starting in 1930, the collapse in household income meant that the debt-to-income ratio continued to rise until 1933.



Source: IMF staff calculations.
Note: The debt-to-income ratio is in percentage points; nominal household debt is in billions of dollars.

deleveraging started soon after the collapse in asset prices. In addition, a tightening of available credit associated with banking crises triggered household deleveraging during all these episodes. The distress in household balance sheets due to the collapse of their wealth spread quickly to financial intermediaries' balance sheets, resulting in tighter lending standards and forcing further household deleveraging.

The experience of Iceland in 2008 provides a particularly grim illustration of how a collapse in asset prices and economic prospects, combined with a massive banking crisis, leads to household overindebtedness and a need for deleveraging. Iceland's three largest banks fell within one week in October 2008. Household balance sheets then came under severe stress from a number of factors (Figure 3.10). First, the collapse in confidence triggered sharp asset price declines, which unwound previous net wealth gains. At the same time, the massive inflation and large depreciation of the krona during 2008–09 triggered a sharp rise in household debt since practically all loans were indexed to the consumer price index (CPI) or the exchange rate. CPI-indexed mortgages with LTV ratios above 70 percent were driven underwater by a combination of 26 percent inflation and an 11 percent drop in house prices. Likewise, with the krona depreciating by 77 percent, exchange-rate-indexed mortgages with LTV ratios above 40 percent went underwater. Inflation and depreciation also swelled debt service payments, just as disposable income stagnated. The combination of debt overhang and debt servicing problems was devastating. By the end of 2008, 20 percent of homeowners with mortgages had negative equity in their homes (this peaked at 38 percent in 2010), while nearly a quarter had debt service payments above 40 percent of their disposable income.

The Policy Response

Having summarized the factors that drove up household debt and triggered household deleveraging, we turn to the policies that governments pursued to mitigate the negative effects on economic activity. For each episode, we start with an overview of the policies implemented and of the political context in which they were introduced. We then consider how effective the policies were in addressing

the negative effects of household debt on economic activity. In particular, we investigate whether the policies helped prevent foreclosures (by restructuring a large share of mortgages), provide transfers to credit-constrained households with a high marginal propensity to consume, and reduce debt overhang. At the same time, the small number of episodes considered and the lack of counterfactual experiences complicate quantifying the effect of these policies on macroeconomic aggregates, such as real GDP.

The discussion starts with two cases that illustrate broadly successful approaches to dealing with household debt—the United States during the Great Depression and Iceland since the Great Recession. We then contrast these cases with less successful episodes—Colombia in the 1990s and Hungary and the United States since the Great Recession. Finally, we consider the case of the Scandinavian countries during the 1990s, when, despite a large increase in household debt, the authorities did not adopt discretionary household debt restructuring policies.

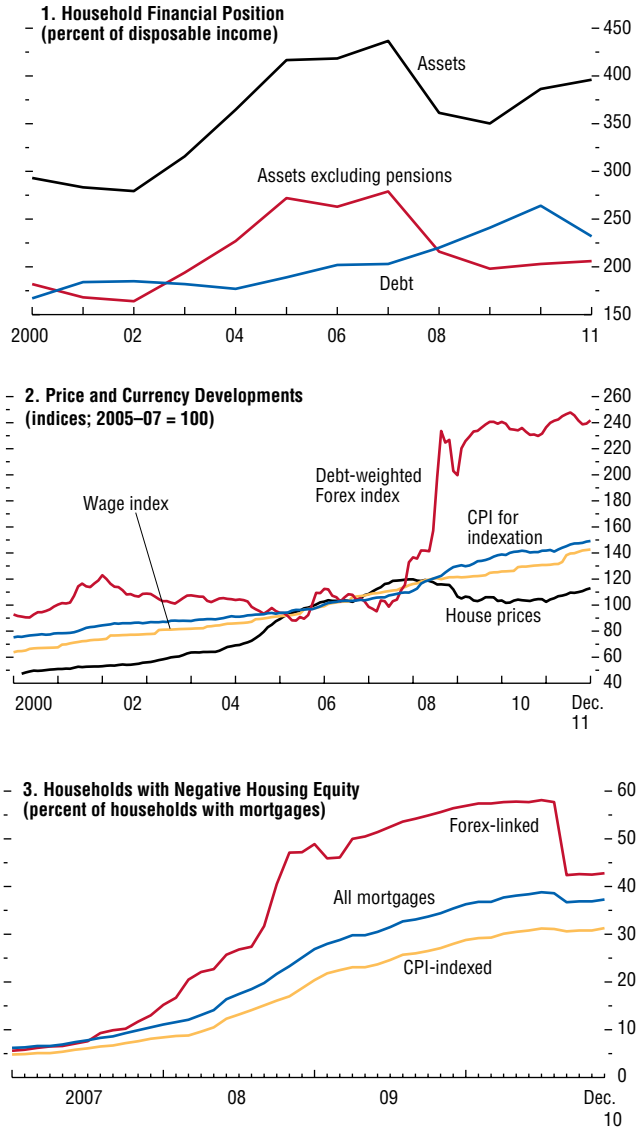
The United States during the Great Depression

This episode exemplifies a bold and broadly successful government-supported household debt restructuring program designed to prevent foreclosures, the U.S. Home Owners' Loan Corporation (HOLC). HOLC was established in 1933 because a series of earlier initiatives designed to stop the rising number of foreclosures had achieved little (see Figure 3.9), and social pressure for large-scale intervention was high.[30] As Harriss (1951) explains, "The tremendous social costs imposed by these conditions of deep depression are vividly and movingly revealed in the files of the Home Owners' Loan Corporation. Demands for direct action by the government were insistent and nearly unanimous" (p. 9). In April 1933, a newly elected President Franklin Roosevelt urged Congress to pass legislation that would

[30]The earlier policies included a number of state initiatives to impose moratoriums on foreclosures and the Federal Home Loan Bank (FHLB) Act of 1932, designed to increase bank lending by providing funding for liquidity-constrained banks. The FHLB Act accepted only 3 out of 41,000 applications within its first two years.

Figure 3.10. Household Balance Sheets during the Great Recession in Iceland

The financial position of Iceland's households came under severe stress in 2008. The collapse in asset prices unwound previous net wealth gains, while widespread indexation coupled with higher inflation and exchange rate depreciation led to a rise in nominal household debt. The share of mortgage holders with negative equity in their homes rose steadily, reaching close to 40 percent by 2010.



Sources: Central Bank of Iceland; Statistics Iceland; and IMF staff estimates.
Note: In panel 1, pension assets are corrected for an estimated tax of 25 percent. CPI = consumer price index; Forex = foreign exchange.

prevent foreclosures, and HOLC was established that summer.[31]

To prevent mortgage foreclosures, HOLC bought distressed mortgages from banks in exchange for bonds with federal guarantees on interest and principal. It then restructured these mortgages to make them more affordable to borrowers and developed methods of working with borrowers who became delinquent or unemployed, including job searches (Box 3.1 provides further details on the program). HOLC bought about 1 million distressed mortgages that were at risk of foreclosure, or about one in five of all mortgages. Of these million mortgages, about 200,000 ended up foreclosing when the borrowers defaulted on their renegotiated mortgages. The HOLC program helped protect the remaining 800,000 mortgages from foreclosure, corresponding to 16 percent of all mortgages (Table 3.1).[32] HOLC mortgage purchases amounted to $4.75 billion (8.4 percent of 1933 GDP), and the mortgages were sold over time, yielding a nominal profit by the HOLC program's liquidation in 1951. The HOLC program's success in preventing foreclosures at a limited fiscal cost may explain why academics and public figures called for a HOLC-style approach during the recent recession.

A key feature of HOLC was the effective transfer of funds to credit-constrained households with distressed balance sheets and a high marginal propensity to consume, which mitigated the negative effects on aggregate demand discussed above. The objective, emphasized by President Roosevelt in a message to Congress, was to relieve "the small home owner … of the burden of excessive interest and principal payments incurred during the period of higher values and higher earning power" (Harriss, 1951, p. 9). Accordingly, HOLC extended mortgage terms from a typical length of 5 to 10 years, often at variable rates, to fixed-rate 15-year terms, which were sometimes extended to 20 years (Green and Wachter, 2005). By making mortgage payments more affordable, it effectively transferred funds to households with distressed mortgages that had a higher marginal propensity to consume and away from lenders with (presumably) a lower marginal propensity to consume.[33] In a number of cases, HOLC also wrote off part of the principal to ensure that no loans exceeded 80 percent of the appraised value of the house, thus mitigating the negative effects of debt overhang discussed above.

Iceland during the Great Recession

The case of Iceland illustrates how a multipronged approach can provide debt relief to a large share of households and stem the rise in defaults. Iceland's bold policy response was motivated by the sheer scale of its household debt problem (see Figure 3.10) and intense social pressure for government intervention. In some of the largest protests ever seen in Iceland, thousands of people took to the streets demanding debt write-downs. Over a two-year period, the government provided a framework for dealing with household debt in the context of an IMF-supported program.

The approach to resolving the household debt problem had several elements. At the outset, stopgap measures offered near-term relief in order to ensure that families did not lose their homes owing to temporary problems and to prevent a spike in foreclosures leading to a housing market meltdown. The measures included a moratorium on foreclosures, a temporary suspension of debt service for exchange-rate- and CPI-indexed loans, and rescheduling (payment smoothing) of these loans. About half the households with eligible loans took advantage of payment smoothing, which reduced current debt service payments by 15 to 20 percent and 30 to 40 percent for CPI-indexed and foreign-exchange-indexed loans, respectively.

At a later stage, households were given the option of restructuring their loans out of court by negotiating with their lenders directly or with the help of a (newly created) Office of the Debtor's Ombudsman

[31]Household debt had been falling in nominal terms since 1929 on the back of defaults but continued to rise as a share of households' shrinking incomes until 1933 (see Figure 3.9).

[32]Fishback and others (2010) and Courtemanche and Snowden (2011) offer evidence that this action provided relief to the housing market by supporting home values and home ownership.

[33]HOLC also changed adjustable-rate, interest-only mortgages to fixed-rate, fully amortizing mortgages. This reduced uncertainty about future debt service obligations and implied less need for precautionary saving and helped homeowners avoid a large lump-sum payment at the loan's maturity.

acting on their behalf. The negotiations are on a case-by-case basis but use templates developed through dialogue between the government and the financial institutions. The templates provide for substantial write-downs designed to align secured debt with the supporting collateral, and debt service with the ability to repay. The case-by-case negotiations safeguard property rights and reduce moral hazard, but they take time. As of January 2012, only 35 percent of the case-by-case applications for debt restructuring had been processed. To speed things up, a debt forgiveness plan was introduced, which writes down deeply underwater mortgages to 110 percent of the household's pledgeable assets. In addition, a large share of mortgage holders receives a sizable interest rate subsidy over a two-year period, financed through temporary levies on the financial sector. Box 3.2 provides a detailed description of the household debt restructuring framework.[34]

Iceland's financial institutions had both the incentive and the financial capacity to participate. After the spectacular collapse of the country's banking system, the three large new banks that were assembled from the wreckage acquired their loan portfolios at fair value that took into account the need for write-downs. This gave them the financial room to bear the costs of write-downs, and they frequently took the initiative. Much of the cost of debt restructuring was borne indirectly by foreign creditors, who took significant losses when the banks collapsed. Aligning households' incentives to participate was more complicated. The combination of indexation, inflation, and falling housing prices meant that the longer households waited, the larger the write-down. The unconditional moratorium on foreclosures and the suspension of debt service also reduced the incentive to resolve debt problems, and frequent revisions of the debt restructuring framework created an expectation of ever more generous offers. It was only when a comprehensive framework was put in place with a clear expiration date that debt write-downs finally took off. As of January 2012, 15 to 20 percent of all mortgages have either been—or are in the process of being—written down (see Table 3.1).

[34]For a full discussion of household debt restructuring in Iceland, see Karlsdóttir, Kristinsson, and Rozwadowski (forthcoming).

Overall, while the jury is still out on Iceland's approach to household debt, the policy response seems to address the main channels through which household debt can exert a drag on the economy. A spike in foreclosures was averted by the temporary moratorium and the concerted effort to find durable solutions to the household debt problem. By enabling households to reduce their debt and debt service, the debt restructuring framework transfers resources to agents with a relatively high marginal propensity to consume. The financial-sector-financed interest subsidy is playing a similar role. Finally, the write-down of a substantial portion of excess household debt (that is, in excess of household assets) mitigates the problems associated with debt overhang. The extent to which the Icelandic approach is able to achieve the ultimate goal of putting households back on their feet, while minimizing moral hazard, remains to be seen.

Colombia during the 1990s

This episode illustrates how household debt resolution measures that put the burden on a fragile banking sector can lead to a credit crunch. Following the sudden stop in capital inflows in 1997 triggered by the Asian and Russian crises, and the associated rise in interest rates, household defaults increased sharply and mortgage lenders suffered substantial losses (Fogafin, 2009).With their mortgage obligations increasing significantly while house prices collapsed and unemployment rose, many borrowers took their case to the courts (Forero, 2004). In response, the authorities conducted a bank restructuring program in 1999, and the constitutional court passed a series of rulings that aimed to lower households' mortgage debt burden and prevent foreclosures. In particular, the court ruled that mortgages were no longer full-recourse loans—households now had the option of walking away from their mortgage debt. The court also declared the capitalization of interest on delinquent loans unconstitutional.

These reforms represented a substantial transfer of funds to households with distressed balance sheets—those likely to have a high marginal propensity to consume—but imposed heavy losses on the fragile financial sector. The reforms also encouraged strategic

Table 3.1. Government-Supported Out-of-Court Debt Restructuring Programs in Selected Case Study Countries

Program	Beneficiaries	Debt Modifications	Incentives and Burden Sharing	Take-up (in percent of mortgages, unless specified otherwise)
United States 1929				
Home Owners' Loan Corporation	Households already in default (or at-risk mortgages held by financial institutions in distress)	Repayment burdens further reduced by extending loan terms and lowering interest rates. Principal reductions to a maximum loan-to-value (LTV) ratio of 80 percent	Moral hazard avoided because program was limited to those already in default. Participation was voluntary, but lenders were offered payouts above the amount they could recover in foreclosure. Eligibility criteria ensured that the borrower could service the new loan and limited the potential losses to be borne by taxpayers. Burden of principal reductions was shared between lenders and the government. Government bore risk on restructured mortgages.	Total households: 25 million Households with a mortgage: 5 million Eligible mortgages: 50 percent Applications: 38 percent Approved applications: 20 percent Foreclosures avoided: 800,000 Total authorization: $4.8 billion (8.5 percent of gross national product—GNP) Total restructurings: $3.1 billion (5.5 percent of GNP)
Iceland 2008				
Payment Smoothing	Households with consumer price index (CPI)-linked and foreign exchange (FX)-linked mortgages and car loans	Debt service is reduced through rescheduling and maturity extension.	CPI-linked mortgages: Statutory requirement FX-linked loans: Agreement between government and lenders	Total households: 130,000 Households with a mortgage: 85,000 *Indicators of distress (excluding impact of measures):*[1] Households with negative equity (2010): 40 percent Households with debt service exceeding 40 percent of disposable income (2010): 30 percent Mortgages in default (2010): 15 percent *Take-up:* CPI- and FX-payment smoothing: 50 percent Approved and in-process restructurings: Sector Agreement: 1.6 percent DO: 3.9 percent Mortgage Write-down for Deeply Underwater Households: 14.9 percent
Sector Agreement (bank-administered voluntary restructuring)	Households with multiple creditors and debt service difficulties but able to service a mortgage amounting to at least 70 percent of the value of the house	Debt service is scaled down to capacity to pay. Debt is reduced to 100 percent of collateral value if households remain current on reduced payments for three years.	Government fostered agreement among largest lenders. Participation is voluntary. If agreement is not reached, debtors may apply to the Debtor's Ombudsman (DO) or the courts. The burden of restructuring the loans falls on the lenders.	
DO-Administered Voluntary Restructuring	Similar to Sector Agreement, but reaches less wealthy households. Aimed at households seeking advice and support in dealing with creditors.	Similar to Sector Agreement, but allows deeper temporary reduction in debt service. Procedures are more tailored and complex than under Sector Agreement.	Statutory framework that leads to court-administered restructuring in the event that negotiations are unsuccessful. The burden of restructuring the loans falls on the lenders.	

Program	Beneficiaries	Debt Modifications	Incentives and Burden Sharing	Take-up (in percent of mortgages, unless specified otherwise)
Iceland 2008				
Mortgage Write-down for Deeply Underwater Households	Households with LTV ratio above 110 percent as of December 2010	Principal was reduced to 110 percent of the value of the debtor's pledgeable assets.	Agreement between mortgage lenders and government. Participation was voluntary, but lenders signed on because the written-down value exceeded the recovery likely through bankruptcy. Moral hazard was avoided because the program was limited to those with an LTV ratio above 110 percent in December 2010. The burden of restructuring the loans falls on the lenders.	
United States 2009				
Home Affordable Modification Program (HAMP)[2]	Households in default	Focused on reducing repayment burdens through (1) interest rate reductions, (2) term extensions, (3) forbearance, and, since October 2010, principal reduction for loans outside the government-sponsored enterprises (Fannie Mae, Freddie Mac).	Participation is voluntary (except for receivers of Troubled Asset Relief Program funds). Principal write-down not often used, increasing the likelihood that the modified loan will redefault. Restructuring is initiated by servicers (not lenders), who have little incentive to participate. Securitization and junior-claim holders create conflict of interest.	Total number of households: 114 million Households with a mortgage: 51 million Households with negative equity: 23 percent Targeted reach: 6-8 percent Trial modifications: 4 percent Permanent modifications: 1.9 percent Total committed: $29.9 billion (0.2 percent of GDP)[3] Total amount used: $2.3 billion[3]
Hungary 2011				
September 2011	Borrowers in good standing with FX-denominated mortgages	Principal write-down through the ability to prepay mortgages at a preferential exchange rate	Mandated by statute Burden of write-down borne by lenders alone Prepayment requirement limits ability of borrowers to participate.	Number of households: 4 million Households with a mortgage: 800,000 Mortgages in arrears: 90,000 Technically eligible: 90 percent Practically eligible: 25 percent Preliminary take-up: 15 percent
Colombia 1999				
1999	Mortgage holders	Banks forced to retake underwater property and treat loan as fully repaid Repayment burden lowered through interest rate reduction	Participation mandated by court ruling Moral hazard and loss of confidence led to credit crunch.	Number of households: ±10 million Households with a mortgage: ±700,000 Mortgages in arrears: 126,000 (peak in 2002) Repossessed homes: 43,000 (1999–2003) Eligible borrowers: ±100 percent

[1]Near-universal indexation caused the indicators of distress to peak in 2010, two years after the crash.

[2]HAMP is the flagship debt restructuring program. As discussed in the text, there are other initiatives under the Making Home Affordable (MHA) program. The description of the program and cited numbers are as of the end of 2011.

[3]Source is Daily TARP Update for December 30, 2011 (Washington: U.S. Treasury). This reflects the amount obligated to all MHA initiatives. The total amount obligated for all housing programs under the Troubled Asset Relief Program is $45.6 billion.

default by households that would otherwise have repaid their loans, which further exacerbated lenders' losses.[35] Moreover, the court rulings weakened confidence regarding respect for private contracts and creditor rights. A severe and persistent credit crunch followed, and mortgage credit picked up only in 2005.

Hungary during the Great Recession

This episode illustrates how a compulsory program that is poorly targeted and puts the burden of debt restructuring on a fragile banking sector can jeopardize the stability of the financial system without achieving the desired economic objectives.

Hungarian households' indebtedness in foreign currency is among the highest in eastern Europe, although total household debt peaked at a relatively modest level, 40 percent of GDP, and is concentrated in roughly 800,000 households (or 20 percent of the total).[36] With the sharp depreciation of the Hungarian forint after the start of the global financial crisis, concerns that the rising debt service was undermining private consumption compelled the authorities to help foreign-currency-indebted households.[37] After a series of failed efforts to provide relief (such as a temporary moratorium on foreclosures and a voluntary workout initiative), the government introduced a compulsory debt restructuring program in September 2011, without prior consultation with stakeholders. During a fixed window (roughly five months), banks were forced to allow customers to repay their mortgages at a preferential exchange rate, roughly 30 percent below market rates. All losses from the implied debt reduction would be borne by the banks alone.

The compulsory debt restructuring program appears to have achieved high participation based on preliminary estimates—about 15 percent of all mortgages (see Table 3.1). However, it has three core limitations. First, it is poorly targeted as far as reaching constrained households with a high marginal propensity to consume. Only well-off households can repay outstanding mortgage balances with a one-time forint payment, implying limited redistribution toward consumers with a high marginal propensity to consume. Second, the compulsory program places the full burden of the losses on the banks, some of which are ill prepared to absorb such losses. Consequently, further bank deleveraging and a deepening of the credit crunch may result, with associated exchange rate pressure.[38] And finally, the implicit retroactive revision of private contracts without consulting the banking sector hurts the overall investment climate.

The United States since the Great Recession

This episode, which is ongoing, illustrates how difficult it is to achieve comprehensive household debt restructuring in the face of a complex mortgage market and political constraints. The key programs have reached far fewer households than initially envisaged in the three years since their inception. These shortfalls led the authorities to adopt additional measures in February 2012 to alleviate the pressure on household balance sheets.

Since the start of the Great Recession, a number of U.S. policymakers have advocated a bold household debt restructuring program modeled on the HOLC of the Great Depression.[39] However, support for such large-scale government intervention in the housing market has, so far, been limited.[40] Instead,

[35]In order to compensate lenders for losses incurred by the court ruling, the national deposit insurance company established a line of credit with favorable rates for lenders in 2000.

[36]By the time the crisis arrived in 2008, 100 percent of all new lending and 50 percent of household loans outstanding were in Swiss francs and collateralized by housing.

[37]As IMF (2011a) explains, debt service for holders of foreign-currency-denominated loans increased by more than 50 percent.

[38]Realizing the potential adverse impact of the legislation on the banking sector, the authorities adopted additional measures in December 2011 to spread the burden (see IMF, 2011a).

[39]Specific proposals for household debt policies along the lines of HOLC include those of Blinder (2008) and Hubbard and Mayer (2008). Blinder (2008) proposed a HOLC-style program to refinance 1 to 2 million distressed mortgages for owner-occupied residences by borrowing and lending about $300 billion. Hubbard and Mayer (2008) proposed lowering repayment amounts and preventing foreclosures and estimated that this would stimulate consumption by approximately $120 billion a year, or 0.8 percent of GDP a year. Approximately half of this effect was estimated to come through the wealth effect—higher house prices due to fewer foreclosures—and half through the transfer of resources to constrained households ("HOLC effect"). See Hubbard and Mayer (2008) and Hubbard (2011). Analysis accompanying IMF (2011b, Chapter II) suggests that, for each 1 million foreclosures avoided, U.S. GDP would rise by 0.3 to 0.4 percentage point.

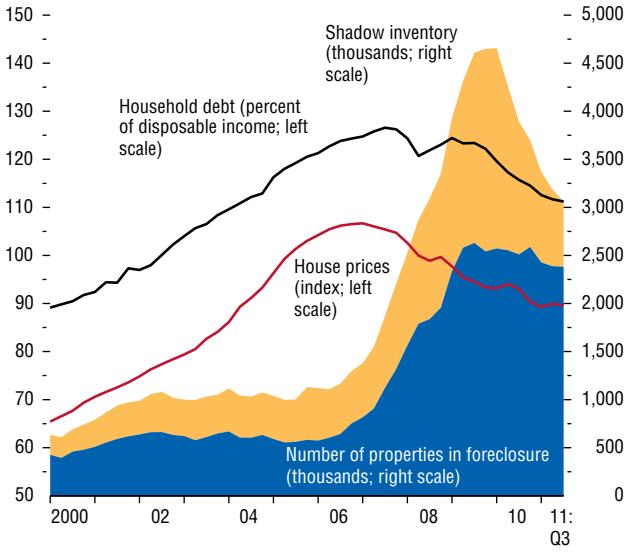
[40]The case of "cramdowns" illustrates how political constraints affected the policy response. As IMF (2011b) explains, the

the authorities implemented a number of more modest policies.[41] Here, we focus on the Home Affordable Modification Program (HAMP), the flagship mortgage debt restructuring initiative targeted at households in default or at risk of default. Announced in February 2009, HAMP's goal was to stabilize the housing market and help struggling homeowners get relief by making mortgages more affordable through the modification of first-lien loans. The program was amended in October 2010 to allow principal write-downs under the Principal Reduction Alternative (PRA) and further enhanced in 2012, as discussed below. HAMP is part of the Making Home Affordable (MHA) initiative, which helps struggling homeowners get mortgage relief through a variety of programs that aid in modification, refinancing, deferred payment, and foreclosure alternatives. Other options under the MHA initiative include the Home Affordable Refinance Program (HARP), which also aims at reducing monthly mortgage payments. However, households already in default are excluded from HARP, and the impact on preventing foreclosures is likely to be more limited.[42]

HAMP had significant ambitions but has thus far achieved far fewer modifications than envisaged. Millions of households remain at risk of losing their homes. The stock of properties in foreclosure at the end of 2011 stood at about 2.4 million—a nearly fivefold increase over the precrisis level—and the so-called shadow inventory of distressed mortgages suggests that this number could rise significantly (Figure

Figure 3.11. The U.S. Housing Market, 2000–11

There were about 2.4 million properties in foreclosure in the United States at the end of 2011, a nearly fivefold increase over the precrisis level, and the "shadow inventory" of distressed mortgages suggests that this number could rise further.



Sources: Office of the Comptroller of the Currency; Office of Thrift Supervision; U.S. Treasury; Federal Reserve; Haver Analytics; and IMF staff calculations.

Note: Shadow inventory indicates properties likely to go into foreclosure based on a number of assumptions. It includes a portion of all loans delinquent 90 days or more (based on observed performance of such loans); a share of modifications in place (based on redefault performance of modified mortgages); and a portion of negative equity mortgages (based on observed default rates). Data on modifications and negative equity are not available prior to 2008:Q2.

authorities viewed allowing mortgages to be modified in courts (cramdowns) as a useful way to encourage voluntary modifications at no fiscal cost, but noted that a proposal for such a policy had failed to garner sufficient political support in 2009. Mian, Sufi, and Trebbi (2012) argue that creditors' greater ability to organize politically and influence government policy may be the reason they were better able to protect their interests during the recent financial crisis: "Debtors, on the other hand, were numerous and diffused, therefore suffering from typical collective action problems" (p. 20).

[41]Early attempts to fix the household debt problem were the Federal Housing Administration (FHA) Secure program, the Hope Now Alliance, the Federal Deposit Insurance Corporation's Mod in a Box, and Hope for Homeowners.

[42]The MHA initiative also includes the FHA's Short Refinance Program for borrowers with negative equity, Home Affordable Unemployment Program, Home Affordable Foreclosure Alternatives Program, Second Lien Modification Program, and Housing Finance Agency Innovation Fund for the Hardest Hit Housing Markets.

3.11). Meanwhile, the number of permanently modified mortgages amounts to 951,000, or 1.9 percent of all mortgages (see Table 3.1).[43] By contrast, some 20 percent of mortgages were modified by the Depression-era HOLC program, and HAMP's targeted reach was 3 to 4 million homeowners (MHA, 2010).[44] By the same token, the amount disbursed under MHA as of December 2011 was only $2.3 billion, well below the allocation of $30 billion (0.2 percent of GDP).

Issues with HAMP's design help explain this disappointing performance. The specific issues are as follows:

- Limited incentives for the parties to participate in the program and tight eligibility criteria for borrowers have resulted in low take-up. The initial legislation made creditor cooperation completely voluntary, thereby enabling many creditors to opt out of the program. Loan servicers have little incentive to initiate a costly renegotiation process given that they are already compensated for some (legal) costs when delinquent loans enter foreclosure.[45] The high probability of redefault may lead lenders and investors to prefer forbearance and foreclosure to modification (Adelino, Gerardi, and Willen, 2009). Securitization presents additional coordination and legal problems. In addition, conflicts of interest may arise, for example, when second-lien holders forestall debt restructuring (IMF, 2011b). Several factors also hamper borrower participation. For instance, many of the expenses related to the outstanding loan, such as late fees and accrued interest, get folded into the new, modified loan. Finally, many distressed borrowers are effectively locked out of the program due to tight eligibility requirements. The unemployed are ineligible to apply for HAMP (they are eligible for a different initiative under MHA that is designed for the unemployed), and households that suffered large income losses often fail to meet the postmodification debt-to-income requirements, especially without principal reduction. Overall, therefore, the program transfers only limited funds to distressed homeowners.
- HAMP has not reduced monthly mortgage payments enough to restore affordability in many cases. HAMP includes strict step-by-step instructions for modifying a loan, with the primary methods being interest rate reductions, term extensions, and forbearance. Certain exceptions to this step-by-step process are allowed. Non-GSE loans with an LTV above 115 percent may also be eligible for principal reductions under PRA.[46] As of the end of 2011, 11 percent of HAMP permanent modifications included a principal write-down.[47] The nonparticipation by GSEs, which hold about 60 percent of all outstanding mortgages, helps explain this low take-up. Importantly, the modifications focus on bringing a narrow definition of the mortgage repayment burden down to 31 percent of monthly gross income rather than the total repayment burden (including other installment loans and second mortgages). As a result, most borrowers remain seriously constrained even after the modifications, with after-modification total debt repayment burdens averaging 60 percent of monthly gross income and the after-modification LTV sometimes actually increasing (MHA, 2012). This helps explain the high redefault rate on the modified loans, which currently averages 27

[43]As MHA (2012) explains, as of January 2012, 1.79 million trials had been started, but only 951,000 of these trials succeeded in becoming "permanent." (The trial period allows the loan servicer to test the borrower's ability to make the modified loan payment before finalizing the loan modification.) Note that some 200,000 of these modifications were subsequently canceled, leaving 769,000 *active* permanent modifications.

[44]In a report on the implementation of the HAMP program, the Office of the Special Inspector General for the Troubled Asset Relief Program (SIGTARP) clarified that "Treasury has stated that its 3 to 4 million homeowner goal is not tied to how many homeowners actually receive sustainable relief and avoid foreclosure, but rather that 3 to 4 million homeowners will receive offers for a trial modification" (SIGTARP, 2010). The report criticizes measuring trial modification offers—rather than foreclosures avoided through permanent modifications—as "simply not particularly meaningful."

[45]As Kiff and Klyuev (2009) explain, a servicer's primary duty is to collect mortgage payments from borrowers and pass them to the mortgage holders (trusts, in the case of securitized loans). Servicers also manage the escrow accounts they hold on behalf of borrowers to pay property taxes and insurance, and they employ various loss-mitigation techniques should the borrower default. Servicers are paid a fee for this work.

[46]The GSEs—government-sponsored enterprises—include the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac).

[47]As MHA (2012) explains, 47,000 permanent modifications received principal write-downs (p. 4), which is equivalent to 11 percent of the 432,000 permanent modifications between October 2010 and December 2011.

percent after 18 months and as high as 41 percent in cases where the monthly payment reduction was less than or equal to 20 percent (MHA, 2012).

In response to these shortcomings, the authorities adopted additional measures to alleviate the pressure on household balance sheets. In February 2012, the authorities announced an expansion of HAMP, including broader eligibility and a tripling of the incentives for lenders to offer principal reductions. In addition, the program was extended by one year. However, participation of the GSEs in the program remains subject to approval by the Federal Housing Finance Agency. Principal reductions are likely to reduce foreclosure rates and, if implemented on a large scale, would support house prices substantially—helping to eliminate the overall uncertainty weighing on the housing market via the shadow inventory.[48]

Scandinavia during the 1990s

The Scandinavian countries illustrate how institutional features, such as a large social safety net, may influence governments' adoption of discretionary household debt restructuring policies. In contrast to the cases discussed above, these episodes featured few government initiatives directly targeted at household debt. After housing prices peaked in the late 1980s and the subsequent onset of banking crises in these economies, the primary discretionary policy responses of the Scandinavian governments consisted of support for the financial system.

These economies did not initiate any household debt restructuring measures, but their large existing social safety nets supported household incomes and their ability to service their debt. The large safety nets are a result of a tradition of providing many public services, mainly as a way to promote equality in these economies.[49] For example, unemployment benefits as a percentage of previous wages averaged 65 percent in Finland, Norway, and Sweden in 1991, well above the 47 percent average in other OECD economies (OECD, 1995, p. 61). In Sweden, the wage replacement ratio was 83 percent. This government-provided insurance, along with other social safety net benefits, substantially mitigated the impact of job loss on households with distressed balance sheets and supported their ability to pay their mortgages. At the same time, the automatic transfer programs combined with the recession implied a substantial rise in government debt. The government debt-to-GDP ratio rose from an average of 31 percent in 1990 to 64 percent in 1994 (Figure 3.12).[50] In response, the authorities implemented cuts to social welfare payments in the mid- to late 1990s as part of a multiyear fiscal consolidation (Devries and others, 2011).

In addition, the variable mortgage rates prevalent in these economies allowed lower interest rates to pass through quickly to lower mortgage payments. The decline in short-term interest rates after the Scandinavian countries abandoned the exchange rate peg to the European Currency Unit in November 1992 was substantial. For example, the abandonment of the exchange rate peg allowed a cumulative 4 percentage point reduction in short-term interest rates in Sweden (IMF, 1993). By contrast, households in economies where mortgage rates tend to be fixed over multiyear terms often need to apply for a new mortgage (refinance) in order to reap the benefit of lower prevailing rates, a process that can be hampered by lower house values and negative equity.

Lessons from the Case Studies

Our investigation of the initiatives implemented by governments to address the problem of household debt during episodes of household deleveraging leads to the following policy lessons:

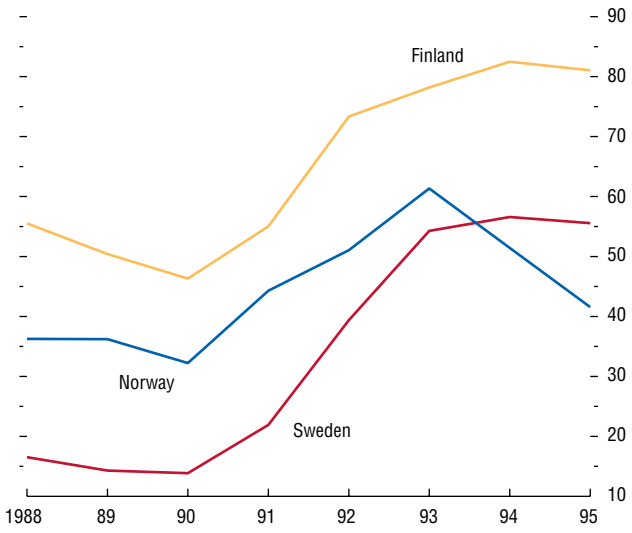
[48]Other measures include a pilot sale of foreclosed properties for conversion to rental housing. Transitioning properties into rentals should help reduce the negative impact of foreclosures on house prices. The authorities also called on Congress to broaden access to refinancing under HARP for both GSE-backed and non-GSE mortgages; these measures would support the recovery of the housing market. In particular, they would allow non-GSE loans to be refinanced through a streamlined program operated by the FHA.

[49]For example, IMF (1991) explains that in Norway, "the Government has traditionally sought to provide many basic services in the areas of health and education publicly, mainly as a way to promote equity but also for reasons of social policy. In addition, efforts to redistribute incomes and reduce regional differences have led to an extensive transfer system." (p. 19)

[50]The rise in government debt was also a result of financial support to the banking sector and discretionary fiscal stimulus aimed at reducing unemployment.

Figure 3.12. Government Debt in the Scandinavian Countries, 1988–95
(Percent of GDP)

Finland, Norway, and Sweden experienced a sharp increase in government debt following the housing bust and banking crisis of the early 1990s.



Source: IMF staff calculations.

- Bold household debt restructuring programs, such as those implemented in the United States in the 1930s and in Iceland today, can significantly reduce the number of household defaults and foreclosures and substantially reduce debt repayment burdens. In so doing, these programs help prevent self-reinforcing cycles of declining house prices and lower aggregate demand. The Icelandic experience also highlights the importance of a comprehensive framework, with clear communication to the public and an explicit time frame. It was only after such a framework was put in place that the process of household debt restructuring took off.
- Ensuring a strong banking sector is crucial during the period of household deleveraging. In Iceland, the fact that the new banks had acquired their loan portfolios at fair value meant that far-reaching household debt restructuring could proceed without affecting bank capital. This also gave banks incentives to initiate negotiations with borrowers. In contrast, in the case of Colombia in the 1990s and in Hungary today, an insufficiently capitalized banking sector could not absorb the losses associated with (mandatory) household debt restructuring. This resulted in a disruption of credit supply.
- Existing institutional features may influence whether or not governments implement discretionary policy initiatives to tackle the problems associated with household debt. In the Scandinavian countries, despite a significant buildup in household debt before the housing bust of the late 1980s, the authorities introduced few new policies targeted at household debt. We argue that this lack of a policy response may reflect the existence of substantial automatic fiscal stabilizers through the social safety net, in addition to variable mortgage interest rates that quickly transmitted monetary policy stimulus to homeowners.
- An important element in the design of targeted policies is sufficient incentives for borrowers and lenders to participate. For example, debt restructuring initiatives need to offer creditors and debtors a viable alternative to default and foreclosure. The case of the United States during the Great Depression demonstrates how specific provisions

can be implemented to ensure that the lenders willingly accept the government-supported modifications. In contrast, the case of the United States since the Great Recession, where loan modifications may open the door to potential litigation by investors, illustrates how poorly designed household debt restructuring efforts can result in low participation.

- Government support for household debt restructuring programs involves clear winners and losers. The friction caused by such redistribution may be one reason such policies have rarely been used in the past, except when the magnitude of the problem was substantial and the ensuing social and political pressures considerable.

Summary and Implications for the Outlook

Housing busts preceded by larger run-ups in gross household debt are associated with deeper slumps, weaker recoveries, and more pronounced household deleveraging. The decline in economic activity is too large to be simply a reflection of a greater fall in house prices. And it is not driven by the occurrence of banking crises alone. Rather, it is the combination of the house price decline and the prebust leverage that seems to explain the severity of the contraction. These stylized facts are consistent with the predictions of recent theoretical models in which household debt and deleveraging drive deep and prolonged slumps.

Macroeconomic policies are a crucial element of efforts to avert excessive contractions in economic activity during episodes of household deleveraging. For example, fiscal transfers to unemployed households through the social safety net can boost their incomes and improve their ability to service debt, as in the case of the Scandinavian economies in the 1990s. Monetary easing in economies in which mortgages typically have variable interest rates can quickly reduce mortgage payments and prevent household defaults. Support to the financial sector can address the risk that household balance sheet distress will affect banks' willingness to supply credit. Macroeconomic stimulus, however, has its limits. The zero lower bound on nominal interest rates can prevent sufficient rate cuts, and high government debt may constrain the scope for deficit-financed transfers.

Targeted household debt restructuring policies can deliver significant benefits. Such policies can, at a relatively low fiscal cost, substantially mitigate the negative impact of household deleveraging on economic activity. In particular, bold household debt restructuring programs such as those implemented in the United States in the 1930s and in Iceland today can reduce the number of household defaults and foreclosures and alleviate debt repayment burdens. In so doing, these programs help prevent self-reinforcing cycles of declining house prices and lower aggregate demand. Such policies are particularly relevant for economies with limited scope for expansionary macroeconomic policies and in which the financial sector has already received government support.

However, the success of such programs depends on careful design. Overly restrictive eligibility criteria or poorly structured incentives can lead to programs having a fraction of their intended effect. Conversely, overly broad programs can have serious side effects and undermine the health of the financial sector.

Appendix 3.1. Data Construction and Sources

Data on household balance sheets were collected from a variety of sources. The main source is the Organization for Economic Cooperation and Development (OECD) Financial Accounts Database. The data set contains detailed information on households' financial assets and liabilities for 33 economies, spanning the period 1950–2010, though the series for most of the economies begin in the 1990s. We focus on the household sector's total financial liabilities. For several economies, the series on total financial liabilities were extended back using data from national sources (Finland, Italy, Korea, New Zealand, Norway, Sweden, United Kingdom, United States). Household financial liabilities series for Australia, Belgium, France, Germany, Greece, the Netherlands, and Portugal going back to 1980 were obtained from Cecchetti, Mohanty, and Zampolli (2011). More recent data on household balance sheets for several non-OECD countries (Bulgaria, Latvia, Lithuania, Romania) were obtained from Eurostat. Data for the United States before 1950 come from the U.S. Bureau of Economic Analysis and from *Historical Statistics of the United States;*

for Iceland, data on household liabilities are from national sources.

The remainder of the series used in the chapter draw mostly on the IMF World Economic Outlook (WEO), World Bank World Development Indicators, OECD.Stat, and Haver Analytics databases. In particular, household disposable income, housing prices, and unemployment rates are taken from OECD.Stat and spliced with Haver Analytics data to extend coverage. House price information for Colombia and Hungary are from the *Global Property Guide;* for Iceland, the housing price index is from national sources. Macroeconomic variables, such as real and nominal GDP, private consumption, investment, and so on are from the WEO database.

Housing bust indicators are obtained from Claessens, Kose, and Terrones (2010), who use the Harding and Pagan (2002) algorithm to determine turning points in the (log) level of nominal house prices. Recession indicators are from Howard, Martin, and Wilson (2011), who define a recession as two consecutive quarters of negative growth. Because our empirical analysis relies on annual data, we assign the recession or housing bust, respectively, to the year of the first quarter of the recession or house price peak. Financial crisis indicators are from Laeven and Valencia (2010).

Appendix 3.2. Statistical Methodology and Robustness Checks

This appendix provides further details on the statistical methods used in the first section of the chapter and the robustness of the associated regression results.

Model Specification and Estimation

The baseline specification is a cross-section and time-fixed-effects panel data model estimated for 24 Organization for Economic Cooperation and Development economies and Taiwan Province of China during 1980–2011:

$$\Delta Y_{it} = \mu_i + \lambda_t + \sum_{j=0}^{2} \beta_j \Delta Y_{i,t-j} + \sum_{s=0}^{2} \beta_s \, Bust_{i,t-s} + \sum_{s=0}^{2} \gamma_s \{Bust_{i,t-s} \times HiDebt_{i,t-s-1}\} + \sum_{s=0}^{2} \theta_s \, HiDebt_{i,t-s-1} + v_{i,t}, \quad (3.1)$$

where ΔY_{it} denotes the change in the variable of interest. We start with the (log) of real household consumption and then examine the components of GDP, unemployment, household debt, and house prices. The term *Bust* denotes a housing bust dummy that takes the value of 1 at the start of a housing bust; *HiDebt* is a dummy variable that takes the value of 1 if the rise in the household debt-to-income ratio in the three years before the bust was "high." In our baseline specification, we define the rise as high if it was above the median for all housing busts across all economies. We conduct a number of robustness checks on this definition of "high," finding similar results (see below). We include country and time fixed effects to allow for global shocks and country-specific trends. We cumulate the estimates of equation (3.1) to obtain estimates of the response of the *level* of the variable of interest (Y) along with the standard error (clustered by economy) using the delta method.

Robustness Checks

As Table 3.2 shows, the finding that housing busts preceded by a large buildup in household debt tend to be more severe holds up to a number of robustness checks. For each robustness check, we focus on the severity of the housing bust for the high- and low-debt groups in terms of the decline in real household consumption five years after the bust.[51] The robustness tests include the following:

- *Definition of "high-debt" group:* Our baseline places a housing bust in the high-debt group if it was preceded by an above-median rise in the household debt-to-income ratio during the three years leading up to the bust. The results do not depend on whether the rise is defined in absolute terms (percentage point increase in the ratio) or in relative terms (proportionate increase in percent). The results are also similar if we define "high debt" as being in the top quartile and "low debt"

[51]Similar results are obtained at horizons of less than five years, but these are not reported, given space constraints.

Table 3.2. Real Consumption following Housing Busts: Robustness

	High Debt	Low Debt	Difference
Baseline	–4.315***	–0.396	–3.918***
	(0.829)	(0.791)	(0.970)
Alternative Samples			
Excluding the Great Recession	–4.098***	–0.425	–3.673***
	(0.987)	(1.068)	(1.294)
Excluding Financial Crises	–1.757**	0.504	–2.261**
	(0.876)	(0.735)	(1.095)
Excluding Outliers	–2.978***	–0.133	–2.845***
	(0.755)	(0.726)	(0.946)
Alternative Statistical Models			
Generalized Method of Moments	–4.142***	–0.277	–3.865***
	(0.996)	(1.015)	(1.301)
Four Lags of Dependent Variable	–2.121**	0.984	–3.105**
	(1.071)	(1.273)	(1.310)
Alternative Definitions of High versus Low Debt			
Above versus Below Median (percent increase in debt)	–3.675***	–0.543	–3.132***
	(0.779)	(0.841)	(0.917)
Top versus Bottom Quartile (percentage point increase in debt)	–5.690***	–0.948	–4.742**
	(1.601)	(1.236)	(2.332)

Source: IMF staff calculations.

Note: The table presents the estimated cumulative response of real consumer spending following housing busts at year $t = 5$ for episodes with a low and high buildup in household debt in the three years prior to the housing bust. Robust standard errors, corrected for clustering at the economy level, are shown in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively.

as being in the bottom quartile of the increase in the debt-to-income ratio.

- *Time sample:* The results are not driven by the Great Recession. Ending the sample in 2006 produces similar results.
- *Outliers and specification:* The results regarding the more severe contraction in economic activity are robust to the exclusion of outliers using Cook's distance. (This involves excluding outlier data points with large residuals or high influence.) The results are also similar if we use a dynamic specification with four lags instead of the two lags in the baseline specification.
- *Alternative estimation procedure:* The results are also similar if we undertake the estimation using the Arellano-Bond (1991) estimator. This procedure addresses the possibility of bias because country fixed effects are correlated with the lagged dependent variables in the autoregressive equation.

Box 3.1. The U.S. Home Owners' Loan Corporation (HOLC)

HOLC, a program that involved government purchases of distressed loans, was established June 13, 1933. The explicit goals of HOLC, set forth in its authorizing statute, were as follows: "To provide emergency relief with respect to home mortgage indebtedness, to refinance home mortgages, to extend relief to the owners of homes occupied by them and who are unable to amortize their debt elsewhere, to amend the Federal Home Loan Bank Act, to increase the market for obligations of the United States, and for other purposes."

The program provided for (1) the exchange of HOLC bonds (with a federal guarantee at first of interest only but later, beginning in spring 1934, of both interest and principal) for home mortgages in default and, in a few cases, for (2) cash loans for payment of taxes and mortgage refinancing. HOLC loans were restricted to mortgages in default (or mortgages held by financial institutions in distress) and secured by nonfarm properties with dwelling space for not more than four families and appraised by HOLC officials at not more than $20,000 ($321,791 in 2008 dollars). No loans could exceed 80 percent of the HOLC appraisal, nor could any loan exceed $14,000. Loans were to carry no more than 5 percent interest and were to be amortized by monthly payments during their maturity of 15 years, which was sometimes extended to 20 years (Green and Wachter, 2005).

How It Worked

Eligibility criteria for borrowers and properties were stringently applied. In total (between June 13, 1933, and June 27, 1935) HOLC received 1,886,491 applications requesting $6.2 billion in refinancing, equivalent to roughly 35 percent of outstanding nonfarm mortgage loans, or 11 percent of gross national product, which exceeded its total authorization of $4.75 billion. Approximately 40 percent of those eligible for the program applied, and 46 percent of these applications were rejected or withdrawn. "Inadequate security" and "lack of distress" were the most cited reasons for rejection of an application. Some of the applications were withdrawn as a result of voluntary bilateral agreements between the applicant and the lender, at the encouragement of HOLC. Nevertheless, HOLC bought and restructured about 1 million distressed mortgages that were at risk of foreclosure, or about one in five of all mortgages.

The success crucially depended on the lenders' willingness to accept HOLC bonds in exchange for their outstanding mortgages. Lenders were reluctant to participate because of the initial limitation of the government guarantee to interest only, with no commitment on principal, and the belief that HOLC would lose money. The relatively low 4 percent interest rate—roughly one-third below the customary rate on mortgages, some financial institutions' legal restrictions on investment policies, and the lack of confidence in the government's credit were also reasons not to accept the exchange.

Yet the government guarantee of interest was much better than the promise of a distressed homeowner: an almost certain return of 4 percent was more attractive than an accruing but uncollectible 6 percent and came without collection and servicing costs or the expense of potential foreclosure. In addition, the appraisal standards might permit the receipt of more in bonds than could be obtained from sale at foreclosure. Finally, the bonds were exempt from state and local property taxes, and the income was exempt from state and federal normal income tax. To further improve the terms for the exchange, the legal restrictions on investment policies were lifted, the New York Real Estate Securities Exchange announced that the bonds would be admitted for trading, the Treasury authorized use of the bonds as collateral for deposits of public money, the Reconstruction Finance Corporation (RFC) agreed to accept the bonds as collateral at up to 80 percent of face value, and the Comptroller of the Currency reversed an earlier stand to permit receivers of national banks to accept the new bonds. In early 1934, the government guarantee was extended to the bond principal, undoubtedly enhancing their acceptability, and HOLC announced new 18-year bonds, callable in 10 years and bearing a 3 percent coupon.

Appraisal values were critical in providing incentives for participation in the refinancing program as well as ensuring adequate reach and burden sharing.

The author of this box is Deniz Igan.

Box 3.1. *(continued)*

The lower the valuation placed on properties, the less the risk for HOLC, but the fewer the number of homeowners who could benefit and the greater the sacrifice required from the former lenders. Appraisals were based on three equally weighted factors: "the market value at the time of appraisal; the cost of a similar lot at the time of the appraisal, plus the reproduction cost of the building, less depreciation; and the value of the premises as arrived at by capitalizing the monthly reasonable rental value of the premises over a period of the past ten years." The result often exceeded the current market value given the circumstances in the housing market.

A couple of complications arose in the case of mortgages held by recently failed banks and in the case of second mortgages and other junior claims. A wholesale operation was established to handle the cases involving recently failed banks: the RFC would make a loan to a bank in difficulty and accept mortgages as collateral, and then HOLC would process these mortgages and turn its bonds or cash over to the bank, which in turn repaid the RFC. About 13 percent of all HOLC-refinanced mortgages fell into this category. The policy for dealing with junior claim holders was to limit the total obligations on a property to 100 percent of its appraisal to ensure that borrowers could reasonably be expected to carry out their obligations. The junior lien had to be secured by a bond and mortgage, requiring foreclosure as a means of liquidation. (HOLC consent was required before the second-lien holder could foreclose.)

HOLC got off to a rough start: it underestimated the size of the task and was poorly organized. Its status as an independent organization gave it more freedom in terms of budgeting and administration, but the lack of precedent and the urgency of the situation posed challenges. Yet, within a few years, HOLC had gained a reputation for proper execution and efficient provision of much-needed relief.

Box 3.2. Household Debt Restructuring in Iceland

In the aftermath of Iceland's devastating financial crisis in 2008, the authorities sought to shield households from near-term distress, set them on a path to financial viability, and prevent a wave of foreclosures. Their policy initiatives fall into two broad categories: postponing or rescheduling debt service and reducing the stock of debt. The task was complicated by a Supreme Court finding, midway through the process, that most exchange-rate-linked obligations are illegal under a 2001 law. This stalled the debt reduction programs described below but also led to debt reduction equivalent to 10 percent of GDP, some of which would otherwise have been provided via those programs.[1] Much of the cost of debt restructuring was borne indirectly by foreign creditors, who took significant losses when the banks collapsed.

Postponing or Rescheduling Debt Service

The immediate goal was to shield households from a ballooning in debt service stemming from the near universal indexation of debt to the consumer price index (CPI) or the exchange rate, both of which had risen sharply. A first step was to suspend debt service, temporarily, on all exchange-rate-linked loans and some local-currency mortgages. Soon thereafter, the authorities introduced payment smoothing: a mechanism for rescheduling by rebasing debt service on an index that had risen much less than the CPI or the exchange rate. Payment smoothing provided up-front debt service relief of 15 to 20 percent for CPI-indexed loans and 30 to 40 percent for exchange-rate-indexed loans. The relief came at the cost of larger future payments and possible extensions of maturity. To encourage households to participate, payment smoothing was made the default option for CPI-indexed loans, and a three-year limit was placed on maturity extensions (with any remaining balances written off). About 50 percent of mortgages benefited from payment smoothing. A temporary moratorium on foreclosures of residential properties complemented these measures.

Debt Reduction

Several principles shaped Iceland's approach to debt reduction. First, the financial burden was to fall on the financial sector, which had financial buffers, rather than on the public sector, whose debt was already high. Second, the needs of distressed households were to be weighed against preserving creditors' rights. And finally, speed was an important consideration.

The approach rests on four pillars, each of which has been modified over time in light of experience. Three provide for case-by-case solutions administered, respectively, by the courts, the financial sector, and the newly created Office of the Debtor's Ombudsman (DO). The fourth is an agreement that allows fast-track write-downs for deeply underwater mortgages.

- *Court-administered solutions:* The authorities amended the Law on Bankruptcy in order to make it easier and cheaper for households to file for consolidation of unsecured debt and to shorten the discharge period in the event of bankruptcy. They also enacted the Law on Mitigation of Residential Mortgage Payments, aimed at households with moderately priced homes. This law allows lenders to write down mortgages to 110 percent of collateral value (later reduced to 100 percent) and convert the written-down portion to an unsecured claim. This framework is cumbersome, but its basic elements—reduced payments during a specified period, a subsequent reduction of the lien, and possible cancellation of unsecured debt—were the model and legal basis for the out-of-court initiatives that followed. It also serves as a backstop in case out-of-court negotiations break down.
- *Sector agreement:* The authorities supported a sectorwide agreement on a bank-administered framework for fast-track out-of-court debt mitigation. This agreement addresses many of the problems associated with court-administered

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[1]The illegal loans were recalculated as if they had been made in domestic currency on the best terms available at the time of the original loan. A February 2012 Supreme Court decision modified this treatment, but its effect is still unclear and is not reflected in this discussion.

Box 3.2. *(continued)*

restructuring. It integrates the handling of secured and unsecured debt and sets out guidelines for third-party guarantees and collateral.

Under this framework, households seeking relief first liquidate nonessential assets and use any excess cash to reduce debt. Outstanding underwater mortgages (or auto loans) are then divided up into a secured loan, equal to 100 percent of the value of the collateral, and a provisionally unsecured loan. The general rule is that the household must service the secured loan in full and use its remaining "capacity to repay" to make partial pro rata payments on all unsecured loans.[2] But there are also provisions for a three-year suspension of up to 30 percent of the mortgage. If the household remains current on all these payments for three years, the outstanding balances of all unsecured loans are canceled.

- *The Debtor's Ombudsman:* A third case-by-case framework was set up by legislation under a DO and its supporting legal framework. The DO provides households with legal and financial advice and appoints a supervisor to represent them in negotiations. The legislation seeks to reduce delays by introducing time limits for processing applications; it also incentivizes lenders by introducing a formal procedure for lodging claims, making court-administered restructuring the fallback (and threat) should negotiations fail. DO-administered debt restructuring has the same basic features as restructuring under the sector agreement, but it allows for more tailoring to individual circumstances, brings in a wider set of borrowers and creditors, and may provide for a smaller write-down of unsecured claims.
- *Fast-track write-downs:* The final pillar, erected in December 2010, was a government-fostered agreement by lenders on relatively simple rules for writing down deeply underwater mortgages to 110 percent of pledgeable assets. This agreement removed households' incentive to hold back in the hope of a better deal later on by specifying the dates on which the mortgage and the property would be valued and by specifying the date on which the offer would expire. The fast-track write-downs have reduced more debt and reached more households than all the other programs. As of January 31, 2012, close to 15 percent of households with mortgages have benefited from the fast-track write-downs, compared with fewer than 6 percent who have used or are using the sector agreement and the DO. That said, the case-by-case approaches may be reaching a larger number of households with high debt service ratios since only about a quarter of the households benefiting from the fast-track write-downs were in this category (Ólafsson and Vignisdóttir, 2012).

[2]Capacity to pay is defined as the difference between disposable income and the "normal" cost of living.

Outcomes and Lessons

While the jury is still out on Iceland's approach to household debt, a number of conclusions can already be drawn. First, measures with simple eligibility criteria, such as write-downs of deeply underwater mortgages, can provide quick relief with rough-hewn targeting. Second, case-by-case out-of-court frameworks can help bail out households with complex problems faster than the courts. However, these frameworks are also slow: only 35 percent of the applications received had been processed by the end of January 2012. In part this is because key concepts (such as "capacity to repay") were not defined precisely. But it is also because the legislation and the sector agreement leave more to be decided on the basis of individual circumstances than is consistent with the fast-track objective. Finally, in the same vein, the more complex structure of the DO approach contributes to long processing periods.

There appears to be a trade-off between speedy resolution and fine-tuning debt relief in order to protect property rights and reduce moral hazard. One way to minimize this trade-off is through the use of parallel frameworks—general measures for severe cases in which write-downs appear inevitable and case-by-case measures for more complex cases. Indeed the authorities' decision to complement case-by-case frameworks with fast-track measures for deeply underwater mortgages is a step in the right direction.

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CHAPTER 4

COMMODITY PRICE SWINGS AND COMMODITY EXPORTERS

How do commodity price swings affect commodity exporters, and how should their policies respond? These questions have become relevant again with the confluence of a weak global economy and the sustained buoyancy of commodity markets following the slump of the 1980s and 1990s. This chapter reexamines the macroeconomic performance of commodity exporters during commodity price cycles. It highlights how performance moves with the price cycle. The economic effects on commodity exporters are strong when commodity prices are driven by the global economy. Countercyclical fiscal policies—which build buffers during commodity price upswings that can be used during downswings—can help insulate small commodity exporters that are exposed to economic volatility induced by commodity price fluctuations. However, when price increases endure permanently, higher public investment and lower labor and capital taxes can boost private sector productivity and welfare. Against the backdrop of near-record commodity prices, coupled with unusual uncertainty in the global outlook, the priority for commodity exporters is to upgrade their policy frameworks and institutions in addition to building fiscal buffers. However, if high price levels persist, a cautious approach—which maintains fiscal buffers while gradually incorporating new information to allow a smooth adjustment to potentially permanently higher prices—is a sensible way forward.

Commodity prices have risen dramatically over the past decade, interrupted only briefly by the global financial crisis. By the end of 2011, average prices for energy and base metals in real terms were three times as high as just a decade ago, approaching or surpassing their record levels over the past four decades (Figure 4.1). Food and raw material prices also rose markedly, although they remain well below the highs reached in the 1970s. Many analysts attribute elevated commodity prices to the sustained

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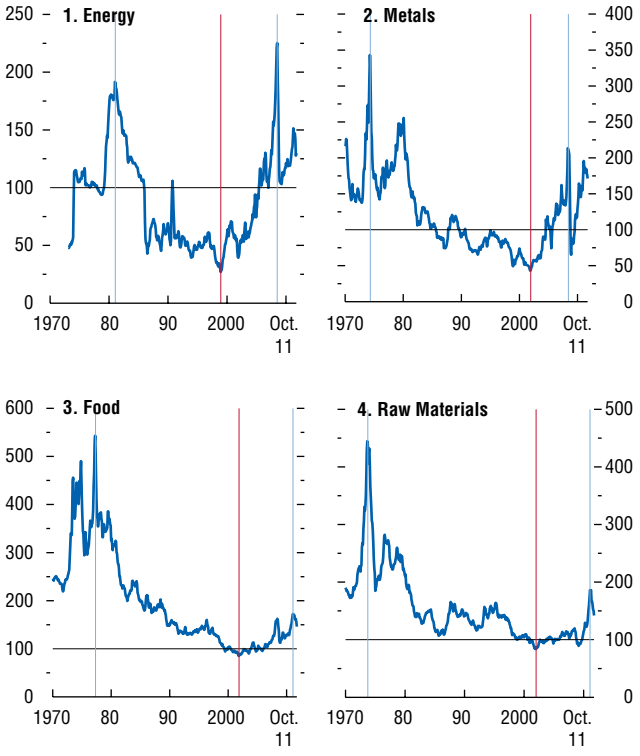
Figure 4.1. World Commodity Prices, 1970–2011
(In real terms)

There has been a broad-based rise in commodity prices during the past decade.



Source: IMF staff calculations.
Note: The real price index for a commodity group is the trade-weighted average of the global U.S. dollar prices of the commodities in the group deflated by the U.S. consumer price index and normalized to be 100 in 2005. The blue vertical lines indicate long cycle peaks, and the red vertical lines indicate long cycle troughs. The exact dates of these turning points are as follows (where M = month). Energy: 1981:M1, 1998:M12, 2008:M7. Metals: 1974:M4, 2001:M12, 2008:M6. Food: 1977:M4, 2001:M11, 2011:M2. Raw materials: 1973:M9, 2002:M1, 2011:M2. See Appendix 4.1 for a full description of the underlying data.

growth in emerging market economies over the past decade.[1]

Looking ahead, given the weak global activity and heightened downside risks to the near-term outlook, commodity exporters may be in for a downturn (see Chapter 1). If downside risks to global economic growth materialize, there could be even greater challenges facing commodity exporters, most of which are emerging and developing economies (Figure 4.2). Conversely, if geopolitical risks to the supply of oil materialize, oil prices could rise temporarily, but the ensuing slowdown in global growth could lead to a decline in the prices of other commodities. This chapter addresses these concerns by asking the following questions:

- How is the economic performance of commodity exporters influenced by commodity price cycles? How do standard indicators such as real GDP growth, credit growth, and external and fiscal balance behave over the course of such cycles?
- What are the effects on exporters of commodity price fluctuations driven by unexpected changes in global activity?
- How should small, open commodity exporters shield their economies from commodity price swings? What is the role of fiscal policy? How should fiscal and monetary policy interact? How do the preexisting public debt level and other structural characteristics, such as the share of commodity exports in the economy, affect policy choices?

This chapter contributes to the policy debate in several ways. First, it sheds light on how exporters of different commodities—energy, metals, food, and agricultural raw materials—may have different sensitivities to commodity price cycles. It also recognizes that not all commodity price changes are alike in terms of their potential effects and identifies the economic effects of commodity market shocks driven by global activity.[2] Finally, using the IMF's workhorse Global Integrated Monetary and Fiscal model (GIMF), it assesses the optimal fiscal policy response to globally driven commodity price changes for small, open commodity exporters. This model-based analysis complements a related literature on the role of fiscal policy in commodity-exporting economies by distinguishing between the effects of global commodity price shocks that are demand driven from those that are supply driven. The analysis also highlights how the appropriate fiscal policy response depends on other prevailing policies and structural characteristics of the commodity exporter, as well as the implications of these domestically oriented policies for global economic stability.[3]

It is important to stress that macroeconomic stabilization in the face of commodity price volatility is only one of many policy priorities for commodity-exporting emerging market and developing economies. Others include resource exhaustibility, intergenerational equity, and Dutch disease challenges associated with resource discoveries. The relative priority of addressing various policy challenges depends on country-specific conditions, including the structure of the commodity endowment, institutional capacity, and the level of development.[4] Although we also consider the effects of permanent commodity price changes, a full-fledged analysis of optimal policies, given the whole gamut of cyclical and longer-term objectives of commodity exporters, is beyond the scope of this chapter.

The main conclusions of this analysis are as follows:

- Macroeconomic performance in commodity exporters tends to move with commodity price cycles. Economic activity and external and fiscal balances deteriorate (improve) during commodity price downswings (upswings), whether the latter entail long periods of falling (rising) commodity prices or shorter commodity price swings that last for only a few years. This behavior is generally

[1]See Heap (2005) and previous *World Economic Outlook* chapters (Chapter 5 in the September 2006 issue, Chapter 5 in April 2008, and Chapter 3 in October 2008).

[2]To do this we use a variant of the identification strategy in Kilian (2009); Kilian, Rebucci, and Spatafora (2009); and Kilian and Murphy (2010) for estimating the effect of global demand and commodity production shocks on crude oil, copper, coffee, and cotton prices.

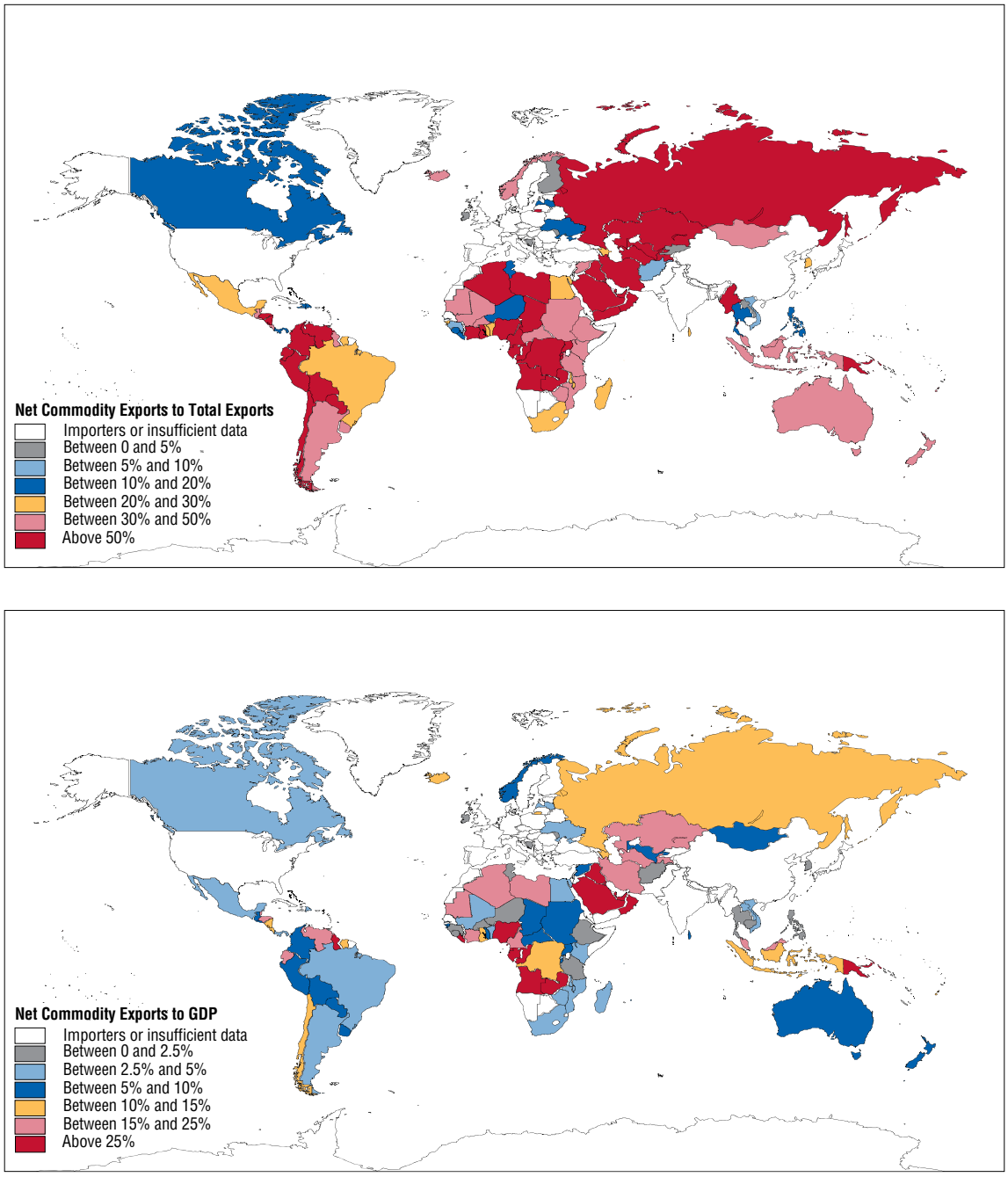
[3]See IMF (2009) and Baunsgaard and others (forthcoming) for a discussion of the role of commodity exporters' fiscal institutions in addressing macroeconomic stabilization against commodity price shocks.

[4]See Baunsgaard and others (forthcoming), Medas and Zakharova (2009), Deaton (1999), Collier and Goderis (2007), and Eyzaguirre and others (2011) for a discussion of some of these issues.

Figure 4.2. Share of Net Commodity Exports in Total Exports and GDP

(Percent)

Net commodity exports comprise a sizable share of total goods exports and GDP in many emerging market and developing economies.



Source: IMF staff calculations.
Note: These maps show the economy averages using the available yearly data for 1962–2010. See Appendix 4.1 for a full description of the underlying data.

more prominent for energy and metal exporters than for exporters of food and raw materials, possibly because energy and metal prices are more sensitive to the global business cycle and because they generally account for a higher share in total exports and GDP.

- The source of the commodity price change matters in terms of its economic effects on commodity exporters. In particular, commodity prices underpinned by unexpected changes in global activity (demand) have a significant effect on exporters' real activity and external and fiscal balances, while those driven by unexpected changes to global commodity production (supply) are not always significant. This effect is generally stronger for oil exporters than for exporters of other commodities.
- The optimal fiscal policy response to commodity price fluctuations for small commodity exporters is a countercyclical policy stance: save commodity-related revenue increases during upswings and use these buffers during downswings. Such a fiscal stance dampens the macroeconomic volatility arising from commodity price fluctuations.
- The effectiveness of a countercyclical policy stance, however, also depends on the degree of monetary policy autonomy—fiscal policy is more effective under an inflation-targeting regime with a flexible exchange rate because monetary policy helps reduce inflation volatility. It also depends on the level of public net debt—at high levels of debt, debt reduction should become a priority to help reduce the sovereign risk premium and build credibility. Furthermore, for some commodity market shocks and under some circumstances, a less countercyclical policy response in major commodity exporters might be the preferred solution from the perspective of collective action.
- Under permanent commodity price changes, the pivotal issue becomes how best to adjust to the permanently higher or lower commodity-related fiscal revenue levels. For a permanent price increase, increases in public investment and reductions in taxes on labor and capital boost private sector productivity and welfare. However, distinguishing between temporary and permanent commodity price changes is not a trivial exercise. This underscores the need to enhance policy frameworks and fiscal buffers, while gradually incorporating new information about the persistence of commodity prices.

What messages do these findings provide for commodity exporters? The weak global economic outlook suggests that commodity prices are unlikely to increase at the pace of the past decade. In fact, under the baseline *World Economic Outlook* projections, commodity prices are forecast to decline somewhat during 2012–13 (see Chapter 1). Sizable downside risks to global growth also pose risks of further downward adjustment in commodity prices. In contrast, if oil prices were to rise sharply as a result of greater supply-side concerns, this could unexpectedly depress global demand and eventually lower the prices of all other commodities. If prices were to enter such a cyclical downswing, commodity exporters would likely suffer, given historical patterns. A number of commodity exporters are ready to handle such a downswing, having strengthened their policy frameworks over time or having already adopted operating principles to guide fiscal policy. Others should use the opportunity presented by strong prices to lower debt levels, strengthen institutions, and build fiscal room to support a timely countercyclical policy response in the event of a commodity price downswing.

What are the lessons for the longer term? Commodity prices may be experiencing a long upswing and prices may stay close to current historic highs.[5] Alternatively, they may retreat in response to increasing user efficiency and the unwinding of earlier supply constraints. Given the unusual uncertainty and the difficulty of projecting commodity market prospects in real time, the best approach is a cautious one that builds buffers to address cyclical volatilities and gradually incorporates new information to allow a smooth adjustment to potentially permanently higher commodity prices.[6]

The chapter is structured as follows. The first section presents stylized facts on domestic economic

[5]See the Commodity Market Review in Chapter 1, and Erten and Ocampo (2012).

[6]These conclusions are not without precedent. Frankel (2011) underscores the need for commodity exporters to avoid procyclical fiscal policy that exacerbates economic volatility. Baunsgaard and others (forthcoming) stress the importance of designing fiscal frameworks that gradually incorporate new information.

indicators during commodity price swings. The second discusses the economic effects of commodity market shocks. The third examines the optimal policy responses to commodity price changes. The final section summarizes and concludes.

Commodity Price Swings and Macroeconomic Performance

How does commodity exporters' economic performance relate to commodity prices?[7] This question is examined in two parts. First, we focus on performance during the two most prominent recent commodity price booms (periods of sustained increases in commodity prices)—the early 1970s and the 2000s—and the intervening period of slumping commodity prices during the 1980s and 1990s.[8] This exercise sheds light on how commodity exporters' performance relates to the level of commodity prices. Next, we study regular commodity price swings and cycles during the past 50 years. This sheds light on any comovements between exporters' economic conditions and commodity price cycles, regardless of the underlying trends in prices. These descriptive analyses uncover useful correlations between global commodity price cycles and domestic economic indicators, without implying any causal relation between the two. Differences are highlighted across four distinct commodity groups—energy, metals, food (and beverages), and agricultural raw materials. These groups differ across many dimensions—in terms of the basic structure of the underlying markets, the nature of the commodity (for example, renewable versus exhaustible resource bases), and their association with global activity (for example, metals and energy are more important for industrialization and infrastructure building, and as such their prices may be more strongly correlated with the global business cycle than the prices of food and agricultural raw materials). We also focus on one major commodity from each of the four groups—crude oil (energy), copper (metals), coffee (food), and cotton (raw materials)—so as to study whether the broad patterns observed for commodity groups also hold at the commodity-specific level.[9]

Economic Performance Leading into Commodity Price Booms and Slumps

Commodity exporters experienced stronger macroeconomic performance during the 1970s and 2000s, when commodity prices were high in real terms, compared with the 1980s and 1990s, when prices were weak (Table 4.1).[10] Real GDP growth for the median commodity exporter was 1½ to 3½ percentage points higher during the 1970s and 2 to 4 percentage points higher during the 2000s, compared with the interim period.[11] In addition, despite higher commodity prices, consumer price index (CPI) inflation was lower during both booms compared with the interim period, when many exporters experienced crises and struggled to achieve macroeconomic and financial stability.

Energy and metal exporters appear to have fared relatively better during the recent decade compared with the 1970s. They achieved strong gains in real GDP growth and sizable reductions in inflation during the past decade. The latter may represent a shift toward inflation targeting among emerging and developing economies in the 2000s, including among commodity exporters (Brazil, Chile, Colombia, South Africa, and Thailand, among others).[12] These economies also reduced their public debt levels considerably during the

[7]We define commodity exporters as those whose share of net exports of the commodity (or commodity group) in total goods exports is at least 10 percent. See Appendix 4.1 for details.

[8]We focus on three long stretches in commodity prices over the past 50 years (see Figure 4.1 and Radetzki, 2006): the run-up to the peak in the mid-1970s (energy prices peaked in the 1980s); the subsequent protracted slump until 2001 (energy prices troughed in 1998); and the rebound thereafter.

[9]These commodities are also notable as being relevant among the commodities within their groups for the largest number of commodity exporters in the sample (that is, the largest number of commodity exporters with at least a 10 percent share of net exports of these commodities in total goods exports).

[10]Throughout, we use real commodity prices for the study: the global U.S. dollar–denominated commodity prices are deflated by the U.S. CPI. See Appendix 4.1 for details.

[11]For each indicator, we take the cross-sample median value of the country averages.

[12]See Heenan, Peter, and Roger (2006) and Roger (2010) for cross-country evidence on the adoption of inflation targeting. Batini and Laxton (2005) find that emerging and developing economies that adopted inflation targeting made significant progress in anchoring inflation and inflation expectations.

Table 4.1. Average Economic Performance of Net Commodity Exporters, 1970–2010

	1970s Boom	1980–2000 Slump	2000s Boom	Average 1960–2010
		Real GDP Growth (percentage points)		
Net Energy Exporters	5.6	2.5	4.6	4.3
Net Metal Exporters	5.6	2.2	6.4	3.5
Net Food Exporters	5.1	2.9	4.5	4.0
Net Raw Material Exporters	5.0	3.3	5.3	4.3
		Differential in Real GDP Growth Relative to Emerging and Developing Noncommodity Exporters (percentage points)		
Net Energy Exporters	1.1	–0.8	–0.8	0.5
Net Metal Exporters	2.0	–1.8	0.5	–0.4
Net Food Exporters	0.6	–0.8	–0.6	0.2
Net Raw Material Exporters	1.4	–0.6	0.2	0.5
		Level of Public Debt to GDP (percent of GDP)		
Net Energy Exporters	31.3	63.9	24.1	44.4
Net Metal Exporters	36.2	52.7	27.3	52.4
Net Food Exporters	21.9	78.7	37.4	50.0
Net Raw Material Exporters	33.6	80.2	34.5	57.4
		Change in Public Debt to GDP (percentage points; increase = deterioration)		
Net Energy Exporters	0.7	1.1	–4.5	–0.4
Net Metal Exporters	1.5	1.2	–4.0	–0.4
Net Food Exporters	0.8	1.5	–3.9	0.4
Net Raw Material Exporters	0.1	1.7	–5.9	–0.3
		Average Inflation (percentage points)		
Net Energy Exporters	8.6	14.4	6.6	12.5
Net Metal Exporters	8.4	22.5	9.2	16.1
Net Food Exporters	6.4	13.2	7.3	10.7
Net Raw Material Exporters	4.6	12.4	6.8	10.1

Source: IMF staff calculations.

Note: Unless indicated otherwise, numbers represent the median value of the averages over the relevant period, except for the level of public debt to GDP, which is the median end-of-period value. Commodity exporters are those whose share of net exports of the particular commodity (or commodity group) in total goods exports is at least 10 percent; noncommodity exporters are those whose share is less than or equal to zero. See Figure 4.1 for the exact dates that mark the long cycles for each commodity group. Because the underlying data for the table are annual, the dates are rounded to the nearest year.

recent decade, relative to the 1970s boom.[13] Finally, only in the 2000s was there a marked improvement in average fiscal balances—proxied by the change in the public-debt-to-GDP ratio—for exporters in all commodity groups; there was none in the 1970s.

Macroeconomic policies in commodity exporters appear to have continued to improve during the 2000s. We examine the behavior of economic indicators in commodity exporters in three snapshots from the past decade—at the beginning of the boom, at mid-decade, and at the end of the decade (Table 4.2).[14] Inflation and public debt levels fell sharply through the 2000s, notwithstanding the Great Recession. In contrast, the overall and cyclically adjusted fiscal balance improved until mid-decade but deteriorated toward the end of the decade. The deterioration in fiscal positions in 2010 is likely related to fiscal action in response to the global crisis. Moreover, policies and economic conditions interacted such that despite the deterioration in fiscal balances, some debt reduction was accomplished by commodity exporters by the end of the decade.[15]

[13]We use the change in public debt to GDP as a proxy for fiscal position because the cyclically adjusted primary balance is not available for many countries over the period between 1960 and 2010. We also do not have data on noncommodity real GDP for all the commodity exporters in the sample, which could better gauge economic performance outside the commodity sector.

[14]Note that prices of energy and metal commodities peaked in 2008, while those of food and agricultural materials crested in 2010.

[15]Empirical analysis of the fiscal stance in commodity producers during commodity price cycles is relatively recent (compared

Table 4.2. Economic Performance of Net Commodity Exporters during the 2000s

	2001	2005	2010	Average 2001–10
		Public Debt to GDP (percent)		
Net Energy Exporters	59.8	38.7	20.7	41.1
Net Metal Exporters	52.7	41.1	36.4	47.6
Net Food Exporters	78.7	65.8	37.4	54.5
Net Raw Material Exporters	80.2	52.9	34.5	53.9
		Change in Public Debt to GDP (percentage points)		
Net Energy Exporters	–1.0	–6.7	–1.8	–4.2
Net Metal Exporters	–7.1	–7.6	–0.8	–3.0
Net Food Exporters	1.5	–5.4	–0.4	–3.4
Net Raw Material Exporters	–1.0	–6.5	–0.3	–4.8
		Overall Fiscal Balance (percent of GDP)		
Net Energy Exporters	–0.9	0.7	–1.3	–0.7
Net Metal Exporters	–1.8	0.8	–0.4	–0.9
Net Food Exporters	–3.4	–2.1	–2.1	–1.8
Net Raw Material Exporters	–2.6	–2.4	–2.3	–2.1
		Cyclically Adjusted Fiscal Balance (percent of potential GDP)		
Net Energy Exporters	2.5	0.3	–2.2	–0.9
Net Metal Exporters	0.8	–0.2	–3.1	–1.6
Net Food Exporters	–3.2	–2.6	–2.6	–3.2
Net Raw Material Exporters	–4.8	–1.6	–3.1	–2.6
		Inflation (percentage points)		
Net Energy Exporters	4.9	7.4	4.7	7.5
Net Metal Exporters	8.4	7.9	6.9	8.6
Net Food Exporters	5.7	7.2	4.8	7.7
Net Raw Material Exporters	5.1	6.9	5.3	7.0
		Change in Log Real Effective Exchange Rate (times 100)		
Net Energy Exporters	3.2	1.5	0.3	1.5
Net Metal Exporters	1.3	2.9	1.5	0.8
Net Food Exporters	1.6	2.2	–2.1	0.9
Net Raw Material Exporters	1.6	0.4	–2.8	1.0

Source: IMF staff calculations.

Note: Unless indicated otherwise, numbers represent the median value within the sample for the relevant year. Commodity exporters are those whose share of net exports of a particular commodity group in total goods exports is at least 10 percent.

Economic Performance during Shorter Commodity Price Swings

With some evidence of a positive correspondence between macroeconomic performance and commodity price booms and slumps, we now turn to the consequences of shorter-term commodity price cycles. To do this, we identify turning points in real prices within each commodity group from 1957 to October 2011.[16] This exercise yields more than 300 completed cycles for 46 commodities, with a median (average)

with studies that assess the procyclicality of fiscal policy with output cycles). See Chapter 3 in the September 2011 *Regional Economic Outlook—Western Hemisphere*; Medina (2010); and Kaminsky (2010) for procyclicality in Latin American commodity producers' fiscal policies, especially among lower- and middle-income economies. Céspedes and Velasco (2011), however, find that fiscal policies in commodity exporters (encompassing a wider group) have become less procyclical in the 2000s.

[16]Drawing on Cashin, McDermott, and Scott (2002), we use the Harding and Pagan (2002) methodology to identify peaks and troughs in the time path of real commodity prices. A candidate turning point is identified as a local maximum or minimum if the price in that month is either greater or less than the price in the two months before and the two months after. The sequence of resulting candidate turning points is then required to alternate between peaks and troughs. Furthermore, each phase defined by

upswing duration of 2 (2½) years and a median (average) downswing of 2½ (3) years. An average downswing entails a decline in real prices (from peak to trough) of 38 to 52 percent, with price changes sharper for energy and metal prices (see Appendix 4.2). The relationship between key economic indicators during commodity price upswings and downswings is summarized below.

With few exceptions, indicators of commodity exporters' domestic economic performance tend to move with commodity price cycles—improving during upswings and deteriorating during downswings. This pattern is observed for each of the four commodity groups. Moreover, the difference in economic performance across downswings and upswings tends to be amplified when cycles last longer and/or when they entail sharper price changes than average. Specifically:[17]

- *Real GDP* (Figure 4.3, panels 1 and 2): Across the four groups of commodity exporters, median real GDP growth is ½ to 1¼ percentage points lower during downswings than during upswings.
- *Credit growth* is 1 to 2 percentage points lower during typical downswings than during upswings for energy and metal exporters, while the difference is sharper for food exporters at 6 percentage points (Figure 4.3, panels 3 and 4).[18]
- *External balances* (Figure 4.3, panels 5 and 6): The current account balance deteriorates during downswings compared with upswings. The sharpest difference is for energy exporters, whose current account falls from a surplus of ¾ percent of GDP in an upswing to a deficit of 2¼ percent of GDP in a downswing. For all commodity exporters, the differences are larger when the underlying price phase lasts longer or price changes are sharper than during a typical phase. Thus, weaker terms of trade resulting from lower commodity export prices more than offset any positive demand effect from the lower price of the commodity.
- *Fiscal balances* (Figure 4.3, panels 9–12): The fiscal position is weaker in downswings compared with upswings. We present two measures of the fiscal position—change in the public-debt-to-GDP ratio and the overall fiscal balance.[19] These measures point to a deterioration in fiscal balance of ½ to 4 percentage points of GDP in downswings relative to upswings, with greater variation in energy and metal exporters.
- *Financial stability:* More commodity price downswings than upswings are associated with banking crises in commodity exporters (Table 4.3).
- *The real effective exchange rate (REER)* is generally stronger in the course of a commodity price upswing compared with a downswing (Figure 4.3, panels 7 and 8). The cumulative percentage change in the REER during an upswing (from trough to peak) is typically greater than during a downswing (from peak to trough). This variation is particularly remarkable for energy and metal exporters, whereas the pattern is not observed for food exporters.[20]

The pattern of cyclical synchronization in macroeconomic indicators and commodity prices becomes muddier for individual commodities within the commodity groups (Figure 4.4).

- *Activity:* Procyclical behavior in real GDP growth is more prominent for oil and copper exporters compared with coffee and cotton exporters. The stronger comovement of economic activity and commodity price cycles could reflect the greater

the turning points (upswing or downswing) is required to be at least 12 months in length. See Appendix 4.2 for details.

[17]The macroeconomic variables are studied for each phase (upswing or downswing) using three characteristics—cross-country median for the entire phase, median when the phase is in the top quartile in terms of duration (long swings), and median when the phase is in the top quartile in terms of amplitude (sharp swings). We also compared mean values (instead of median values) for the macroeconomic indicators across alternative commodity price swings. The pattern is the same, with slightly larger differences in variation between upswings and downswings.

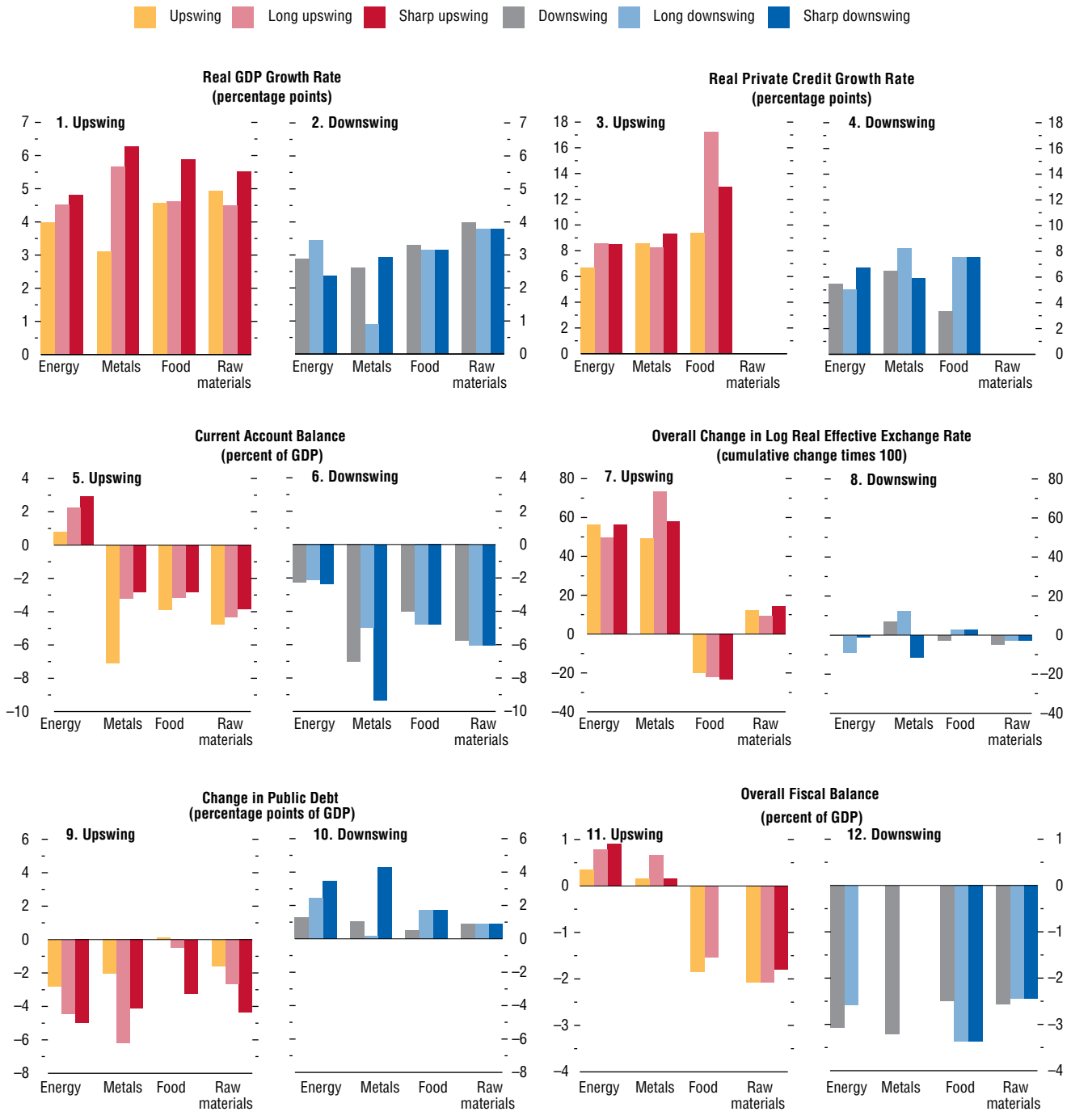
[18]We do not have sufficient data on credit growth for raw materials exporters.

[19]The data coverage for the change in public debt is more comprehensive than for the overall fiscal balance.

[20]This is consistent with the empirical literature. For instance Chen, Rogoff, and Rossi (2010) find that commodity exporters' real exchange rates are higher during periods of increasing commodity prices. However, the average growth in the REER during a commodity price upswing is not always greater than its average growth in a downswing (not shown here), which is a bit puzzling. We offer two possible explanations. First, the REER (like the other variables analyzed) is affected not only by changes in commodity prices but also by underlying policies and other factors, none of which are identified or controlled for in this exercise. Second, there may be some overshooting of the REER in the beginning of an upswing, which unwinds somewhat during the rest of the phase, resulting in average growth of the REER that is not necessarily stronger in an upswing relative to a downswing.

Figure 4.3. Macroeconomic Performance of Commodity Exporters during Commodity Price Swings

Commodity exporters' economic performance moves in tandem with commodity price swings.



Source: IMF staff calculations.

Note: Each bar shows the median value of the economy-level averages within the relevant sample for each variable. Long swings are in the top quartile by duration, and sharp swings are in the top quartile by amplitude. Bars appear only if there are at least three years of data for at least three economies, and therefore bars are missing when these criteria are not met. See Appendix 4.1 for a full description of the underlying data.

Table 4.3. Relationship between Commodity Price Swings and Banking Crises in Commodity Exporters
(Number of observations)

	Net Energy Exporters		
	No Banking Crisis	Banking Crisis	Total
Upswing	409	67	476
Downswing	399	77	476
Total	808	144	952

	Net Metal Exporters		
	No Banking Crisis	Banking Crisis	Total
Upswing	262	25	287
Downswing	340	49	389
Total	602	74	676

	Net Food Exporters		
	No Banking Crisis	Banking Crisis	Total
Upswing	433	83	516
Downswing	825	168	993
Total	1,258	251	1,509

	Net Raw Material Exporters		
	No Banking Crisis	Banking Crisis	Total
Upswing	520	46	566
Downswing	492	105	597
Total	1,012	151	1,163

Source: IMF staff calculations.

Note: The table shows the cross tabulation of the indicated commodity price index phase with banking crises in the associated group of net commodity exporters. Observations are economy-years. The banking crisis indicator comes from Laeven and Valencia (2008, 2010). See Appendix 4.1 for a full description of the data.

importance of oil and copper in their exporters' economic activity—average net exports of oil to GDP are more than 20 percent and more than 10 percent for copper. For exporters of coffee and cotton, net exports to GDP average between 3 and 4 percent.

- *External balance:* The current account balance is procyclical in all commodity exporters, and the differences between upswings and downswings are amplified when the underlying cycle is longer or the price changes are sharper.
- *Fiscal balance:* The comovement of fiscal balances and commodity cycles is more prominent for exporters of crude oil and copper than for exporters of food and raw materials.

Commodity Price Cycles and Policy Regimes

Having established that domestic commodity exporters' economic conditions move with commodity price cycles, we next examine whether this comovement is dampened or accentuated under alternative policy regimes in commodity exporters. In particular, we focus on the nature of the exchange rate regime (pegged versus nonpegged) and the degree of capital account openness (relatively high versus low). As before, these basic correlations should not be misinterpreted as a causal link between structural characteristics and comovement of economic conditions and commodity price swings.

Exchange rate regime

The cyclical variability in macroeconomic indicators is slightly stronger with pegged exchange rate regimes relative to flexible regimes, especially for energy and metal exporters (Figure 4.5). Under pegged regimes, output growth falls more sharply during downswings for all except raw material exporters, while the current account balance differences are sharper for exporters of metals and energy. Conceptually, a fixed exchange rate can reduce economic volatility by limiting exchange rate fluctuations, but it is also unable to absorb external shocks, including changes in real commodity prices. We find weak evidence of the latter effect dominating for energy and metal exporters.[21]

Capital account openness

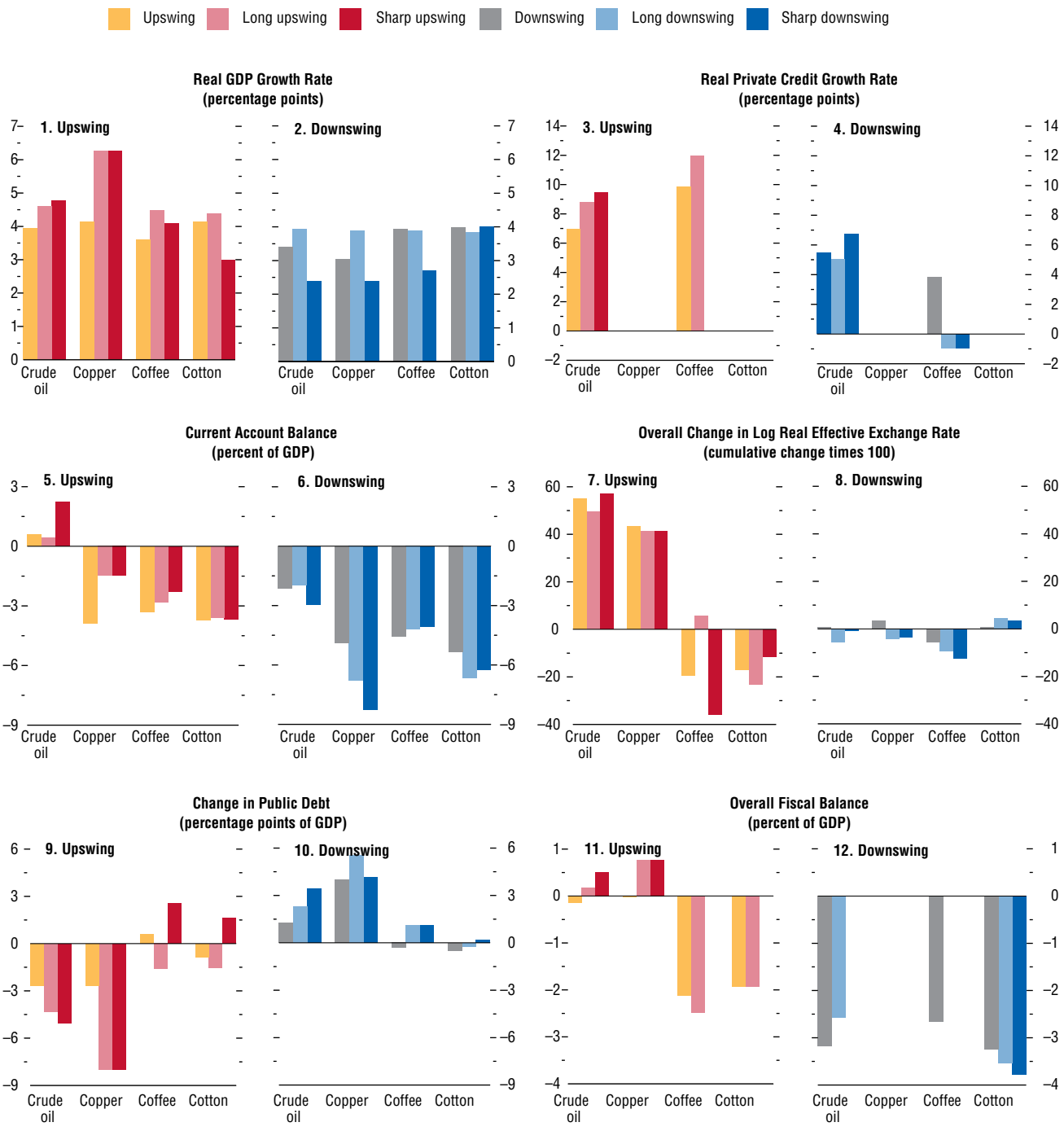
There is more comovement of macroeconomic indicators with commodity price cycles under greater capital account openness for energy and metal exporters but not for other commodity exporters (Figure 4.6). Overall, there may be offsetting forces at play. Economies with greater access to international capital markets should be better able to smooth output volatility when commodity prices fluctuate—for instance, by borrowing in international markets during downswings. Markets may, however, be procyclical for some—with capital flows increasing during commodity price upswings and declining during downswings.[22] The latter force appears to dominate for energy and

[21]See Rafiq (2011) for evidence from the Gulf Cooperation Council oil exporters, and Adler and Sosa (2011) for Latin American commodity exporters.

[22]Adler and Sosa (2011) find evidence of this procyclicality for Latin American commodity exporters.

Figure 4.4. Macroeconomic Performance of Exporters of Four Major Commodities during Commodity Price Swings

The comovement with commodity price cycles of domestic economic indicators is stronger for exporters of oil and copper than of coffee and cotton.

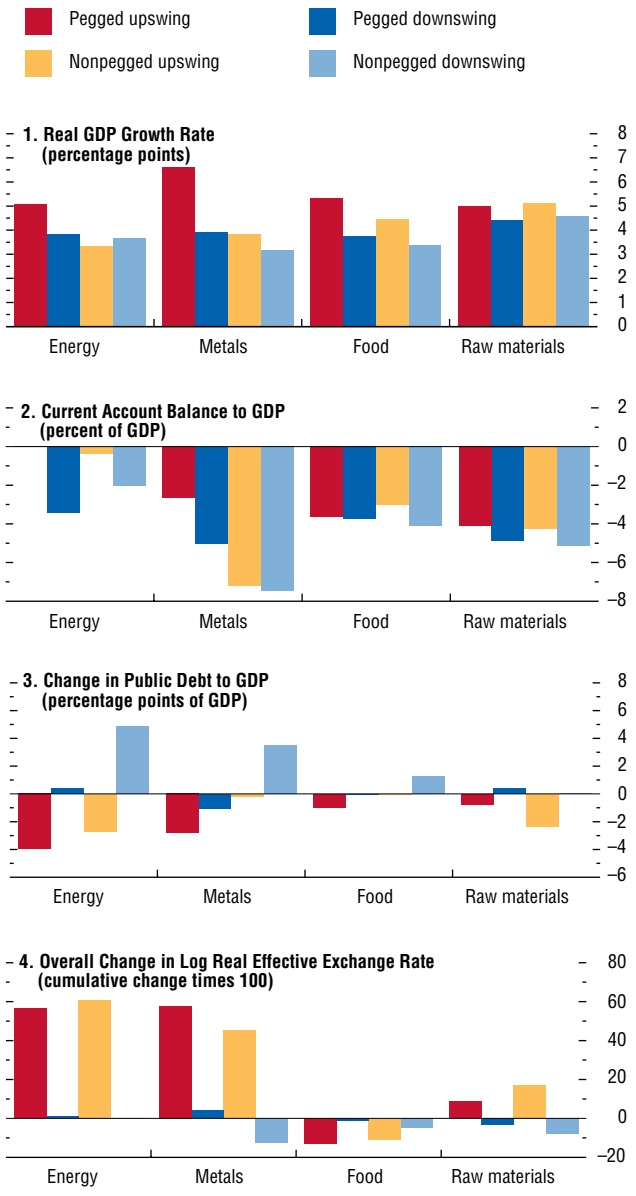


Source: IMF staff calculations.

Note: Each bar shows the median value of the economy-level averages within the relevant sample for each variable. Long swings are in the top quartile by duration, and sharp swings are in the top quartile by amplitude. Bars appear only if there are at least three years of data for at least three economies, and therefore bars are missing when these criteria are not met. See Appendix 4.1 for a full description of the underlying data.

Figure 4.5. The Exchange Rate Regime and Exporter Performance during Commodity Price Swings

The comovement of economic indicators with commodity price cycles is greater under pegged exchange rates for energy and metal exporters.



Source: IMF staff calculations.

Note: Each bar shows the median value of the economy-level averages within the relevant sample for each variable. Bars appear only if there are at least three years of data for at least three economies. Exchange rate regimes are from the "coarse" classification system in Ilzetzki, Reinhart, and Rogoff (2008), updated to 2010. See Appendix 4.1 for a full description of the underlying data.

metal exporters, but not for exporters of food and raw materials.

To sum up, the macroeconomic performance of commodity exporters is closely related to commodity price swings. This procyclical behavior with respect to commodity prices is accentuated when commodity price swings last a long time or involve sharp price changes. There are, however, considerable differences among commodity exporters. Energy and metal exporters are typically more synchronized with commodity price swings than exporters of food and raw materials, and their macroeconomic variation with commodity price swings tends to be more pronounced under fixed exchange rate regimes and greater capital account openness.

The generally sharper differences in macroeconomic performance between upswings and downswings for energy and metal exporters compared with food and agricultural commodities exporters may reflect in part steeper price changes for energy and metals compared with food and agricultural raw materials. But more generally, the above correlations do not control for policies that may dampen or accentuate the comovement between economic conditions and commodity price cycles. For instance, energy and metals generally carry larger royalties than other commodities, which, if spent during upswings, would reinforce the comovement of economic indicators with commodity price swings.

Commodity Market Drivers and Their Macroeconomic Effects

How does an unanticipated deterioration in the global economic outlook affect commodity prices and commodity exporters? To answer this question, this section first identifies how shocks to global economic activity affect commodity prices and then estimates the macroeconomic effects on commodity exporters.

Commodity Market Drivers

Using a structural vector autoregression (VAR) model of the global commodity markets for crude oil, copper, cotton, and coffee, we identify the contribution of global economic activity and commodity production shocks to commodity price fluctuations. The remaining (unaccounted for) fluc-

tuations in the price reflect other factors that cannot be precisely identified but are likely a combination of commodity-specific demand factors and expectations about future global production and demand.[23]

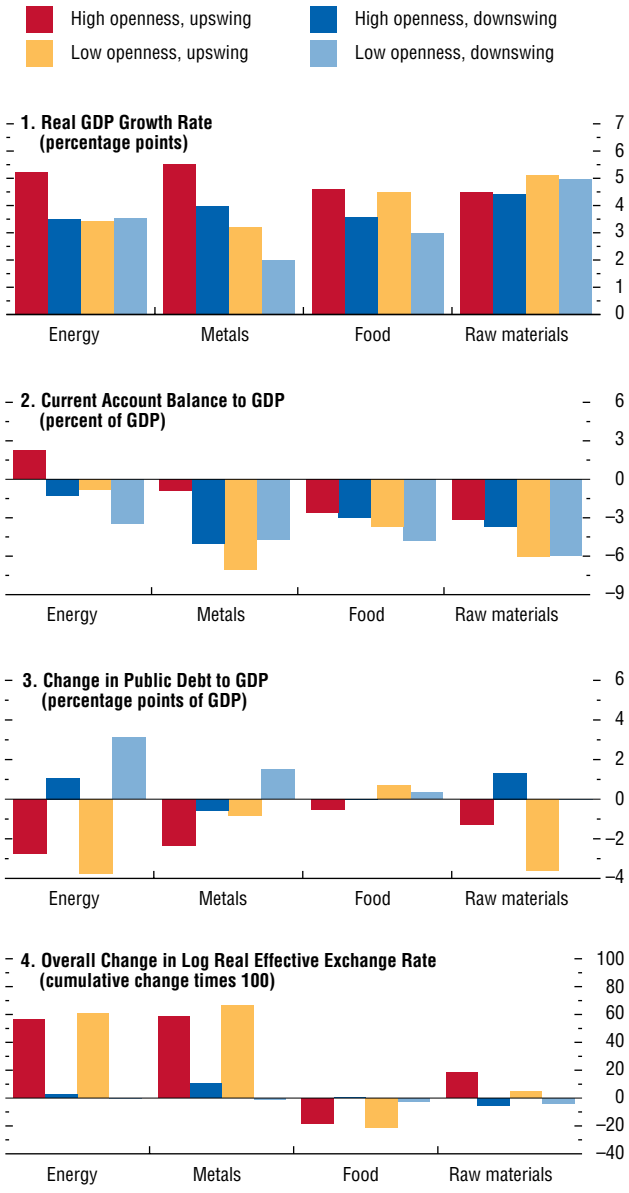
Global demand shocks have a positive effect on the prices of all commodities except coffee (Table 4.4). A 1 standard deviation positive global demand shock (equal to a 0.6 percent rise in the monthly global industrial production index for oil and a 0.75 percent rise for copper) increases the real price in the impact year by 3.5 percent for oil and 2.4 percent for copper. For cotton, a 1 standard deviation rise in global demand, proxied by an increase in global real GDP of 0.8 percent, increases cotton prices by 0.7 percent. The positive effect of the global demand shock remains significant even after three years following the impact for crude oil and cotton prices.

In contrast, although global production shocks result in price movements in the opposite direction, the effect is not significant for any commodity except coffee. A 1 standard deviation positive production shock increases annual production by 7 percent for coffee and 4 percent for cotton in the same year. The average increases in monthly production for oil and copper are 0.5 and 1 percent, respectively. The negative price effect of this production increase is significant for coffee only,

[23]The VARs for oil and copper are estimated at monthly frequency, while those for coffee and cotton use annual data due to data limitations. See Appendix 4.3 for details on the baseline model and robustness checks. Examples of production shocks include unpredictable weather events, such as floods and droughts that adversely impact yields (for food and raw materials); production disruptions from unanticipated equipment breakdowns or work stoppages (for energy and metals); and unexpected technological breakthroughs that boost production. An example of a global activity shock includes a sudden fall in global activity due to an unanticipated hard landing in a systemically important country. Conversely, examples of commodity-specific shocks include a preference shift for coffee over tea (as happened over the past decade), gradual improvements in the intensity of commodity usage, and changes in expectations about future production and global activity. Thus, production or activity changes that are either wholly or partially anticipated would be in the unexplained component of the price, matched to the time at which the news about the forthcoming change is first received rather than at the time it actually occurs. An example of such an anticipated production shock might include the recent case of Libya, where political turmoil was expected to disrupt oil production and thereby the global oil supply, which pushed oil prices up in advance. Similarly, an anticipated increase in demand for commodities because of an ongoing real-estate-driven growth boom in China would push up commodity prices in advance.

Figure 4.6. Capital Account Openness and Exporter Performance during Commodity Price Swings

There is some evidence of greater comovement between economic indicators and commodity price cycles under greater capital account openness for energy and metal exporters.



Source: IMF staff calculations.

Note: Each bar shows the median value of the economy-level averages within the relevant sample for each variable. Bars appear only if there are at least three years of data for at least three economies. An economy is classified as having high openness if its Chinn and Ito (2006, 2008) capital account openness measure is greater than or equal to the grand median of the sample. Otherwise, it is classified as having low openness. See Appendix 4.1 for a full description of the underlying data.

Table 4.4 Dynamic Effects of Global Commodity Market Shocks

		Commodity Production		Global Activity		Real Commodity Price	
Commodity	Shock	On Impact	At 3 Years	On Impact	At 3 Years	On Impact	At 3 Years
Oil	Production	0.488†	0.263	0.024	0.059	–1.098	1.975
	Global Activity	0.128†	–0.080	0.610†	0.215	3.526†	3.693†
Copper	Production	0.949†	0.696†	–0.031	–0.076	–0.873	–2.106
	Global Activity	0.305†	0.229	0.752†	0.475†	2.414†	0.693
Coffee	Production	6.933***	1.767	–0.144	–0.163	–1.050*	–1.481
		(0.731)	(1.175)	(0.156)	(0.321)	(0.557)	(1.252)
	Global Activity	. . .	2.393*	1.041***	1.162***	0.517	–1.466
		. . .	(1.263)	(0.110)	(0.328)	(0.544)	(1.319)
Cotton	Production	4.149***	0.095	0.370***	0.425	–0.038	–0.296
		(0.437)	(1.059)	(0.132)	(0.345)	(0.369)	(0.536)
	Global Activity	. . .	–3.005**	0.848***	1.320***	0.693*	1.410**
		. . .	(1.178)	(0.089)	(0.373)	(0.361)	(0.614)

Source: IMF staff calculations.

Note: Since the oil and copper commodity market models are at monthly frequency, the average effect over the corresponding year is shown for these commodities. A dagger is placed next to the statistic if at least 50 percent of the underlying statistics are individually significant at the 10 percent level. Standard errors are in parentheses underneath their corresponding estimate for the results from the annual frequency vector autoregression. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively. The thought experiment is a 1 standard deviation rise in the commodity's global production shock or a 1 standard deviation rise in the global activity shock at the relevant frequency. No value is shown when the indicated shock is restricted to have no contemporaneous effect. See Appendix 4.3 for further details.

whose price falls by 1 percent on impact, and is not significant for the others. The result is contrary to the literature for oil, which argues that historical oil price shocks are largely underpinned by global supply.[24] This likely implies that historical supply disruptions in oil markets were mostly anticipated in advance. Conversely, weather-related supply shocks may be harder to predict than shocks to energy and metal supplies, resulting in more significant effects on prices of agricultural commodities, such as coffee.[25]

These findings demonstrate that not all commodity price effects are alike, and much depends on the source of the shock and the type of commodity. More important, changes in commodity prices driven by unexpected movements in global activity can be significant.

Domestic Macroeconomic Effects of Global Commodity Market Shocks

How do global-activity-driven commodity market shocks affect commodity exporters? We answer this question by estimating a dynamic panel model of the economic effects of alternative commodity market drivers for exporters of each commodity.[26] As described above, we are able to identify two types of underlying shocks that drive commodity price changes—shocks to global activity (demand) and shocks to global production of the commodity (supply). The following panel model is estimated by commodity for each set of exporters:[27]

$$Y_{i,t} = \alpha_i + \delta Y_{i,t-1} + \sum_{k=0}^{1}\sum_{j=0}^{2}(\beta_{k,j}u_{t-k,j} + \theta_k W_{i,t-k} + \varphi_{k,j}W_{i,t-k}u_{t-k,j}) + \eta_{i,t}, \quad (4.1)$$

where $Y_{i,t}$ is the macroeconomic variable of interest for economy i at time t. We focus on real GDP, current account balance as a ratio of GDP, and change in public debt to GDP. α_i is an economy-specific fixed effect, $u_{t,j}$ is the jth commodity market shock of interest at time t, $W_{i,t}$ is economy i's commodity exposure at time t, expressed as a lagged three-year moving average of net exports of the commodity to the economy's total GDP, and $\eta_{i,t}$ is a mean-zero error term. The interaction terms allow for the possibility

[24]See for instance Hamilton (2011). However, Kilian (2009) and Kilian and Murphy (2010) hold the opposite view.

[25]The fact that global demand does not significantly affect coffee prices may reflect their greater sensitivity to beverage-related preferences as well as low income elasticity (Bond, 1987).

[26]Commodity price movements can also have serious implications for commodity importers, many of which are low-income countries (LICs). While the chapter mainly focuses on exporters, Box. 4.1 provides a synopsis of the varying effects of food and fuel price increases on LICs.

[27]In the sample, each net commodity exporter's average share of net exports of the commodity to total goods exports over the entire sample period is at least 10 percent.

that the effects of commodity market variables vary with the economy's reliance on commodity exports.

The results confirm that global demand-driven commodity shocks have significant economic effects on commodity exporters (Figure 4.7; Table 4.5). This is not surprising, as global activity surprises may affect the demand for all goods. A diversified exporter of commodities will therefore face an increase in demand for all its exports. Specifically:

- A positive global activity shock improves economic conditions for all commodity exporters via real GDP growth or external balances or both. For oil, a typical global demand shock that increases the price of oil increases real GDP of net oil exporters by close to 0.4 percent in the impact year, while for coffee the increase is 0.6 percent (Table 4.5).[28] The real GDP effects for oil and coffee grow over the next three years, remaining positive and significant. For the remaining cases, the growth effects of demand shocks are not significant. However, there are significant improvements in the current account balance for all commodity exporters, and this effect remains significant even after three years for exporters of all commodities. Global demand shocks improve fiscal balances only for oil exporters, with the effect growing over a three-year horizon.
- In contrast, it is not surprising that a negative global production shock for the commodity, which increases its price, does not always have a significant economic effect. This is because a negative global production shock can be partially driven by a negative domestic production shock, or can result in a fall in global GDP, which could partly or fully offset the positive effect from the stronger terms of trade (as observed for copper and cotton).

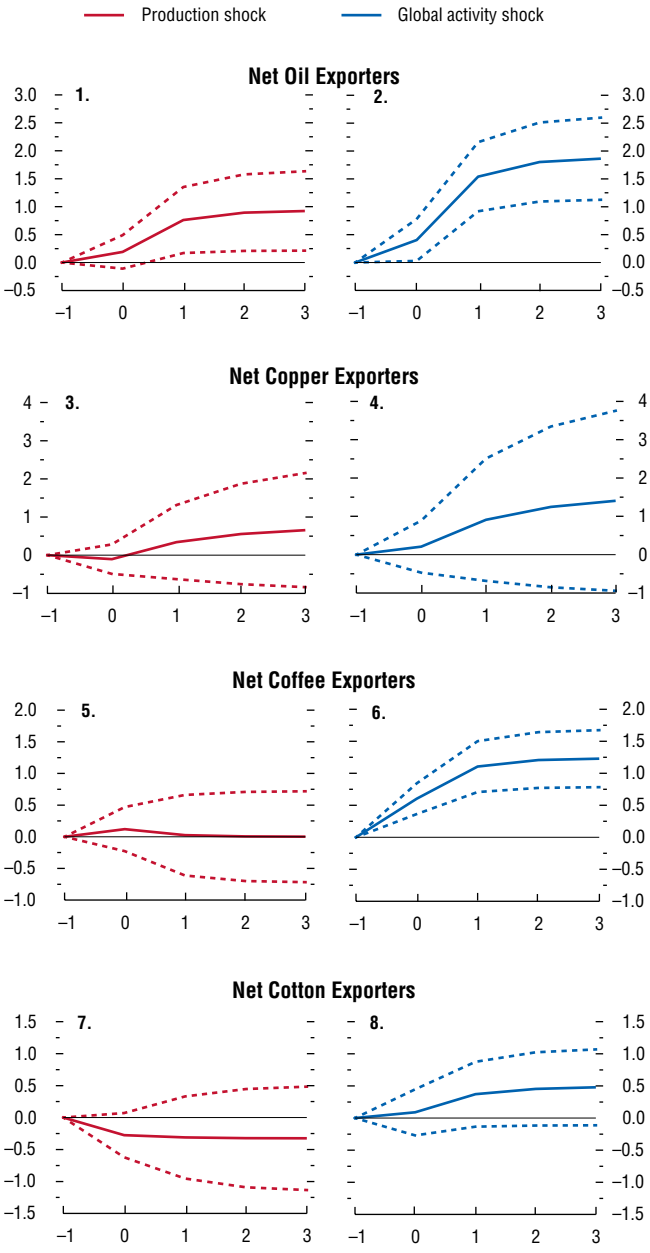
How do the above economic effects of global activity versus global production manifest themselves over the entire phase of a commodity price upswing or downswing? To find out, we draw on the VAR model to separate the oil price upswings that are

[28]Note that a typical global demand (or production) shock for the case of oil and copper prices represents the annual average of the monthly structural shocks in the monthly VAR model. See Appendix 4.3 for details on using these results to obtain an estimate of the implied elasticities of real GDP with respect to price increases at an annual frequency.

Figure 4.7. Real Output Effects of Commodity Market Shocks

(Percent response)

Global demand-driven commodity price shocks can have significant economic effects on commodity exporters.



Source: IMF staff calculations.

Note: The *x*-axis shows the number of years elapsed, where time zero is the year that the shock occurs. The sample consists of net commodity exporters, where net exports of the commodity to total goods exports is at least 10 percent. Dashed lines denote 90 percent confidence bands. Shock magnitudes are a 1 standard deviation annual global production shock decline or annual global activity shock increase. See Appendix 4.3 for a description of the vector autoregression model used to estimate the underlying global activity and production shocks.

Table 4.5. Domestic Macroeconomic Effects of Global Commodity Market Shocks

		Real GDP		Current Account to GDP		Change in Public Debt to GDP	
Commodity	Shock	On Impact	At 3 Years	On Impact	At 3 Years	On Impact	At 3 Years
Oil	Production	0.191	0.923**	0.510	2.802	–1.990***	–4.316***
		(0.182)	(0.432)	(0.329)	(1.851)	(0.671)	(1.043)
	Global Activity	0.404*	1.862***	0.840***	5.458***	–1.333***	–3.269***
		(0.228)	(0.448)	(0.230)	(0.980)	(0.395)	(0.433)
Copper	Production	–0.104	0.658	0.098	–1.253**	0.984	–0.094
		(0.235)	(0.908)	(0.287)	(0.576)	(0.675)	(1.077)
	Global Activity	0.210	1.406	1.049**	2.486***	0.338	–0.851
		(0.412)	(1.428)	(0.549)	(0.952)	(0.752)	(1.191)
Coffee	Production	0.121	0.001	0.220	0.532	2.873*	0.860
		(0.212)	(0.437)	(0.237)	(0.560)	(1.657)	(1.090)
	Global Activity	0.603***	1.229***	0.364*	1.589*	4.579	6.128
		(0.146)	(0.270)	(0.217)	(0.915)	(4.192)	(5.895)
Cotton	Production	–0.275	–0.325	–0.399	–1.153	2.854	1.697
		(0.210)	(0.491)	(0.324)	(1.124)	(3.718)	(2.176)
	Global Activity	0.090	0.479	1.258*	4.110***	0.469	–0.435
		(0.218)	(0.359)	(0.648)	(1.588)	(2.074)	(1.464)

Source: IMF staff calculations.

Note: Standard errors are in parentheses underneath their corresponding estimate. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent levels, respectively. The thought experiment is a 1 standard deviation annual global production shock decline of the commodity or a 1 standard deviation annual global activity shock rise. For oil and copper, the shocks are the average of the monthly shocks within a year, as taken from the model underlying Table 4.4, described in Appendix 4.3. The dynamic effects shown here are evaluated at the sample average value of the commodity exposure measure (net exports of the commodity of interest to GDP): for oil, this is 22.9 percent; for copper, 10.3 percent; for coffee, 4.2 percent; and for cotton, 3.2 percent.

driven predominantly by global demand from those that are driven primarily by changes in global production.[29] The results are summarized in Figure 4.8.

- The cyclical economic effect of oil price swings is somewhat larger when driven by global demand. The difference in real GDP growth between a typical upswing and a downswing is 1 percentage point for a demand-driven oil price cycle, compared with about 0.5 percent for all oil price cycles on average. The variation in the current account balance and the cumulative REER appreciation under a demand-driven oil price upswing relative to a downswing is similar to that observed in all oil price cycles on average.
- The fiscal position improves less during demand-driven oil price upswings relative to downswings. The fiscal balance proxied by the annual change in the public-debt-to-GDP ratio improves by about 2½ percentage points of GDP during a global demand-driven upswing (compared with an improvement of close to 4 percentage points of GDP for all oil price cycles on average). This may reflect a tendency for oil exporters to have a less countercyclical (or more procyclical) fiscal response to global demand shocks than to other shocks, which in turn could explain the greater domestic economic variation in response to demand-driven oil price cycles.

Distinguishing between the underlying sources of commodity price swings does matter, as these drivers have different price and macroeconomic effects for different commodity exporters. Overall, the economic effects of global activity shocks are significant for commodity exporters. These effects are strongest for crude oil, but also hold for other exporters. Oil exporters experience somewhat greater variation in real activity from global demand-driven oil price cycles than from other types of oil price cycles. These findings do not, however, shed light on how commodity exporters should respond to global commodity shocks to minimize their domestic economic effects. These questions are addressed in the next section.

Optimal Fiscal Policy Responses to Commodity Market Shocks

How should commodity exporters respond to commodity price fluctuations? The role of macroeconomic policies in lowering economic volatility may be more important for commodity exporters given the persistence and volatility of commodity price swings. As noted, a typical downswing in oil and metal prices

[29]Such a clear separation of demand-driven from production-driven price cycles is not possible for the other commodities. See Appendix 4.3 for details.

can last two to three years, can entail a real price decline from peak to trough of 40 to 50 percent, and can induce a setback in real GDP growth of ½ to 1 percentage point. In this regard, the role of fiscal policy may be crucial, given the direct effect of commodity prices on government coffers, and through the latter's actions, on the rest of the economy.[30]

This section focuses on the optimal fiscal policy response to commodity price fluctuations in a small, open commodity exporter and its interaction with monetary policy through the choice of exchange rate regime. Although the model is calibrated for oil, as discussed below, the qualitative results are equally applicable to other commodities. The section analyzes how the optimal fiscal policy choice is affected by the source of commodity price fluctuations, differences in underlying macroeconomic conditions, and structural characteristics of the commodity exporter. Recognizing some of the limitations of the model-based analysis, we also discuss possible trade-offs between optimal policies at the country versus the global level for the case of large commodity exporters, given the possibility for spillover of their policies. We also consider the optimal fiscal response to permanent commodity price changes. Finally, we consider how commodity exporters can best design their policies in light of prevailing uncertainty about the future direction of commodity prices.

The Setting

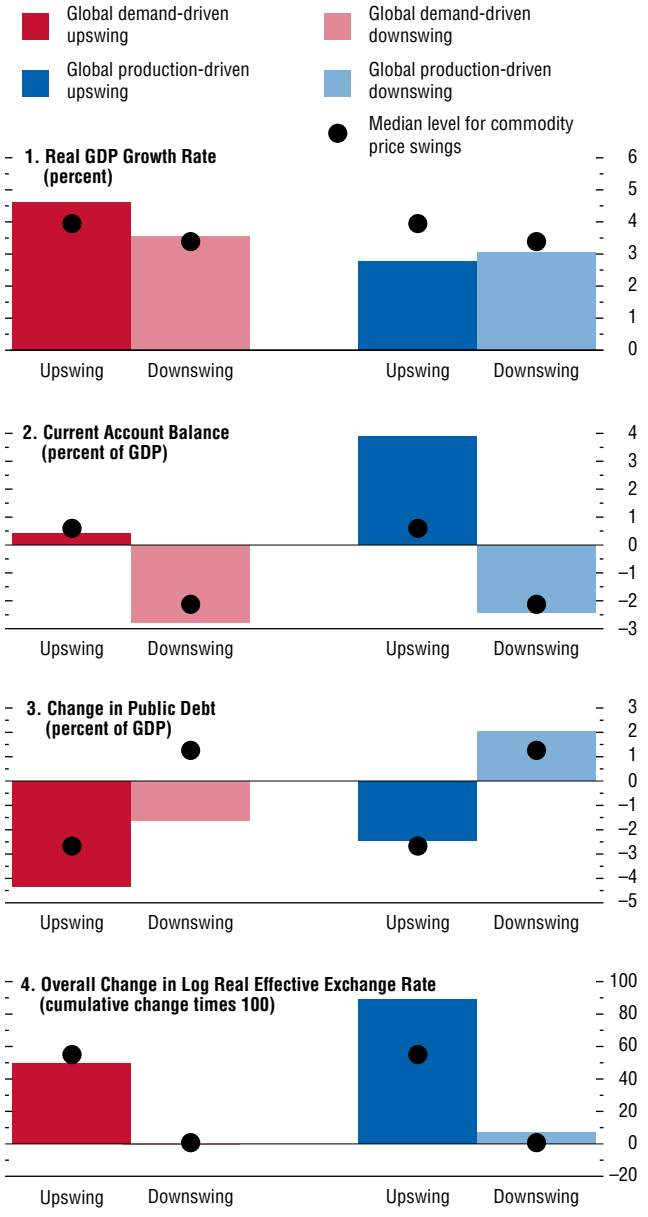
We use a two-region version of the Global Integrated Monetary and Fiscal model (GIMF) comprising a small, open oil exporter and the rest of the world, which is a *net* oil importer.[31] The small, open oil exporter takes the global oil price as given. It exports the bulk of its oil production, with net oil exports equivalent to 18 percent of its GDP and

[30]The empirical evidence, however, points to fiscal policies being procyclical, thereby exacerbating domestic volatility. For instance, Husain, Tazhibayeva, and Ter-Martirosyan (2008) find that fiscal policy reactions to oil price shocks raise real domestic volatility. As noted, Frankel (2011) argues that commodity exporters are too procyclical in their macroeconomic policies, while Céspedes and Velasco (2011) find that there may have been a decline in procyclical fiscal policies in commodity exporters in recent years.

[31]See Appendix 4.4 for details.

Figure 4.8. Oil Price Drivers, Cycles, and Performance in Net Oil Exporters

Global demand-driven oil price cycles lead to greater macroeconomic volatility.



Source: IMF staff calculations.

Note: The black circles denote the sample median level during upswings and downswings, without taking into account their underlying driver. There are two production-driven oil price swings: a downswing (1996:M1–1998:M12) and an upswing (1999:M1–2000:M9). There are four demand-driven price swings: two downswings (1990:M10–1993:M12 and 2000:M10–2001:M12) and two upswings (1994:M1–1996:M10 and 2002:M1–2008:M7). See Appendix 4.1 for a full description of the underlying data. See Appendix 4.3 for a description of the vector autoregression model used to estimate the underlying global activity and production shocks.

representing 45 percent of its total exports.[32] This structure implies that a global demand-driven shock would affect the oil exporter not only through a change in the price of oil, but also through a change in the demand for other goods it exports (thereby allowing for Dutch-disease-type effects). The exporter is populated by households with overlapping generations as well as liquidity-constrained households, to more realistically capture the effects of fiscal policy. The government can borrow in international capital markets but faces a risk premium that is increasing with the level of its net external debt.[33] In the baseline, we also assume that (1) oil production is largely controlled by the government, which accrues most of the associated rent (through "commodity royalties"); (2) net public debt is relatively small, and the sensitivity of the sovereign risk premium to its changes is low; and (3) monetary policy follows an inflation-targeting regime, with a floating nominal exchange rate. These assumptions are relaxed in subsequent robustness analyses.

The fiscal policy stance is modeled through rules that target the government budget balance to minimize output and inflation volatility. Specifically, in each period the fiscal policy authority sets a fiscal instrument in response to deviations of non-oil tax receipts relative to their long-term level and deviations of commodity royalties from their long-term level. For example, if the global oil price and tax receipts temporarily rise unexpectedly, commodity royalties temporarily increase above their long-term levels and the fiscal authority may adjust the fiscal instrument in response. The specific instrument used is the labor tax rate, which is chosen for simplicity and does not constitute a policy recommendation. Also, policy conclusions do not depend on this choice. We consider three broad stances:

- *A balanced budget rule:* Under such a rule, the government budget is balanced in every period, so all exceptional commodity royalties and tax revenues are redistributed immediately to households through lower tax rates. This rule is procyclical by design but maintains fiscal balance and net debt at long-term targets.
- *A structural surplus rule:* Under this rule, exceptionally high commodity royalties and tax revenues are saved, while exceptionally low royalties and revenues result in dissavings (thereby avoiding increases in tax rates to offset the loss). This rule results in a one-for-one change in the overall fiscal balance and government debt in response to deviations of royalties and tax revenues from their long-term values. It is cyclically neutral, since it does not add to or subtract from aggregate demand.
- *A countercyclical rule:* Under this rule, the fiscal authority not only saves exceptionally high commodity royalties and tax revenues, but also increases taxes to dampen the stimulus to aggregate demand from higher oil revenue accruing to the private sector. In the case of exceptionally low royalties and tax revenues, taxes are lowered temporarily. This rule implies larger changes in budget surpluses and government debt in response to oil price changes. However, it acts countercyclically, increasing (reducing) the structural balance during periods of strong (weak) oil prices and/or economic activity.

In practice, fiscal policy behavior in a number of commodity exporters has been broadly influenced by rules of this kind. Chile and Norway have even adopted specific rules along the lines of those used in the model simulations. Chile follows a structural surplus rule, which allows for the presence of automatic stabilizers. Norway's rule targets a structural non-oil balance and also allows for the possibility of countercyclical responses over the business cycle.[34]

Response to Temporary Commodity Price Shocks

To compare the effects of the three fiscal policy stances, we analyze the results from simulations based on two oil-price-shock scenarios. In the first, the oil

[32]This is similar to the average shares for oil exporters in the sample (see Appendix 4.1).

[33]Net debt takes into account any positive foreign asset position (such as a sovereign wealth fund).

[34]Over the past two decades, there has been a marked increase in the adoption of rules-based fiscal policy, expressed through some concept of the fiscal balance or its components (revenue and/or expenditure) and/or the debt level. Fiscal rules are currently in use in some form in more than 65 countries. See IMF (2009).

price increases in response to unexpected increases in global activity. In the second, the increase is due to a negative shock to global oil production. In both scenarios, the shocks are calibrated to result in comparable oil price increases (close to 20 percent after one year). Also, the persistence of the oil price increases is about three years—within the distribution of the duration of oil price cycles in the empirical analysis.

We find that the effects of oil price increases on the domestic economy differ according to whether they are driven by external demand or external supply conditions, in line with the empirical results.

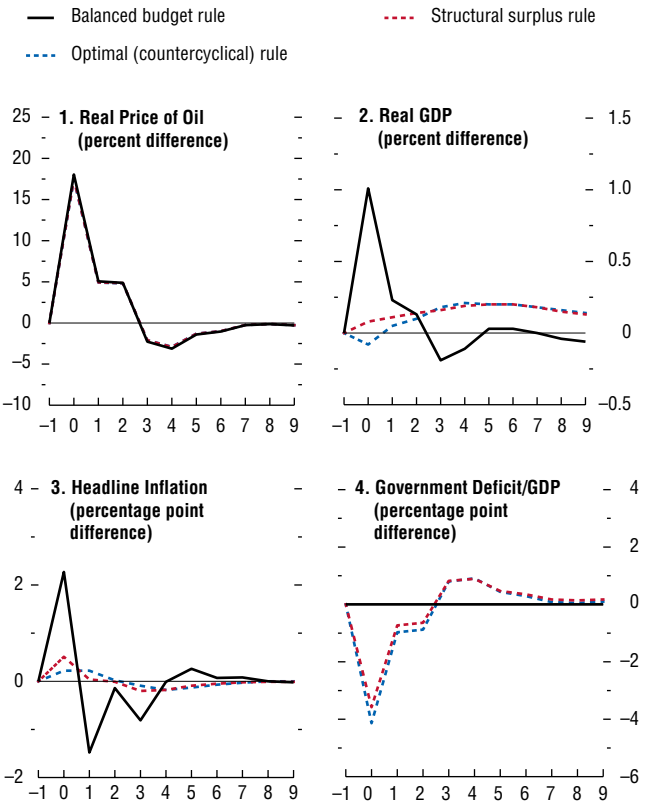
For the external supply-driven oil price increase, a temporary decline in oil supply in the rest of the world increases the real price of oil by 20 percent in the first year. The price gradually falls over the next two years (Figure 4.9). As the rest of the world's GDP declines so does real external demand for all goods exported by the small, open oil exporter. However, the fall in external demand is offset by an increase in the real value of the economy's oil exports, which improves its trade balance. Despite the increase in headline inflation resulting from higher oil prices, depressed global demand reduces the real price of final goods and in fact causes core inflation to fall. This is mitigated in part by slightly more stimulative monetary policy.

For the external demand-driven oil price increase, a temporary increase in liquidity in the rest of the world boosts global demand, driving up the real price of oil by about 20 percent in the first three years, after which global demand unwinds. Oil prices also experience a boom-bust cycle. Unlike a supply-driven oil price shock, the global demand boom drives up the demand and prices of *all* the small, open economy's exports.

For both shocks, a fiscal policy stance that aims at a balanced budget exacerbates macroeconomic volatility relative to the structural and countercyclical stances (Figures 4.9 and 4.10). Under a balanced budget rule, the excess tax revenues and oil royalties obtained during the boom are spent via a decline in labor taxes. Conversely, when the oil price increase unwinds, the fall in tax revenues and royalties is offset by an increase in labor taxes. In either direction, there is an increase in the output gap and in inflation volatility. With a structural surplus rule, the excess

Figure 4.9. Dynamic Effects of a Temporary Reduction in Oil Supply in the Rest of the World on a Small, Open Oil Exporter

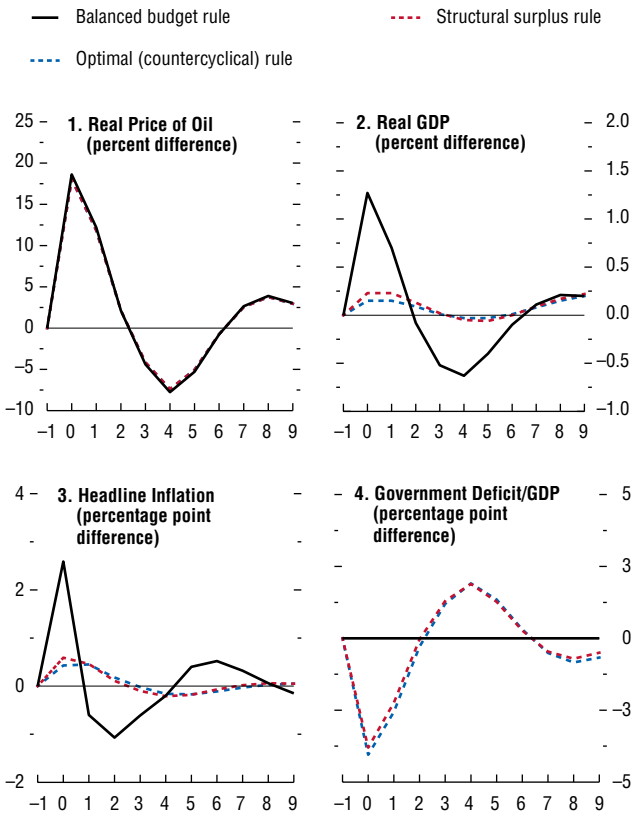
A balanced budget fiscal policy in response to a global supply-driven oil price increase elevates domestic macroeconomic volatility in the oil exporter. A countercyclical fiscal response is the best way to reduce this volatility.



Source: IMF Global Integrated Monetary and Fiscal Model.
Note: The *x*-axis shows the number of years elapsed, where time zero is the year that the shock occurs. See Appendix 4.4 for a description of the model.

Figure 4.10. Dynamic Effects of a Temporary Increase in Liquidity in the Rest of the World on a Small, Open Oil Exporter

Domestic economic volatility induced by a global demand-driven oil price increase is even greater than that of a global supply-driven increase. In either case, a countercyclical fiscal policy dominates the balanced budget policy in terms of minimizing the volatility.



Source: IMF Global Integrated Monetary and Fiscal Model.
Note: The *x*-axis shows the number of years elapsed, where time zero is the year that the shock occurs. See Appendix 4.4 for a description of the model.

revenues and royalties during the price boom are saved, resulting in no change in labor taxes and a fall in the debt-to-GDP ratio. Conversely, these revenues are allowed to fall short of their potential levels when the boom unwinds. In either direction, the structural surplus rule helps dampen inflation and output volatility relative to a balanced budget rule.[35] Under a countercyclical rule, the labor tax rate rises with the boom, helping further dampen demand and inflation. Conversely, the labor tax rate is reduced when the boom unwinds, mitigating the fall in demand. Thus, a countercyclical rule reduces the output gap and inflation volatility more than a structural surplus rule under both types of cyclical commodity price shocks and constitutes the optimal fiscal response to them both. In the simulations, the size of countercyclical responses to the temporarily high royalties is quite small. This largely reflects the assumption that most of the oil royalties accrue to the government, which in turn implies that insulating the economy from changes in government oil revenues is broadly sufficient for macroeconomic stabilization.

Alternative Policy Frameworks and Structural Characteristics

The result that a countercyclical fiscal policy stance is optimal is generally robust to alternative assumptions about policy regimes and structural characteristics. Nevertheless, there are some nuances to consider (Figure 4.11).

Fixed exchange rate regime

Under a fixed exchange rate regime, the fiscal authority's countercyclical response to oil price shocks must be more aggressive. The main reason is that it lacks the support of the monetary authority, which, unlike under an inflation-targeting regime, is not complementary but procyclical in its response to commodity price shocks. For example, in the case of an unexpected oil price increase, the monetary policy stance is relaxed to offset the upward pressure on the nominal exchange rate. This feature is reminiscent of the empirical regularity that the comovement of the

[35]This is consistent with the findings of Kumhof and Laxton (2010), who find that a structural surplus rule can reduce macroeconomic volatility for a small copper exporter such as Chile.

domestic economy with the commodity price cycle is stronger with pegged exchange rates, as discussed earlier.[36]

Initial debt levels

The size of the countercyclical response might also reflect initial public net debt levels, depending on how strongly the sovereign risk premium reacts to changes in the level of net debt. In an alternative simulation with an initial net debt level of 100 percent of GDP (compared with the baseline of 30 percent), changes in the net debt level due to countercyclical policy responses can lead to a substantial change in the sovereign risk premium and hence domestic interest rates. In the case of an unexpected oil price drop, for example, a strong countercyclical response would result in a substantial increase in the risk premium due to higher public net debt, which would induce a sharp contraction in private domestic demand. This latter effect could be strong enough to fully offset the initial expansionary fiscal policy response.[37] Thus, at high levels of net debt, a higher priority is placed on reducing debt and building fiscal credibility prior to adopting a countercyclical fiscal response.

Different ownership structure in the oil sector

If there is a higher share of domestic private ownership in the oil sector, the saving behavior of households matters.[38] Assuming that a higher share of private sector oil royalties goes to households that can smooth their consumption by saving more (compared with the case of public sector ownership, when the government distributes revenues in a broadly similar way across households that smooth their consumption and those that do not), the ensuing output and inflation volatility is lower than in the baseline case. However, it is still optimal to have

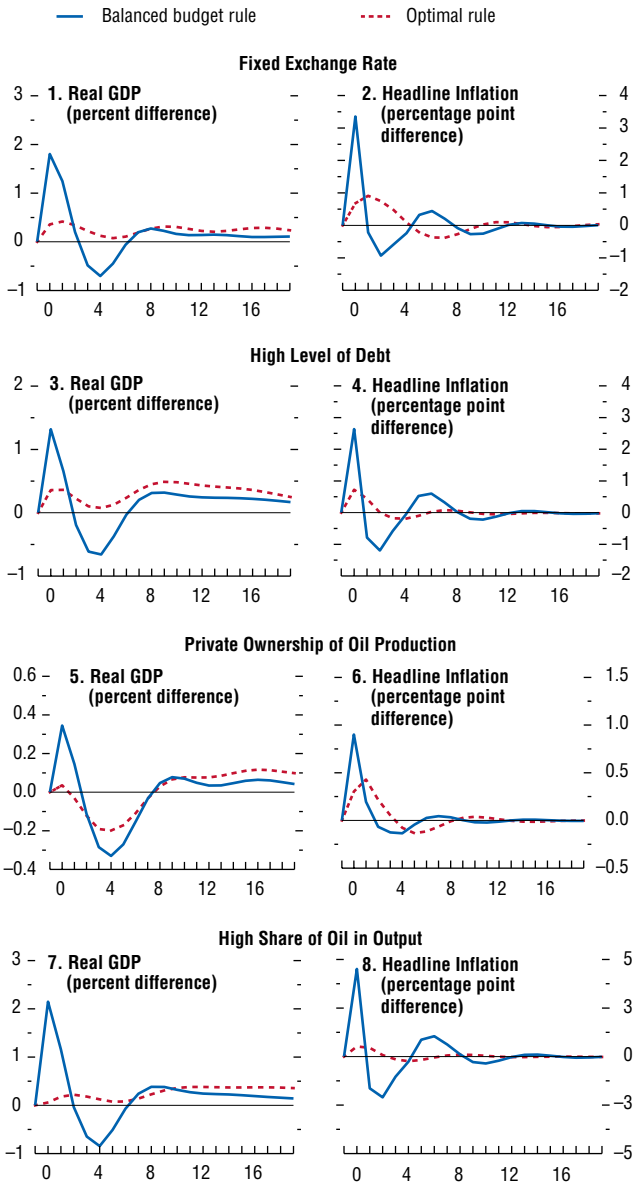
[36]See also Broda (2004) or Rafiq (2011).

[37]See also Demirel (2010), who finds that optimal fiscal and monetary policies are procyclical (countercyclical) in the presence (absence) of the country spread. IMF (2009) finds that for a sample of Organization for Economic Cooperation and Development (OECD) countries, fiscal rules were more effective when public debt ratios were below a certain threshold.

[38]In this scenario, the private sector is assumed to own 90 percent of the oil production, compared with the baseline case, in which it owned only 10 percent.

Figure 4.11. Optimal Fiscal Policy Stance under Alternative Policy Frameworks and Structural Characteristics

This figure compares the optimal fiscal rule to the balanced budget rule for a temporary increase in global liquidity (similar to Figure 4.10). A countercyclical fiscal policy is consistently optimal for alternative macroeconomic conditions or different characteristics of commodity exporters. The exception is when the risk premium is highly sensitive to the level of sovereign debt, in which case the optimal fiscal response is closer to a structural surplus rule.



Source: IMF Global Integrated Monetary and Fiscal Model.

Note: The *x*-axis shows the number of years elapsed, where time zero is the year that the shock occurs. Panels 1 and 2 show the case when the exchange rate regime is fixed. Panels 3 and 4 show the case where net public debt is 100 percent of GDP. Panels 5 and 6 show the case where the share of private ownership in total oil production is 90 percent. Panels 7 and 8 show the case where the ratio of net oil exports to GDP is 36 percent.

a countercyclical fiscal response, which mitigates output and inflation volatility more than the other fiscal rules.

Higher share of oil in production

If the oil sector accounts for a larger share of output,[39] it is optimal to have a countercyclical fiscal response only to the changes in tax revenues, while saving the changes in oil royalties. Even though there are spillovers from the oil revenues into the non-oil sector, the non-oil sector contributes less to overall demand fluctuations relative to the baseline. Also, given the much larger share of the oil sector in the economy, a more countercyclical fiscal response to the increase in oil royalties can cause output to fall. Thus, saving the difference in government oil royalties may be enough for macroeconomic stabilization.

Subsidies for oil consumption

Many oil producers implicitly subsidize gasoline consumption and oil in domestic production. Such subsidies reduce the pass-through of changes in the price of oil into headline inflation. However, output fluctuations are similar to those considered in the baseline model because of changes in oil royalties and their effect on the non-oil economy. Thus, a countercyclical fiscal rule is still preferred to a structural rule for smoothing output volatility. A full analysis of the desirability of these subsidies should take into account the long-term viability of these subsidies, which is beyond the scope of this chapter.

Non-oil commodities

The results of the model are easily applicable to commodities other than oil. Although specific parameter values in the simulations have been chosen to replicate features of oil exporters, there is nothing about the structure of the model that makes it relevant only for oil.[40] For example, our results are broadly similar to those of Kumhof and Laxton (2010) for the case of copper in Chile. The main difference is that oil price shocks might have larger effects on headline inflation compared with copper and other industrial raw materials, since oil is more important in the consumption basket. In contrast, for food, the difference in headline inflation might be even more pronounced. Intuitively, the optimal size of the countercyclical fiscal response therefore increases with a higher share of the commodity in the consumption basket.

These findings underscore the importance of countercyclical fiscal policy in commodity exporters to ameliorate domestic volatility induced by temporary global commodity price shocks. A countercyclical fiscal stance is preferred under both fixed and flexible exchange rate regimes but needs to work harder under fixed rates when monetary policy becomes procyclical. Moreover, for a countercyclical policy to be effective and credible, public net debt levels should be low. When commodity production comprises a large share of an economy's value added, the size of the countercyclical fiscal response is closer to that of a structural surplus rule.

Where do commodity exporters stand vis-à-vis the policy lessons above? In general, they have been moving in the right direction by reducing their debt levels and strengthening their fiscal balances, especially over the past decade. However, economies vary greatly when it comes to macroeconomic and institutional readiness to implement fiscal policies aimed at macroeconomic stabilization. Some effectively now operate under a structural or countercyclical fiscal rule or fiscal responsibility laws (Botswana, Chile) and/or have moved toward further enhancement of their monetary policy frameworks by adopting inflation targeting (Indonesia, South Africa, and many Latin American economies). Some have achieved large debt reductions over the past decade (many OPEC members) or are in the process of

[39]In this scenario, the share of net oil exports in total GDP is 36 percent, as in some members of the Organization of Petroleum Exporting Countries (OPEC), compared with the baseline of 18 percent.

[40]When it comes to quantifying the optimal fiscal policy response to cyclical commodity price fluctuations, the structure of commodity exporters matters, of course, because of differences in demand and supply price elasticities across commodities, the heterogeneity of commodity prices across regions, and the level of production rents. In addition, economies that are more diversified across commodities are less inclined to experience domestic fluctuations from global supply shocks compared with broad-based global demand shocks. Moreover, structural characteristics such as high commodity intensity in total production and public ownership are more applicable to metal and oil production than to agricultural commodities.

formalizing fiscal institutions.[41] For those that have yet to initiate policy reforms, the current strength of commodity prices offers a good opportunity to build additional fiscal buffers and to ready fiscal and monetary institutions for any unexpected cyclical downturn in commodity prices.

Global Spillovers from Domestic Policies in Commodity Exporters

Could there be trade-offs between the optimal response to temporary commodity price shocks from the perspective of individual economies and the optimal response from the perspective of global economic stability? The analysis of optimal policies in this chapter was based on the assumption that commodity exporters are small and their policies do not affect economic activity in the rest of the world, including commodity markets. While this is a reasonable assumption for most commodity exporters and commodities, it may not be realistic for some large exporters. For instance, some oil exporters account for a substantial share of global absorption, wealth, and spare oil production capacity. When a commodity exporter is large, its policies can generate spillovers to other economies. Similarly, broadly identical policy responses by a group of relatively large commodity exporters may also generate important spillovers. This, in turn, raises the question of whether such spillovers could change the advice about optimal responses to commodity price changes.

A comprehensive analysis of optimal policies for large commodity exporters is beyond the scope of this chapter since it would need to consider not only the type of shock but also policies of other large economies, including commodity importers. Instead, this section touches on the possible conflicts between policies that are optimal for large oil exporters from a domestic perspective and policies that are optimal from a global perspective in the case of a temporary oil supply shock. The backdrop to this discussion is the current concern about increased geopolitical risks to the supply of oil as a source of downside risks to the global economy. Policy responses of large oil exporters are thus an important consideration in the global response to such shocks (see Chapter 1).

A temporary oil supply shock would have asymmetric effects on oil exporters for whom oil is a dominant source of exports compared with oil importers as well as other oil exporters. For exporters whose main export is oil, the terms-of-trade gains from the increase in oil prices in response to a supply shock would dominate any negative effect from a fall in external demand. The optimal domestic fiscal response to the windfall revenue gain in a small, open oil exporter (that does not experience the supply shock) would be a countercyclical one. Such a response by large exporters, however, would not be helpful in offsetting the negative direct effects of the shock on aggregate demand of oil importers. As a result, global output growth could slow or fall further than it would without such policies in oil exporters.[42] However, in normal times, the increased saving by large oil exporters could lower global real interest rates and boost interest-sensitive components of aggregate demand in importers.

Do such spillovers from large oil exporters' policies change the policy advice? Not necessarily. In many cases, the countercyclical fiscal response for oil exporters is still likely to be optimal. Importers can respond to the supply shock with countercyclical policies of their own. Nevertheless, there could be circumstances where other policy choices might be more relevant—for example, when the policy room in importers is limited or when the global economic downturn is so deep or protracted that the ensuing falloff in global demand can ultimately depress prices for all commodities, including oil. Under such circumstances, the countercyclical response may not be optimal in the first place for large exporters.

What are the policy options under these circumstances? The best option (from a global perspective) would be increased oil production by oil exporters

[41]See Céspedes and Velasco (2011), IMF (2009), De Gregorio and Labbé (2011), Ossowski and others (2008), and Roger (2010).

[42]This trade-off between domestic and global economic stability arises only when the effects of commodity market shocks are asymmetric across different economies. Therefore, there is no relevant trade-off when commodity prices are driven by global activity, which affects commodity exporters and the rest of the world in similar ways.

unaffected by the initial supply disruption, if they have spare capacity. This would offset the shock and stabilize global oil markets. If oil supply increases are not feasible, a less countercyclical policy response in large oil exporters combined with supportive economic policies in major importers (where possible) could also help alleviate the negative effect of the oil price increase on global output. How large could this effect be? If major oil exporters opted to spend all of their revenue windfalls from a 50 percent hike in the price of oil on imports, then real demand in the rest of the world could rise by up to ¾ percentage point, not a negligible amount.[43]

Fiscal Response to a Permanent Increase in the Price of Oil

Besides cyclical fluctuations, commodity prices also display long-term trends. While these trends are difficult to forecast, they nevertheless point to the possibility that some price shocks may have a permanent component. The main difference with respect to temporary price rises is the fact that a permanent oil price increase will have a permanent effect on potential royalties and possibly even on potential output. This naturally leads to the question of how a permanent windfall in oil royalties should be used most efficiently to maximize potential output and overall welfare.

A permanent oil price increase raises many policy issues, including those related to equity across generations, and an exhaustive analysis of these issues is beyond the scope of the chapter.[44] Nevertheless, using the GIMF, we can examine which fiscal instrument is most effective in maximizing output and welfare. By exploring a relatively wide array of fiscal instruments, we complement previous work on this topic, which has focused primarily on the desirability of investing savings in foreign assets (Davis and others, 2001; Barnett and Ossowski, 2003; Bems and de Carvalho Filho, 2011) or domestic government investment (Takizawa, Gardner, and Ueda, 2004; Berg and others, forthcoming). It should be emphasized that this analysis is conducted for an oil exporter, but as noted, the results also apply to other commodities.

The fiscal policy options in response to a permanent increase in oil royalties are increases in public investment (such as public infrastructure), increases in household transfers, reductions in distortionary tax rates (such as those on labor and capital income), and reductions in debt levels or increases in sovereign wealth invested abroad. The key features of this model are the assumption that higher investment and lower taxes boost labor demand and that higher transfers lower the supply of labor, which is in line with the empirical evidence.[45] To evaluate these options, we analyze their effects on the new long-term equilibrium in the model, compared with the long-term equilibrium before the shock. Because the speed of the transition to the new equilibrium differs depending on the fiscal policy options, the results also include the net present value of each option in terms of household utility (Table 4.6). It is important to bear in mind, however, that the results depend on the choice of underlying model parameters. The parameters used in this model closely follow those in the literature, but the results could vary according to economy-specific characteristics.

Increased public investment has the strongest effect on output (see also Takizawa, Gardner, and Ueda, 2004). However, it is important to stress that the simulations do not account for low-quality governance and production bottlenecks, which could substantially impede the efficient conversion of resources into public capital (see Box 4.2). In addition, the benefits of public investment accrue only slowly because it takes time to build up public

[43]These calculations present an upper bound on the positive effects from spending increases by large oil exporters that account for more than one-third of global oil production (such as a majority of the OPEC producers together). We assume that these oil exporters' fiscal revenues increase proportionately with the oil price increase and that they channel all the windfall fiscal revenues back to the rest of the world via increased import demand. See Beidas-Strom (2011) for a related analysis of global spillover effects of fiscal spending by Saudi Arabia.

[44]Among these questions are resource exhaustibility, Dutch disease effects, bequest objectives, and exporting economies' institutional and development needs. See Box 4.2 for a discussion of some of these issues.

[45]See Eissa and Hoynes (2004) and Keane (2010). Another implicit assumption is that the original equilibrium was not already at the optimal capital and output levels due to prevailing distortions in the economy, a reasonable assumption for most developing economies.

Table 4.6. Comparison of Policy Instruments for Permanent Increases in Oil Royalties

	Real GDP (percent)	Real Consumption (percent)	Current Account (percent of GDP)	Debt-to-GDP Ratio (percent of GDP)	NPV of Utility (percent)
Reduction in Labor Taxes	1.7	9.7	0.8	0.0	24.6
Reduction in Capital Taxes	12.2	11.9	–0.6	0.0	25.1
Increase in General Transfers	–0.6	6.5	0.2	0.0	21.8
Increase in Government Investment	53.7	31.6	0.3	0.0	19.0
Reduction in Net Debt from Low Initial Debt Position	4.1	12.6	5.5	–109.0	12.8
Reduction in Net Debt from High Initial Debt Position	15.4	21.5	7.6	–109.0	20.1

Source: IMF Global Integrated Monetary and Fiscal Model.

Note: The first four columns show the difference between the new long-term level and the old long-term level of each variable. The last column shows the net present value (NPV) of household utility evaluated over the transition to the new steady state.

capital. As a result, the net present value of the expected utility flow is lower than under some other options, although this result depends on how much policymakers discount the future. The more patient a country's policymakers and citizens, the more beneficial the public investment option becomes.[46] An increase in general transfers to households—even though it raises household income and, thus, private consumption—negatively affects labor supply, thus reducing the total hours worked and output in the long term.

However, there are trade-offs between maximizing output and maximizing welfare, with the ultimate choice of the instrument depending on country-specific preferences. For instance, an increase in general transfers to households raises the net present value of utility (from increases in consumption and leisure) by more than an increase in public investment, even though the former has less of an output effect. The public welfare benefits of using resource revenues to pay off debt are significant only when a country's initial debt level is high and debt reduction significantly lowers the sovereign risk premium. In this case, the main benefit is to lower sovereign risk, which means the government can borrow at lower interest rates to finance investment and service its debt (see, for example, Venables, 2010). Lower borrowing costs stimulate demand, while the lower cost of servicing the debt increases fiscal room. In contrast, paying off a low amount of debt and then accumulating assets (for example, via a sovereign wealth fund) yields a relatively small return—namely, investment income from safe international assets. This might be a good option in response to prudential and intergenerational equity demands, but in this model context, where there is no uncertainty, accumulating low-yielding foreign asset positions offers lower benefits in terms of both output and welfare.

The effects of various fiscal policy instruments are almost the same whether prices rise or fall. This would argue for a cut in general transfers to minimize the output effects under a permanent decline in oil prices, as the model assumes that increases in transfers reduce the labor supply. However, if optimizing the net present value of utility by meeting social needs were a concern, then cutting transfers would not be optimal. Another option, if the economy started at a relatively low net debt position, would be to reduce holdings of assets, with relatively small negative effects on both output and household welfare. Conversely, cutting public infrastructure investment would be the least desirable fiscal response if the objective were to minimize the output shortfall from permanently lower commodity prices.

Conclusions and Policy Lessons

This chapter presents evidence of commodity exporters' vulnerability to swings in commodity prices. Historically, exporters' macroeconomic performance has fluctuated with commodity price cycles—improving during upswings and deteriorating during downswings. The comovement of domestic economic conditions with commodity

[46]We assume a 5 percent discount factor.

price cycles is amplified when the underlying cycles are longer or deeper than usual. When the underlying drivers of commodity price changes are identified, we find that global demand-driven commodity market shocks have a positive and significant effect on exporters' activity and external balances. For oil exporters, domestic economic indicators tend to vary with global demand-driven oil price cycles.

What are the policy implications for commodity exporters? If all commodity price swings were temporary, the optimal fiscal policy response for a small commodity exporter would be a countercyclical one—save the windfall fiscal revenue and royalties during price upswings and spend them during downswings to ameliorate the macroeconomic volatility induced by commodity price cycles. These policies are desirable under both fixed and flexible exchange rate regimes but are more effective under a flexible exchange rate combined with inflation targeting, when monetary policy complements fiscal policy by reducing inflation volatility. When public debt levels are high, however, the priority should be on lowering debt and sovereign risk premium to build credibility prior to adopting countercyclical fiscal policies. For large commodity exporters whose policies generate spillovers for others, the optimal policy response may depend on the nature of the shock and the state of the global economy. Thus, when global demand is weak and policy room in the rest of the world is limited, there may be a case for a less countercyclical fiscal policy response.

Under a permanent increase in the commodity price, the key challenge is how best to use the permanently higher royalties to maximize welfare. Changes in public investment expenditures give the strongest output effect by raising private sector productivity (for instance, via improvements in education, health, and infrastructure) and subsequently by increasing private capital, labor and corporate incomes, and consumption. Conversely, if prices were to fall permanently, cutting general transfers could best limit the output shortfall, although the social welfare impact of such cuts must be taken into account.

What messages do these findings provide for commodity exporters? In the near term they face a weak global economy. If downside risks to the global outlook materialize, commodity prices could decline further. Over the longer term, commodity prices are even more unpredictable. They may stay at their current levels in real terms if rapid commodity-intensive growth continues in emerging and developing economies. On the other hand, prices may decline in response to increasing user efficiency and the unwinding of earlier supply constraints. In light of the unusually high uncertainty and the difficulty of forecasting prospects for commodity markets in real time, a cautious approach is the best option. This involves upgrading policy frameworks and institutions and building buffers to address cyclical volatility while gradually incorporating new information to smooth the adjustment to potentially permanently higher prices.

Appendix 4.1. Data Description

Real Commodity Prices

Monthly data on commodity prices come mainly from the IMF's Primary Commodity Price System. All prices are period averages and are representative of the global market price because they are determined by the largest exporter of a given commodity. The key exception is the monthly oil price, which is the U.S. Energy Information Administration (EIA) import price of crude oil to refiners between January 1974 and August 2011. The price is extended backward through 1973 with Barsky and Kilian's (2002) imputed series value. All prices are denominated in U.S. dollars and, in line with other work (such as Cashin, McDermott, and Scott, 2002), deflated by the U.S. consumer price index (CPI) to obtain a real commodity price (CPI is taken from the St. Louis Federal Reserve Economic Data database, series CPIAUCSL). These real prices are then normalized such that the average real price in 2005 is equal to 100. Annual data on real commodity prices are calculated by taking the mean of the data at a monthly frequency for the corresponding year.

Exports and Imports by Commodity

Annual data on imports and exports used in the chapter are taken from the UN-NBER bilateral country and commodity-level merchandise trade flows database, which covers the period 1962–2000 (Feenstra and others, 2005). These data are extended

with the United Nations COMTRADE data from 2001–10, following the methodology described in Feenstra and others (2005) and using the Standard International Trade Classification (SITC) Version 2 to define trade in each commodity. These data are then aggregated to compute country-level total exports and imports and country-level exports and imports by commodity.

Commodity Price Indices

The four commodity group price indices (energy, metals, food and beverages, raw materials) are weighted averages of the real prices of the commodities within a group. The weight for each commodity is its once-lagged three-year moving average of total world exports of the commodity divided by total world exports of all commodities in the group.

Economy-Level Macroeconomic Variables

These data come largely from the World Economic Outlook (WEO) database: real output (series NGDP_R), nominal output in U.S. dollars (series NGDPD), the current account in current U.S. dollars (series BCA), the overall fiscal balance (GGXOFB), and the cyclically adjusted fiscal balance as a percent of potential GDP (series GGCB). The change in the public-debt-to-GDP ratio is taken from the Historical Public Debt database (Abbas and others, 2010). The real effective exchange rate is series EREER from the IMF's Information Notice System (INS) database, from 1980 to the present. We construct a comparable series for the years prior to 1980 by combining the INS weights with historical nominal, bilateral exchange rates. We take the growth rate of this constructed series and splice the original INS series using this growth rate as far back as possible. The underlying data for real private credit growth are the level of bank credit to the private sector in current local currency units, taken from line 22 of the IMF's International Financial Statistics (IFS) database. This private credit series is releveled whenever a level shift or break is observed in the series. These data are deflated using the economy's CPI to construct a real private credit level. The exchange rate regime indicator is taken from Ilzetzki, Reinhart, and Rogoff (2008). We collapse their coarse classification into a binary indicator, mapping their classes 1 and 2 to "fixed" and 3 and 4 to "flexible." To extend this indicator to the present, we take the 2008 value for the indicator by economy and assume that it is the same during 2009–11. The capital account openness indicator (high versus low) is calculated using Chinn and Ito's (2006, 2008) capital openness measure, KAOPEN. To extend this indicator to the present, we take the last value for the indicator by economy and carry it forward to the present. We then take the grand median of this measure and categorize an observation as high if it is above this grand median and low if it is below it. The banking crisis indicator comes from Laeven and Valencia (2008, 2010). It takes a value of 1 if the economy is deemed to be experiencing a systemic banking crisis and zero otherwise.

Commodity Production and Inventories

The four major commodities explored in this chapter are crude oil, copper, coffee, and cotton. Production data for these commodities came from various sources.

Monthly oil production data come from the EIA's *International Energy Statistics* for world petroleum production (thousands of barrels a day), from January 1974 to August 2011. These data are extended backward through 1973 with Barsky and Kilian's (2002) imputed value of the series. The monthly global inventory level for oil is proxied by total OECD inventories, taken from the EIA's *International Energy Statistics* for the total petroleum stock in the OECD, measured on an end-of-period basis in millions of barrels. For data prior to 1988, we follow the approach of Kilian and Murphy (2010) and splice the total OECD stock back to 1970 using the monthly growth rate of the U.S. stock (also taken from the EIA).

Monthly copper production data come from two sources. From January 1995 onward, world copper production comes from the World Bureau of Metal Statistics—WBMS (originally sourced from the U.S. Geological Survey). To recover a monthly measure of world copper production prior to 1995 requires two steps. First, we calculate the growth rate of monthly U.S. copper production—which goes back

to 1955—from the Commodity Research Bureau (CRB). This growth rate series is then used to extend the WBMS U.S. series backward. Second, we add this resulting extended series to the "Outside of the U.S." production series from the CRB, starting in 1955 (originally sourced from the American Bureau of Metal Statistics). We then calculate the growth rate of the resulting world production series and use it to extend the WBMS world copper production series backward from 1995 to 1955. Monthly global copper inventories are the sum of copper inventory stocks recorded by the London Metal Exchange, COMEX (part of the New York Mercantile Exchange), and the Shanghai Metals Market. Data are in thousands of metric tons and were kindly shared with us by the Comisión Chilena del Cobre.

Yearly coffee and cotton production data are from the U.S. Department of Agriculture (USDA) Foreign Agricultural Service. We match the harvest year to the calendar year during which most of the production occurred. Inventories for these commodities are end-of-year amounts and are also from the USDA.

Global Activity

At the monthly frequency, global activity is measured as the change in the natural logarithm of a global industrial production index. This global industrial production index comes from the Netherlands Bureau for Economic Policy Analysis (CPB) for 1991 to the present. Prior to 1991, the growth rate of the advanced economies' industrial production index from the IFS was used to splice the CPB data backward. At the annual frequency, global activity is measured as the change in the natural logarithm of global real GDP, which is taken from the WEO database. In a robustness check for the vector autoregression at the monthly frequency, we used the global activity index of Kilian (2009). This is an index of detrended real shipping freight costs around the world.

Oil Price Forecast Error

The oil price forecasts used in Appendix 4.3 are the 12-month-ahead forecasts for the U.S. dollar price of West Texas Intermediate (WTI) crude oil, taken from the March/April survey of Consensus Economics. The forecast error is calculated as the difference between the log of this forecast and the actual log average spot price of WTI crude oil in March/April of the following year.

Global GDP Forecast Error

The global GDP growth forecast used in Appendix 4.3 is the weighted average of the GDP growth forecasts for the G7 economies plus Brazil, China, India, and Russia. The growth forecasts are the 12-month-ahead Consensus Economics forecasts from March/April. The weights are purchasing-power-parity GDP weights for 2011 from the WEO database. The forecast error is calculated as the difference between this forecast and the similarly weighted average of the actual growth rates of these economies.

Sample

The sample consists of emerging and developing economy commodity exporters with populations of at least 1 million, and each economy with a ratio of net commodity exports (for the relevant commodity group or commodity) to total goods exports that averages at least 10 percent over all available years (Table 4.7).

Table 4.7. Commodity Intensity in Exports

(Net exports of commodities over total goods exports times 100)

	International Financial Statistics Code	World Bank Code	All Commodities	Commodity Groups				Major Commodities			
				Energy	Metals	Food	Raw Materials	Oil	Copper	Coffee	Cotton
Islamic Republic of Afghanistan	512	AFG					23.5				
Algeria	612	DZA	60.5	68.4				53.7			
Angola	614	AGO	80.9	65.6		15.5		68.0		13.4	
Argentina	213	ARG	37.3			35.3					
Azerbaijan	912	AZE	27.8	38.1			13.5	45.2			13.0
Benin	638	BEN	27.7				32.5				31.3
Bolivia	218	BOL	61.4	22.0	26.1						
Brazil	223	BRA	29.0			29.4				14.4	
Burkina Faso	748	BFA	33.6				47.1				43.0
Burundi	618	BDI	70.7			64.4				63.2	
Cambodia	522	KHM					25.2				
Cameroon	622	CMR	78.8	22.8		33.5	19.4	33.0		13.7	
Central African Republic	626	CAF	43.8			15.8	28.5			15.9	12.9
Chad	628	TCD	83.0	13.9			70.0	68.2			68.5
Chile	228	CHL	51.2		48.5				48.9		
Colombia	233	COL	56.1	16.7		42.3		12.0		36.2	
Democratic Republic of Congo	636	COD	58.9	11.7	34.7			14.3	32.8		
Republic of Congo	634	COG	75.9	54.5			17.2	56.2			
Costa Rica	238	CRI	48.4			51.9				20.2	
Côte d'Ivoire	662	CIV	61.9			49.6	19.6			17.5	
Dominican Republic	243	DOM	19.8			17.9					
Ecuador	248	ECU	74.3	28.8		49.7		29.6			
Egypt	469	EGY	29.4	31.1			12.7	30.2			15.6
El Salvador	253	SLV	39.4			39.9				39.1	
Ethiopia	644	ETH	38.7			40.5				53.9	
Georgia	915	GEO			12.7						
Ghana	652	GHA	62.8			46.9					
Guatemala	258	GTM	44.6			41.2				29.2	
Haiti	263	HTI	12.9			14.7				17.8	
Honduras	268	HND	56.8			50.3				15.4	
India	534	IND				10.6					
Indonesia	536	IDN	49.1	32.1			10.6	24.3			
Islamic Republic of Iran	429	IRN	77.8	85.4				85.0			
Iraq	433	IRQ	61.1	89.8				93.5			
Kazakhstan	916	KAZ	69.0	44.1	19.0			42.8			
Kenya	664	KEN	30.2			39.8				23.6	
Kuwait	443	KWT	67.0	69.5				67.7			
Kyrgyz Republic	917	KGZ					12.0				
Lao People's Democratic Republic	544	LAO					32.6			13.8	
Latvia	941	LVA	15.4				13.2				
Liberia	668	LBR	19.4				14.5				
Libya	672	LBY	88.1	90.2				88.9			
Madagascar	674	MDG	26.7			29.1				20.4	
Malawi	676	MWI	23.2			25.0					
Malaysia	548	MYS	36.0				25.5				
Mali	678	MLI	43.4				57.5				55.0
Mauritania	682	MRT	49.8		26.0	22.5					
Mauritius	684	MUS	37.5			42.2					
Mexico	273	MEX	23.5	15.0				16.1			
Moldova	921	MDA			13.8						
Mongolia	948	MNG	34.0		16.3		12.7		15.8		
Mozambique	688	MOZ	40.3		15.9	13.6	10.2				
Myanmar	518	MMR	59.6			26.2	28.8				
Nicaragua	278	NIC	56.0			41.1	17.9			21.1	16.6
Niger	692	NER	19.0			10.7					

Table 4.7. Commodity Intensity in Exports *(continued)*

	International Financial Statistics Code	World Bank Code	All Commodities	Commodity Groups				Major Commodities			
				Energy	Metals	Food	Raw Materials	Oil	Copper	Coffee	Cotton
Nigeria	694	NGA	87.8	80.5				79.1			
Oman	449	OMN	85.1	89.3				86.4			
Panama	283	PAN	12.2			27.7					
Papua New Guinea	853	PNG	72.7		22.7	24.3	11.5	19.9	25.6	11.3	
Paraguay	288	PRY	58.5			40.1	22.8				13.3
Peru	293	PER	54.3		31.2	16.0			18.6		
Philippines	566	PHL	12.2			10.2					
Russia	922	RUS	55.5	34.8	12.1			28.7			
Rwanda	714	RWA	63.6			57.0				51.5	
Saudi Arabia	456	SAU	82.6	86.3				84.0			
Sierra Leone	724	SLE	11.4			12.5					
South Africa	199	ZAF	24.1		12.5						
Sri Lanka	524	LKA	26.3			24.4					
Sudan	732	SDN	47.9	14.3			33.8	39.0			32.3
Syrian Arab Republic	463	SYR	49.7	50.5			10.1	51.0			
Tajikistan	923	TJK	65.3		43.1		30.3				29.9
Tanzania	738	TZA	34.9			24.1	13.5			20.1	11.7
Thailand	578	THA	16.0			20.6					
Togo	742	TGO	27.1			18.9	10.3			11.1	
Tunisia	744	TUN	12.6	12.2				14.5			
Turkmenistan	925	TKM	68.8	48.2			23.9				23.3
Uganda	746	UGA	77.5			69.1	10.3			65.8	
Ukraine	926	UKR	15.4		34.9						
United Arab Emirates	466	ARE	65.5	67.7				69.9			
Uruguay	298	URY	35.6			26.3					
Uzbekistan	927	UZB	53.6	11.1			41.8				41.7
Venezuela	299	VEN	59.5	58.1				57.3			
Vietnam	582	VNM						16.1			
Republic of Yemen	474	YEM	67.0	80.4				79.4			
Zambia	754	ZMB	72.3		71.7				72.9		
Zimbabwe	698	ZWE	33.3		19.0						
Maximum			88.1	90.2	71.7	69.1	70.0	93.5	72.9	65.8	68.5
Mean			47.9	47.8	27.1	31.8	23.5	50.1	35.8	26.8	29.2
Median			49.4	46.2	22.7	28.4	19.5	51.0	29.2	20.2	26.6
Standard Deviation			21.8	28.0	15.9	15.5	14.4	26.6	21.7	17.2	17.6
Number of Economies			78	30	17	40	32	29	6	22	14

Source: IMF staff calculations.

Note: Entries are not shown if the share is less than 10 since this is the criterion used to define the sample. The table shows the averages of each share over the period 1962–2010 using all available data. For the commodity groups, the average share is calculated for each component and then these averages are added together. All Commodities includes gold and silver. See Appendix 4.1 for details on the source data.

Appendix 4.2. Statistical Properties of Commodity Price Cycles

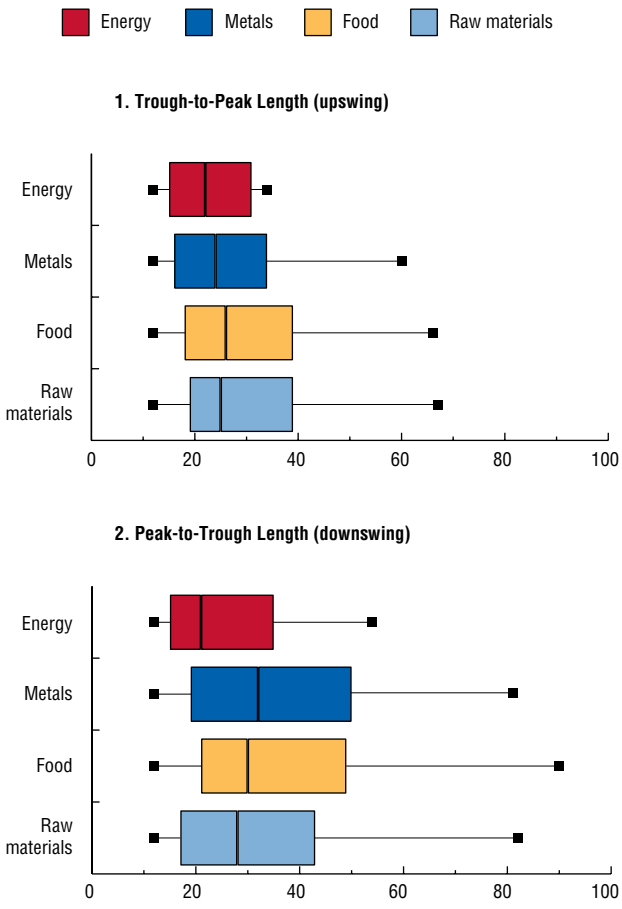
We adopt the Harding and Pagan (2002) methodology used for dating business cycles to identify turning points (peaks and troughs) in the time path of real commodity prices.[47] A full cycle in real commodity prices comprises one upswing phase—the period from trough to peak—and one downswing phase—the period from peak to trough. Drawing on Cashin, McDermott, and Scott (2002), a candidate turning point is identified as a local maximum or minimum if the price in that month is either greater or less than the price in the two months before and the two months after. The set of resulting candidates is then required to alternate peaks and troughs. Furthermore, each phase defined by the turning points (either upswing or downswing) must be at least 12 months long, and thus a complete cycle must be at least 24 months.

This exercise gives us over 300 completed cycles for 46 commodities with an average duration of five years (Table 4.8). Among upswings and downswings, the average (median) duration of the former is about 2½ (2) years, and of the latter about 3 (2½) years (Figure 4.12). However, there are significant variations in the distribution within and across commodity groups. For instance, an average downswing in crude oil lasted 31 months compared with upswings of 33 months. Among nonfuel commodities, downswings typically lasted longer than upswings, especially for food and raw material prices. The latter could be affected by some persistent negative factors, related to weather, plant disease, and so forth, that do not generally affect the prices of energy and metals. With the exception of crude oil and a few metals' prices, the amplitude

[47]The business cycle literature has traditionally distinguished between classical cycles and growth cycles. In the former case, variables of interest are not pretreated or transformed before turning points are identified. In the latter case, variables are filtered prior to the dating analysis—for example, turning points are chosen to capture periods of above- or below-trend growth. Since we are agnostic about the presence of any trend in commodity prices, we focus on commodity prices in levels, distinguishing between periods of expansion and contraction. Even more important, this classical cycle approach avoids the need to choose between alternative filtering or detrending methods, which are known to introduce potentially spurious phase shifts, confounding the turning points algorithm.

Figure 4.12. Duration of Commodity Price Upswings and Downswings
(Months)

Downswings last somewhat longer than upswings for most commodity groups except energy.

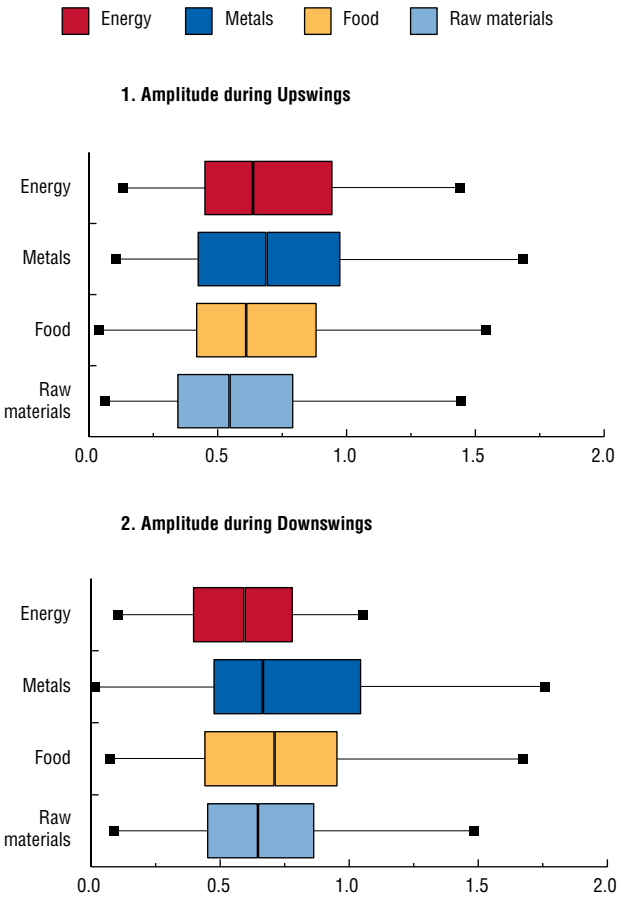


Source: IMF staff calculations.

Note: The vertical line inside each box is the median duration within the group; the left and right edges of each box show the top and bottom quartiles. The distance from the black squares (adjacent values) on either side of the box indicates the range of the distribution within that commodity group, excluding outliers. See Appendix 4.2 for a description of the algorithm used to identify peaks and troughs.

Figure 4.13. Amplitude of Commodity Price Upswings and Downswings
(Change in log real price)

With the exception of energy prices, the amplitude of commodity price downswings is generally greater than that of upswings.



Source: IMF staff calculations.

Note: The vertical line inside each box is the median amplitude within the group; the left and right edges of each box show the top and bottom quartiles. The distance from the black squares (adjacent values) on either side of the box indicates the range of the distribution within that commodity group, excluding outliers. See Appendix 4.2 for a description of the algorithm used to identify peaks and troughs.

of price downswings is slightly greater than that of upswings (Figure 4.13).

The above findings support the related literature (Cashin, McDermott, and Scott, 2002) and earlier literature that found long periods of doldrums punctuated by shorter upward spikes to be characteristic of agricultural commodity prices (Deaton and Laroque, 1992). However, for coffee and cotton, the differences in the length of upswings and downswings are small. This could be related to the fact that both are storable commodities, and therefore inventories may play an important role in smoothing prices in either direction.

Appendix 4.3. Description of the Vector Autoregression Model

In this appendix, we describe the global commodity market model used to determine the sources of commodity price fluctuations described in the section Commodity Market Drivers and Their Macroeconomic Effects.

A Structural Vector Autoregression (VAR) Model for Global Commodity Markets

Drawing on Kilian's (2009) insights into the global oil market, we estimate a structural VAR model of the global commodity market for each of four major commodities: crude oil, copper, coffee, and cotton. Each VAR includes the following set of variables:

$$z'_{i,t} = (\Delta q_{i,t}, \Delta y_t, \Delta k_{i,t}, \Delta s_t, \Delta p_{i,t}), \qquad (4.1)$$

where t indexes time, $\Delta q_{i,t}$ is the change in log global production of commodity i, Δy_t is a proxy for the changes in global economic activity, $\Delta k_{i,t}$ is the change in log global inventories of commodity i, Δs_t is the change in the log U.S. real effective exchange rate (REER), and $\Delta p_{i,t}$ is the change in the log real price of commodity i.[48] The structural VAR for each commodity i takes the following form:

[48]For the copper and oil monthly VARs, we take the global industrial production index as a measure of global activity. For agricultural commodities, we use the growth rate of global GDP, since the VARs are estimated at annual frequency. In a robustness check of the results at monthly frequency, we try as an alternative measure of global activity the one proposed by Kilian (2009).

Table 4.8. Statistical Properties of Real Commodity Prices

Commodity	Series Start Date (year: month)	Number of Peak-to-Trough Episodes	Number of Trough-to-Peak Episodes	Peak-to-Trough Average Length	Trough-to-Peak Average Length	Peak-to-Trough Average Amplitude	Trough-to-Peak Average Amplitude	Average Cycle Length	Amplitude between Latest Available Observation and Latest Trough/Peak	Length of the Latest Period
Energy	1973:M2	7	6	31.0	33.0	0.7	0.9	65.3	0.1	17
Coal	1993:M12	4	5	25.0	20.4	0.6	0.7	45.0	–0.1	9
Crude Oil	1973:M2	7	6	31.3	32.7	0.8	0.9	65.3	0.2	15
Natural Gas	1992:M1	6	6	16.7	18.5	0.4	0.5	36.6	0.6	25
Food	1970:M1	7	8	37.9	26.0	0.5	0.4	60.9	–0.2	8
Cocoa	1957:M1	9	10	38.8	28.5	0.9	0.8	63.2	–0.3	22
Coffee	1957:M1	7	8	36.1	40.0	0.9	0.8	77.6	–0.2	6
Tea	1957:M1	10	10	35.7	29.0	0.7	0.6	65.3	0.1	6
Barley	1975:M1	7	8	34.0	24.5	0.7	0.6	57.1	0.0	3
Maize	1957:M1	9	10	39.2	27.9	0.6	0.6	66.6	–0.2	6
Rice	1957:M1	9	8	40.7	33.6	0.8	0.8	76.0	0.2	16
Wheat	1957:M1	10	10	35.6	26.8	0.6	0.5	64.0	0.6	16
Beef	1957:M1	7	7	58.6	31.7	0.5	0.5	81.9	–0.1	6
Lamb	1957:M1	7	8	39.4	39.5	0.5	0.4	72.1	–0.1	11
Poultry	1980:M1	6	6	21.5	40.2	0.2	0.2	67.2	0.0	8
Pork	1980:M1	6	7	37.0	22.1	1.1	0.9	46.3	–0.1	2
Fish	1979:M1	4	5	64.5	25.2	0.9	0.6	82.5	–0.7	6
Shrimp	1957:M1	12	11	24.3	31.2	0.6	0.5	49.5	0.2	18
Coconut Oil	1957:M1	12	13	25.8	25.5	0.9	0.9	51.0	–0.6	8
Olive Oil	1978:M9	4	4	34.5	44.3	0.6	0.5	84.5	–0.8	79
Palm Oil	1957:M1	10	11	27.6	27.7	0.8	0.8	53.7	–0.3	8
Soy Meal	1965:M1	9	10	32.6	25.4	0.7	0.7	55.6	–0.1	4
Soy Oil	1957:M1	9	10	37.3	27.9	0.8	0.7	65.4	–0.1	8
Soybeans	1965:M1	8	8	41.3	25.5	0.7	0.7	70.3	0.2	20
Sunflower Oil	1960:M7	6	7	51.8	39.0	1.0	0.9	89.8	–0.1	4
Bananas	1975:M1	6	6	40.0	31.5	0.8	0.8	69.3	–0.1	8
Fishmeal	1957:M1	9	10	28.4	37.2	0.7	0.7	67.1	–0.4	18
Groundnuts	1980:M1	5	6	37.6	26.5	0.8	0.6	62.0	0.0	3
Oranges	1978:M1	6	5	43.7	23.2	0.9	0.9	69.6	0.3	10
Sugar	1957:M1	7	7	52.9	39.4	1.3	1.2	87.1	–0.1	9
Metals	1970:M1	8	8	33.0	28.5	0.7	0.6	60.1	–0.1	8
Aluminum	1972:M5	6	7	37.5	33.6	0.8	0.7	56.0	–0.2	6
Copper	1957:M1	8	9	42.8	32.8	0.7	0.7	69.0	–0.3	8
Lead	1957:M1	9	10	35.1	26.9	0.9	0.9	59.1	–0.3	6
Nickel	1979:M12	5	6	34.6	27.8	1.1	1.2	57.4	–0.4	8
Steel	1987:M1	4	5	37.3	27.6	0.6	0.7	65.3	–0.1	8
Tin	1957:M1	8	9	44.3	25.0	0.6	0.6	68.0	–0.4	6
Uranium	1980:M1	4	4	39.0	34.0	0.8	1.0	81.0	0.2	19
Zinc	1957:M1	10	11	34.0	26.7	0.7	0.7	58.7	–0.3	8
Gold	1968:M4	6	5	39.0	30.4	0.6	0.7	61.2	1.6	126
Silver	1976:M1	7	7	27.3	32.4	0.8	0.9	57.3	–0.3	6
Raw Materials	1970:M1	5	6	48.6	40.3	0.6	0.5	56.4	–0.3	8
Hardwood Logs	1980:M1	6	6	21.7	32.7	0.6	0.7	59.0	0.5	18
Hardwood, Sawed	1980:M1	5	6	23.2	37.3	0.5	0.6	61.2	0.0	4
Softwood Logs	1975:M1	5	6	45.4	32.3	0.6	0.4	70.4	–0.1	5
Softwood, Sawed	1975:M1	6	6	35.7	34.0	0.5	0.4	72.6	0.1	8
Cotton	1957:M1	12	13	24.9	24.8	0.6	0.5	48.7	–0.7	7
Hides	1957:M1	7	7	58.1	33.9	1.0	1.0	55.7	–0.1	7
Rubber	1957:M1	8	9	41.1	33.9	0.8	0.8	55.3	–0.4	8
Wool	1957:M1	9	9	42.4	29.8	0.7	0.7	69.7	–0.3	4

Source: IMF staff calculations.

Note: All series end in October 2011 (2011:M10) except Crude Oil, which ends in August 2011 (2011:M8). Peaks and troughs are determined according to the Harding and Pagan (2002) algorithm, as described in Appendix 4.2. The length or duration of a phase is quoted in months. The amplitude or height of a phase is expressed in natural log units. See Appendix 4.1 for a full description of the underlying data.

$$z_{i,t} = \alpha_i + \sum_{m=1}^{M_i} A_{m,i}\, z_{i,t-m} + e_{i,t}, \qquad (4.2)$$

where $e_{i,t}$ is a mean-zero serially uncorrelated (5 × 1) vector of innovations, α_i is a (5 × 1) vector of constants, and $A_{m,i}$ is a (5 × 5) coefficient matrix for variables at lag m for a total of M_i lags. We assume that the innovations may be expressed as $e_{i,t} = A_{0,i}\, \varepsilon_{i,t}$, where $\varepsilon_{i,t}$ is a vector of mutually and serially uncorrelated structural shocks with variance 1, and $A_{0,i}$ is a coefficient matrix mapping the structural shocks to the contemporaneous reduced-form shocks. To identify production and global demand shocks, we make some assumptions about the structure of the matrix $A_{0,i}$.

Specifically, we assume that the change in a commodity's global production ($\Delta q_{i,t}$) does not respond to other shocks contemporaneously, but only with a lag. This means that the estimated innovation from the production equation represents the structural production shock. In other words, shifts in the demand curve for the commodity due to global activity shocks or other factors do not affect production in the same period, although they may in the next and future periods. This assumption seems justifiable with monthly data, which we have for both crude oil and copper. For coffee and cotton, only annual data on global production are available, but the assumption still seems justifiable, since the production cycles of these commodities are relatively long.[49] Examples of production shocks are unpredictable weather events, such as floods or droughts that adversely impact yields (for agricultural commodities), production disruptions due to unanticipated equipment breakdowns or work stoppages (for oil and metal commodities), or unexpected technological breakthroughs that boost production.

We further assume that global activity (Δy_i) may be contemporaneously affected by the structural production shock, but only with a lag by the other shocks. This means that the estimated innovation from the global activity equation, once the effect of the production shock is accounted for, represents the structural global activity shock. Again, these assumptions seem justifiable at a monthly frequency. Even when the underlying data are annual, it still seems reasonable so long as the commodity in question makes a relatively small contribution to global GDP. Nevertheless, the results for agricultural commodities should be interpreted with caution.[50]

Taken together, these assumptions imply that:

$$e_{i,t} = A_{0,i}\, \varepsilon_{i,t}$$

$$\begin{pmatrix} e_{i,t}^{\Delta q} \\ e_{i,t}^{\Delta y} \\ e_{i,t}^{\Delta k} \\ e_{i,t}^{\Delta s} \\ e_{i,t}^{\Delta p} \end{pmatrix} = \begin{bmatrix} \cdot & 0 & 0 & 0 & 0 \\ \cdot & \cdot & 0 & 0 & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \end{bmatrix} \begin{pmatrix} \varepsilon_{i,t}^{\Delta q} \\ \varepsilon_{i,t}^{\Delta y} \\ \varepsilon_{i,t}^{3} \\ \varepsilon_{i,t}^{4} \\ \varepsilon_{i,t}^{5} \end{pmatrix}, \qquad (4.3)$$

where 0 indicates that the structural shock does not influence the corresponding reduced-form shock, and a dot indicates that the relationship is unrestricted. Again, under the restrictions shown here, we are able to recover only the structural shocks to production and global activity ($\varepsilon_{i,t}^{\Delta q}$ and $\varepsilon_{i,t}^{\Delta y}$).

Notice that we include changes in a commodity's inventories and in the log U.S. REER in our model, since both variables are known to improve the forecasts of prices and production of oil, metals, and other commodities.[51] Moreover, because they are able to react quickly to new information, these variables likely incorporate forward-looking information about the specific commodity market (in the case of inventories) and global activity (in the case of both inventories and the REER) beyond what is contained in production, activity, and prices themselves. This means that the flow production and global demand shocks identified are more precise in our five-variable VAR than those that are recovered in a three-variable VAR without REER and inventories.

Price fluctuations that are not explained by either demand or production shocks result from a combination of factors we cannot disentangle. Those factors

[49]New coffee trees take about five years to mature (Wellman, 1961). For cotton the assumption might not be as clear cut, since it has a harvest cycle of about a year (Smith and Cothren, 1999).

[50]At annual frequency, a greater concern is that real commodity price changes may correlate with other factors that do drive global GDP but that are not included in the VAR system. This could give rise to an omitted variable bias that would influence the interpretation of the results.

[51]See De Gregorio, González, and Jaque (2005) for the role of the U.S. REER in determining copper prices, and Kilian and Murphy (2010) for the role of crude oil inventories in determining oil prices.

include commodity-specific shocks, but also news about future commodity market developments.[52] This implies that production changes that are either wholly or partly anticipated will show up in the unaccounted-for component of the price, matched to the time the news of the forthcoming change becomes known rather than the time the change actually occurs. An example of such an anticipated production shock might include the recent case of Libya, where political turmoil was expected to disrupt oil production, and thereby the global oil supply, hiking prices in advance.[53] Our results mainly confirm those of Kilian (2009) for the other commodities as well. This means that demand shocks are more important in explaining commodity price fluctuations than unanticipated production shocks.

An alternative exercise we performed also suggests the greater relevance of demand over production shocks, corroborating our VAR results (for the case of oil). We find a positive and significant correlation between revisions in commodity price forecasts and in global real GDP forecasts, suggesting that on balance oil prices are driven by global activity (Figure 4.14). In fact, if forecast revisions in oil prices were more strongly associated with negative commodity production shocks, which adversely affect global GDP, then the commodity price forecast revisions should correlate negatively with global economic activity revisions. We were unable to conduct this analysis for other commodities because of the lack of time series data on Consensus Economics forecasts for other commodity prices.

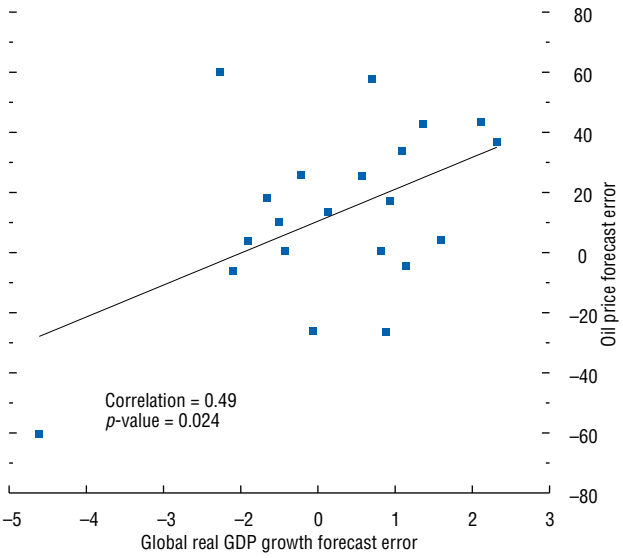
How much can commodity exporters' GDP be expected to move with changes in the real commodity price driven by global demand or production shocks? To answer this question for copper and oil, we need to make the global demand and production shocks in

[52]There are various examples of commodity-specific shocks. A preference shift for coffee over tea (as has happened in the past decade) is an example of a shock that is captured by our residual component. Other examples are technological improvements that affect oil intensity, an alternative source of energy, or a global housing boom/bust that affects demand for copper.

[53]The financialization of commodity markets may have exacerbated commodity price sensitivity to news about market prospects (see Chapter 1 in the September 2011 *World Economic Outlook* for a discussion of the role of financialization in influencing commodity prices).

Figure 4.14. Correlation of Global Real GDP Growth and Oil Price Forecast Errors

Surprises in global oil price movements correlate positively with surprises in global activity.



Sources: Consensus Economics and IMF staff calculations.

Note: Forecast errors are calculated as the actual value minus the forecast value. The global real GDP growth forecast error is in percentage points, while the oil price forecast error is in log units times 100. The line shows the least squares line of best fit. See Appendix 4.1 for a full description of the underlying data.

the monthly VAR model comparable with the shocks used in the panel regression, which are at an annual frequency. To do this, we assume that there are a series of shocks for the first 12 months, each equal to the size of the 1 standard deviation shock used in the annual regression. For oil, this results in a 12.2 percent increase in the real price of oil over the year from an annual global demand shock and a 3.8 percent increase from a (negative) global oil production shock. For copper, this is about an 8 percent increase in the real price of copper from a global demand shock and a 3 percent increase from a (negative) global copper production shock. Thus, the elasticity of real GDP for exporters in response to price changes can now be obtained by drawing on the real GDP effects of such commodity price changes over a year (see Table 4.5). For instance for oil, the implied elasticity of real GDP with respect to a global demand-driven oil price change is 0.03 in the impact year and 0.15 three years after the impact year. Although the elasticity with respect to a global production-driven oil price change is comparable in size (0.05 on impact, and –0.14 three years after impact), the effect of the shock on an exporter's GDP is not statistically significant (as seen in Table 4.4).

Robustness

We undertook several robustness checks of our baseline VAR model. These include (1) using the log real commodity price and log U.S. REER in levels instead of differences, since there is no self-evident reason why these variables should be nonstationary; (2) using the real global activity index of Kilian (2009) in the VARs with monthly data instead of the change in log global industrial production; (3) using an alternative deflator for commodity prices based on the SDR basket-weighted wholesale price index instead of the U.S. CPI. Broadly speaking, the results are qualitatively unchanged for all commodities.

Identifying global demand- and production-driven phases

We define a phase as a global demand-driven phase if the contribution to the amplitude of that phase made by the global demand component is at least 25 percent and is bigger than the contribution of the global production component—and vice versa for a production-driven phase. For oil, this results in the identification of four global demand-driven phases, with two downswings (October 1990–December 1993 and October 2000–December 2001) and two upswings (January 1994–October 1996 and January 2002–July 2008). These phases are shown in Figure 4.8. The production-driven phases include one downswing (January 1996–December 1998) and one upswing (January 1999–September 2000).

Appendix 4.4. The Basic Features of the GIMF and Its Application to a Small, Open Oil Exporter

The Global Integrated Monetary and Fiscal model (GIMF) is a microfounded, multicountry, multisector dynamic general equilibrium model that features a wide array of real and nominal types of friction considered relevant in recent macroeconomic literature.[54] For the purposes of this chapter, we use a two-region version of the GIMF comprising a small, open economy oil exporter and the rest of the world, which is a *net* oil importer. The oil sector is modeled along the lines described in Chapter 3 of the April 2011 *World Economic Outlook*. International borrowing by this small, open oil exporter is modeled such that the sovereign risk premium rises with the level of total net debt. In the calibration here—a debt level of 100 percent of GDP—a 20 percentage point decrease (increase) in the debt level would generate a 53 (103) basis point decrease (increase) in the risk premium. In contrast, at a debt level of 30 percent of GDP, a 20 percentage point decrease (increase) in the debt level would generate an 11 (16) basis point decrease (increase) in the risk premium.

Fiscal Policy

The fiscal policy rule is defined by a simple numerical target for the government fiscal-balance-to-GDP ratio that aims to stabilize debt around its long-term target while minimizing output and inflation volatility. It takes the following form:

[54]A full description of the GIMF can be found in Kumhof and others (2010) and Kumhof and Laxton (2009a).

$$gs_t = gs^* + d^{tax}\frac{(\tau_t - \tau_t^{pot})}{GDP_t} + d^{com}\frac{(c_t - c_t^{pot})}{GDP_t}, \qquad (4.4)$$

where gs_t is the fiscal-surplus-to-GDP ratio; gs^* is its long-term target; τ_t and c_t are the actual non-oil tax revenues and oil royalties, respectively; and τ_t^{pot} and c_t^{pot} are the *potential* level of tax revenue and oil royalties.[55] Differences between actual and potential values are *gaps*. The coefficients d^{tax} and d^{com} determine the type of rule that is adopted.[56] The choice of d^{tax} and d^{com} provides a continuum of rules, of which three calibrations are discussed in this chapter: (1) a balanced budget rule when d^{tax} and d^{com} are equal to zero, (2) a structural surplus rule when d^{tax} and d^{com} are equal to 1, and (3) a countercyclical rule when d^{tax} and d^{com} are greater than 1.[57]

To implement the surplus-to-GDP ratio prescribed by the rule, the government, in principle, has a menu of fiscal instruments that can be used. However, for simplicity, we assume that the government satisfies the fiscal rule by changing the labor income tax rate. As mentioned, the qualitative results do not change if a different fiscal instrument is used to satisfy the fiscal rule. To determine the optimal rule, alternative calibrations of the fiscal rule parameters are evaluated to find the minimum loss function of the standard deviations of inflation and output. We evaluate the net present value of discounted household utility for the analysis of permanent changes in the price of oil.

[55]More precisely, tax revenues are given by the sum of labor and capital revenues raised in the non-oil sector, plus consumption taxes and transfers. Potential tax revenues are defined as current tax rates times tax bases at the long-term equilibrium. Potential oil revenues are calculated based on long-term values of commodity output and price.

[56]By construction the fiscal surplus and debt-to-GDP ratios are guaranteed to return to their long-term targets because eventually all *gaps* close after the temporary shocks unwind. Kumhof and Laxton (2009b) have shown that this class of rules is particularly well suited to capturing periods of relatively strong (weak) economic conditions and is therefore effective for stabilizing business cycle fluctuations.

[57]For a more detailed discussion of the fiscal rule and the government sector, see Snudden (forthcoming).

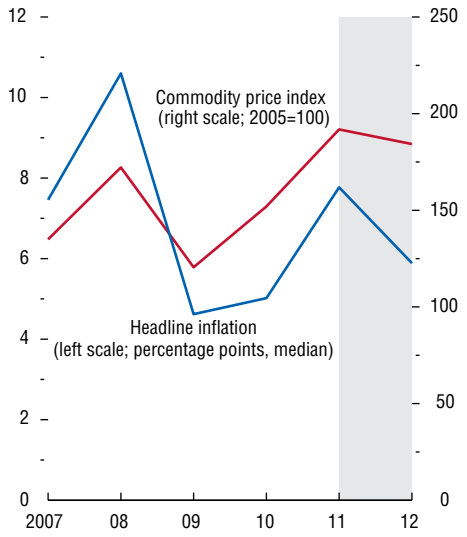
Box 4.1. Macroeconomic Effects of Commodity Price Shocks on Low-Income Countries

Commodity price shocks can have large economic, social, and political effects on low-income countries (LICs), whether they are commodity importers or exporters. Most LICs are net importers of food and fuel, and many face substantial import bills for oil products in particular. At the same time, commodities account for more than half of total goods exports for about a third of LICs, implying that swings in commodity prices can lead to large swings in LICs' external balances, creating winners and losers, depending on their trade structure and the specific commodities involved. Global commodity price shocks also tend to create strong inflation and social pressures in LICs because food prices, which account for nearly half of the consumption basket in LICs, are highly correlated with other commodity prices.[1] The resulting squeeze on real household incomes can increase poverty and exert political pressure for mitigating fiscal measures, which in turn could have a negative impact on public finances.

Recent experience highlights the significance of commodity prices for LICs. The spike in food and fuel prices during 2007–08 created significant inflation pressure (Figure 4.1.1) until 2009, when commodity prices slumped during the global financial crisis. In late 2010 and early 2011, LICs faced a renewed surge in global commodity prices. This time, global price increases were more synchronized across commodities than during 2007–08, softening the impact on LICs that export nonfuel commodities. Inflation pressures were also more contained in most LICs, in some cases due to good local harvests. Moreover, about half of LICs took fiscal measures to mitigate the social and inflation impact of the shock, with a median budgetary cost estimated at more than 1 percent of GDP. Measures included food and/or fuel price subsidies (with only a few explicitly targeted to the poor), safety net expenditure measures, and reductions in taxes and import tariffs.

Figure 4.1.1. Headline Inflation in Low-Income Countries and the World Commodity Price Index

Most low-income countries experienced only a modest uptick in headline inflation in 2011.



Sources: September 2011 *World Economic Outlook*; and IMF staff estimates.

Simulating the Macroeconomic Effects of Another Spike in Global Commodity Prices

We examine the possible implications of a further global commodity price shock using the IMF's newly developed vulnerability exercise framework for LICs.[2] The scenario is constructed using market expectations embedded in commodity futures options, and the shocks for different commodities are aligned with the prices at the top 7 percent of the expected probability distribution.[3] The impact of the shock is then simulated on a country-by-country basis, taking into account the

The author of this box is Julia Bersch. It is based on IMF (2011a). The set of low-income countries in this box includes all countries eligible for concessional financing from the IMF under the Poverty Reduction and Growth Trust, except Somalia, which has been excluded due to a lack of data.

[1]This compares with a food share of less than 20 percent in the consumption baskets of Organization for Economic Cooperation and Development countries.

[2]Details are in IMF (2011a).

[3]Under this specific scenario, food prices are assumed to increase by 25 percent in 2011 and 31 percent in 2012 relative to the baseline forecast; fuel prices by 21 percent in 2011 and 48 percent in 2012; and metal prices by 21 percent in 2011 and 36 percent in 2012.

Box 4.1. *(continued)*

experience of past shock episodes and countries' different trade structures and consumption baskets.

The scenario analysis illustrates that a further spike in commodity prices could have severe macroeconomic and social consequences. Even though the impact on growth would be modest, the price shock would push 31 million people below the poverty line, mainly because of higher inflation and the absence of efficient social safety nets (Figure 4.1.2). Countervailing fiscal measures, modeled on the basis of past experience, could worsen the median fiscal balance by more than 1 percent of GDP in 2012, with about three-quarters arising from higher oil prices, and the other quarter from higher food prices (Figure 4.1.3).

The external impact of the commodity price scenario would be negative for a large majority of LICs, with a median deterioration in the trade balance of almost 3 percent of GDP (Figure 4.1.4). This deterioration would be driven mainly by higher oil prices, with a smaller impact from higher food prices. Only net oil exporters would benefit from higher prices. Net food exporters would fare only slightly better than net food importers, as both would be negatively affected by higher oil prices. For LICs experiencing a negative terms-of-trade shock, external financing needs could increase by about $9 billion, much of which would be accounted for by a small number of large noncommodity exporters.

Policy Responses to Commodity Price Shocks and Policies to Build Resilience

Many LICs used their macroeconomic policy buffers during the recent crisis, so another global commodity price shock may present difficulties.[4] The standard "first-best" fiscal policy advice of passing on higher prices to consumers may not be feasible in most LICs because they lack comprehensive social safety nets to support the vulnerable. It is also challenging to find pragmatic and cost-effective "second-best" solutions given limited fiscal room. Conducting monetary policy in response to commodity price shocks, in particular food price shocks, also poses significant challenges because policymakers need to choose between accommodating higher inflation and tightening policies that exacerbate real costs. However, even though the direct impact of higher food prices on headline inflation is usually much larger in LICs than in more advanced economies, inflation inertia is relatively low. Hence, an accommodative monetary policy stance is less likely to lead to persistent inflation.[5]

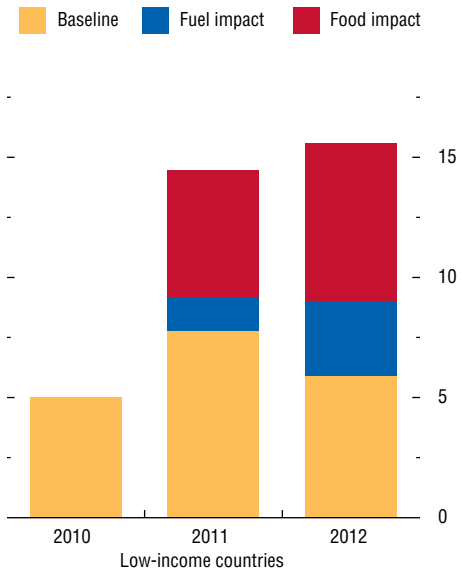
[4]For a detailed analysis of how LICs fared during the global crisis, see IMF (2010).

[5]See Chapter 3 of the September 2011 *World Economic Outlook* for an analysis of monetary policy implications of commodity-price-induced inflation in advanced and emerging market economies. This work underscores the importance of "targeting what you can hit" as a way of building monetary policy credibility and delivering better macroeconomic outcomes.

Figure 4.1.2. Inflationary Impact of Higher Commodity Prices in Low-Income Countries in 2011 and 2012

(Percentage points, median)

Under the higher global commodity price scenario, inflation in low-income countries could double relative to the baseline projection, driven mainly by higher food prices.



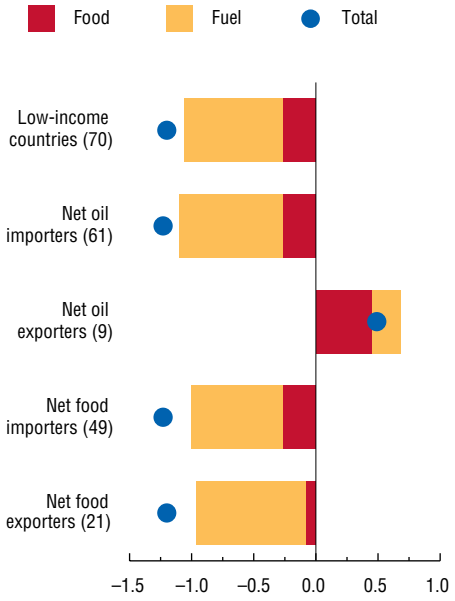
Sources: September 2011 *World Economic Outlook*; and IMF staff estimates.

Note: The scenario gauges the impact of increases in global food and fuel prices compared with the baseline. For food, the price increases used were 25 percent in 2011 and 31 percent in 2012; for fuel, 21 percent and 28 percent, respectively.

Box 4.1. *(continued)*

Figure 4.1.3. Impact of Higher Commodity Prices on the Fiscal Balance for Low-Income Countries in 2012
(Percent of GDP, median)

The fiscal balance of the median low-income country would deteriorate by more than 1 percent of GDP in 2012, mainly due to higher global fuel prices.

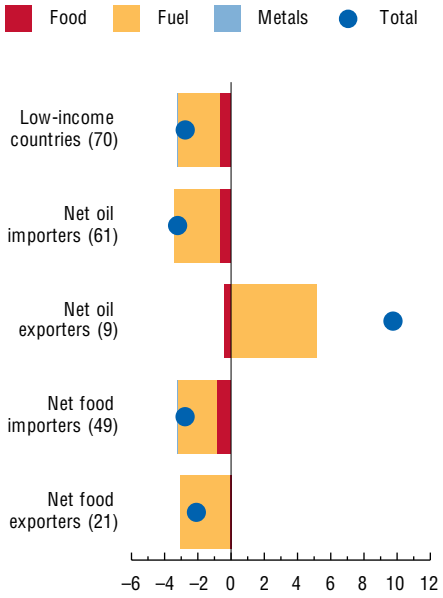


Sources: September 2011 *World Economic Outlook*; and IMF staff calculations.

Note: The estimates of the fiscal impact are calculated using revenue and expenditure elasticities to changes in global food and oil prices. The policy response is assumed to be similar to that in the 2007–08 episode of high global food and oil prices. The calculations are based on the median of differences, so the sum of the components may differ from the total. The numbers in parentheses indicate the sample size (number of economies).

Figure 4.1.4. Impact of Higher Commodity Prices on the Trade Balance for Low-Income Countries in 2012
(Percent of 2010 GDP, median)

Although some countries would gain from higher global commodity prices, for the median low-income country the 2012 trade balance would worsen by almost 3 percent of GDP, with most of the impact coming from oil.



Sources: September 2011 *World Economic Outlook*; and IMF staff calculations.

Note: The scenario simulated the impact of global price increases for food, metal (except gold and uranium), and fuel (31, 36, and 48 percent above the baseline, respectively). The calculations are based on the median of differences, so the sum of the components may differ from the total. The numbers in parentheses indicate the sample size (number of economies).

While coping well with shocks is important, countries can take steps before a crisis occurs to reduce their exposure or create space to prepare for future shocks. Besides building policy buffers during good times, LICs can (1) make their budgets more structurally robust, (2) put in place stronger and more flexible social safety net systems, (3) pursue reforms to encourage domestic saving and deepen their financial sectors, and (4) explore policies to encourage greater diversification in their production and exports.

Box 4.2. Volatile Commodity Prices and the Development Challenge in Low-Income Countries

Recent discoveries of natural resources in many low-income countries (LICs) combine with volatile commodity prices to pose both great opportunities and great challenges for these countries. In many cases, the production horizon is short, meaning that there is only a small window of opportunity to translate resource windfalls into development gains.[1] At the same time, trying to do too much too fast creates its own challenges.

The difficulties are partly analytic. The conventional recommendation, based on the permanent income hypothesis (PIH), is to save most resource income in a sovereign wealth fund, consisting of low-yielding financial assets (for example, Davis and others, 2001; Barnett and Ossowski, 2003; Bems and de Carvalho Filho, 2011). This helps preserve resource wealth, ensure intergenerational equity, and maintain stability.

However, this approach overlooks the longer-term development needs in these capital-scarce, credit-constrained countries. The above analyses generally combine the PIH with an assumption that the capital account is open and that the return to capital—including to public capital—is equal to world interest rates. Substantial empirical evidence, however, indicates that the rate of return to public capital investment in LICs may be well above world interest rates.[2] Limited access to world capital markets and weak domestic tax systems may leave many LICs unable to exploit this opportunity prior to a boom in natural resource exports. Indeed, several studies using models with investment find that front-loading productive public investment can be optimal (Takizawa, Gardner, and Ueda, 2004; van der Ploeg and Venables, 2011; Araujo and others, 2012).

Despite the theoretical appeal of LICs investing their resource income, historical evidence does not generally support the idea that natural resource abundance promotes economic growth—the so-called natural resource curse.[3] For example, the experience of four Latin American countries (Bolivia, Ecuador, Mexico, Venezuela) in the 1970s shows no obvious supply-side effects of growth beyond the resource windfall period (Sachs and Warner, 1999).

All this suggests that LICs should attempt to invest resource income, but with caution. Given the volatile nature of commodity prices, spending resource income as it accrues implies a highly volatile government spending path that aggravates economic instability and makes it harder to execute investment plans efficiently. Moreover, spending a large foreign exchange windfall domestically can lead to real appreciation, which can hurt the traded-goods sector (Dutch disease). Because LICs often suffer from poor governance and production bottlenecks, ramping up public investment is also likely to run into inefficiencies related both to converting resource income to public capital and to absorptive capacity constraints.

To address these potential problems, Berg and others (forthcoming) propose a "sustainable investing" approach, which involves using an investment fund to save some resource income and any increase in nonresource tax receipts.[4] Public investment is scaled up gradually, in line with institutional and absorptive capacity constraints. This approach can minimize the impact of volatile commodity prices in the domestic economy, mitigate Dutch disease effects, and reduce the costs of absorptive capacity constraints. When the magnitude of investment scaling-up is beyond the annuity value of the investment fund, further fiscal adjustments are required.

The author of this box is Susan Yang.

[1]For example, Ghana started to produce oil in 2011, and its reserve from the recent discovery is expected to run out by early 2020 (IMF staff projection).

[2]For example, the median annual rate of return among all the World Bank's projects has risen from about 12 percent during 1987–88 to 24 percent during 2005–07 (World Bank, 2010).

[3]As surveyed by van der Ploeg (2011), although an average negative correlation exists between growth and the export share of natural resources, many countries, such as Botswana and Chile, have escaped the curse.

[4]Collier and others (2010) also propose investing through a sovereign liquidity fund, which mainly aims to smooth the government investment path with resource income. The creation of a separate fund can be thought of as an intellectual construct to help identify the dynamics of an appropriate fiscal policy. In practice, while institutional factors may argue against fragmentation in the form of a separate fund, the insights as far as the trajectory for government saving and spending would remain valid.

Box 4.2. *(continued)*

This approach in effect preserves exhaustible natural resource wealth in the form of public capital that can increase the productivity of private production. Because consumption is also raised permanently, the approach is largely consistent with the PIH principle.

Recent experience among LICs suggests that the vast majority have not followed the PIH-based approach in managing natural resource income (see Appendix II in Baunsgaard and others, forthcoming). For example, during the recent oil price surge, domestically financed capital spending in Chad increased from 2.1 percent of non-oil GDP in 2003 to 12.6 percent during 2008–10 (IMF, 2011b). Timor-Leste, on the other hand, has followed the PIH-based approach for a sustained period. Since oil production began in early 2000, it has built a sizable petroleum fund that reached 886 percent of non-oil GDP in 2011 (IMF, 2012). Capital expenditure remained low before 2011, but the government recently launched a strategic development plan that includes large infrastructure spending to be partially financed by withdrawals from the petroleum fund.

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