WHAT'S THE DAMAGE? MEDIUM-TERM OUTPUT DYNAMICS AFTER FINANCIAL CRISES

The global economy is beginning to recover from the most severe financial crisis since the Great Depression and the deepest recession since World War II. Global economic activity is starting to pick up, but financial systems remain impaired and domestic and external imbalances persist in many economies. The recovery is expected to be slow, and there are concerns about the prospect of long-term damage to the path of global output, as financial institutions and markets worldwide struggle to restore their ability to intermediate and unemployment rises to high levels. In this context, the aftermath of past financial crises may provide useful insights into the medium-term prospects for economies now in the midst of financial crisis and for the global economy.

This chapter builds on Chapter 3 of the April 2009 *World Economic Outlook*, which analyzed the short-term dynamics of output in advanced economies and found that recessions following financial crises are unusually long, particularly with a global downturn. This chapter goes beyond the short term to concentrate on medium-term developments following financial crises in advanced, emerging, and developing economies over the past 40 years.

A first glance at several previous crisis episodes illustrates that although financial crises typically lead to large output losses in the short term, what happens to output over the medium term has varied widely (Figure 4.1). Some economies persistently grow at a slower rate than before, moving further away from their precrisis trend. Some return to growth at a similar rate as before but fail to recover the initial output loss. Some return to their precrisis trend, and

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some recover quickly and outperform their previous trend.

This chapter addresses a number of questions:
- What happens to output over the medium term following financial crises? Does the path of output per capita remain below its precrisis trend? Do growth rates recover? How much do outcomes vary across crisis episodes?
- What factors account for shifts in medium-term output dynamics: changes in the factors of production (capital and labor) or changes in the efficiency of their use (total factor productivity)?
- What are the underlying determinants of medium-term output dynamics? For example, do different country characteristics and macroeconomic conditions before the crisis affect medium-term postcrisis outcomes? What can be said about the role of policies after a crisis?

To explore these issues, this chapter examines medium-term output performance following 88 banking crises that occurred over the past four decades across a wide range of economies, as well as the behavior of world output following major financial crises going back to the 19th century. Building on work by Cerra and Saxena (2008), the main contributions of this analysis are the focus on medium-term output and its driving forces (capital, labor, and total factor productivity) for a broad sample of economies that experienced banking crises, and the assessment of the underlying determinants of postcrisis performance.[1]

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[1]A great deal of work has been done on the output effects of financial crises in the short term (for example, Reinhart and Rogoff, 2009; Haugh, Ollivaud, and Turner, 2009; Bordo, 2006; Hutchison and Noy, 2002; and Gupta, Mishra, and Sahay, 2007, among others). Until recently, the emphasis on the medium term has been much more limited, with the notable exceptions of Boyd, Kwak, and Smith (2005) and Cerra and Saxena (2008). With the current crisis, interest in the topic has surged. For instance, Furceri and Mourougane (2009)

Figure 4.1. Medium-Term Output per Capita after Financial Crises: Case Studies
(Log scale)
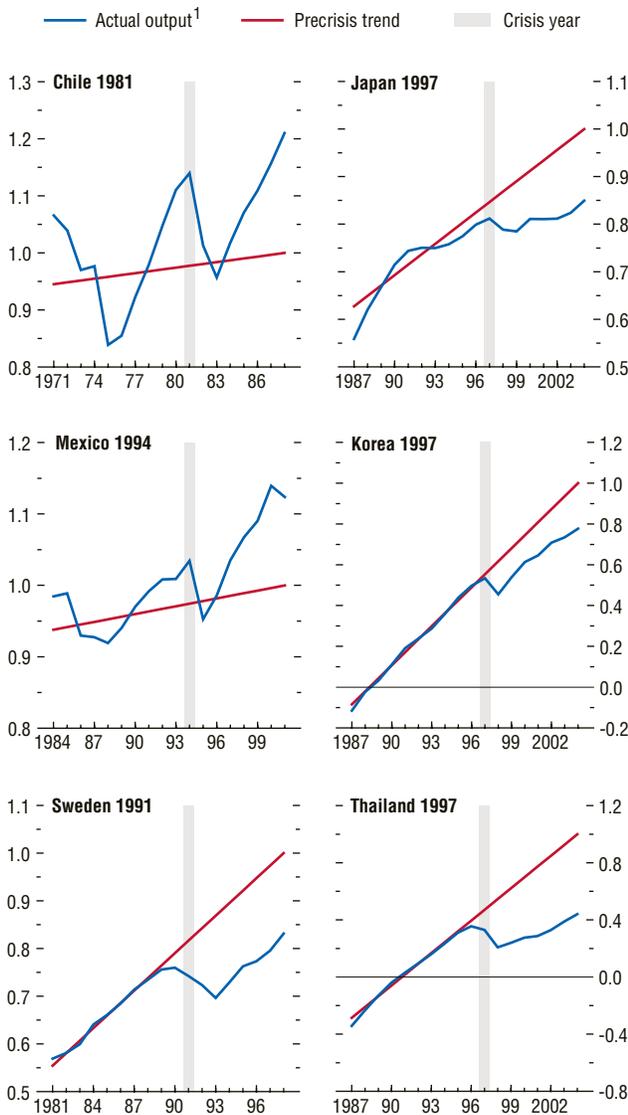
Sources: World Bank, *World Development Indicators;* and IMF staff calculations.
[1]Output = logarithm of per capita real GDP.

Our general approach is to use an event-study methodology that compares the medium-term level of output to the level it would have reached following the precrisis trend, with the medium term defined as seven years after the crisis. Measured this way, the resulting underperformance ("output loss") is then decomposed into its underlying components: capital, labor, and productivity.[2] Output losses are also related to a range of pre- and postcrisis macroeconomic and policy factors, using both statistical methods and a narrative approach, to explore which underlying factors may have contributed to different outcomes across crisis episodes.

The main findings of the chapter are as follows:

- The path of output tends to be depressed substantially and persistently following banking crises, with no rebound on average to the precrisis trend over the medium term. Growth does, however, eventually return to its precrisis rate for most economies.

- The depressed output path tends to result from long-lasting reductions of roughly equal proportion in the employment rate, the capital-to-labor ratio, and total factor productivity. In the short term, the output loss is mainly accounted for by total factor productivity, but, unlike the employment rate and capital-to-labor ratio, the level of total factor productivity recovers somewhat to its precrisis trend over the medium term. In contrast, capital and employment suffer enduring losses relative to trend.

apply the Cerra-Saxena approach, which involves using an autoregressive model of output growth rates augmented by crisis dummies, to growth rates of potential output for Organization for Economic Cooperation and Development (OECD) member countries. Pisani-Ferry and van Pottelsberghe (2009) also discuss the persistent impact on output of banking crises using several case studies. Haugh, Ollivaud, and Turner (2009) analyze the impact of banking crises on potential growth in Finland, Japan, Norway, and Sweden.

[2]Because of data limitations, the decompositions into factor components are based on a smaller sample of 27 observations.

- Initial conditions have a strong influence on the size of the output loss. What happens to short-term output is also a good predictor of the medium-term outcome, as is the joint occurrence of a currency and a banking crisis. This is consistent with the notion that the output drop is especially persistent following large shocks, carrying over into the medium term. A high precrisis investment share of GDP is a reliable predictor of high medium-term output losses, because of its correlation with the dynamics of capital after the crisis. There is also evidence suggesting that limited precrisis policy room tends to be associated with more muted medium-term recoveries. Interestingly, postcrisis output losses are not significantly correlated with the level of income.
- The medium-term output loss is not inevitable. Some economies succeed in avoiding it, ultimately exceeding the precrisis trajectory. Although postcrisis output dynamics are hard to predict, the evidence suggests that economies that apply countercyclical fiscal and monetary stimulus in the short run to cushion the downturn after a crisis tend to have smaller output losses over the medium run. There is also some evidence that structural reform efforts are associated with better medium-term outcomes. In addition, a favorable external environment is generally associated with smaller medium-term output losses.

How do these findings relate to shifts in potential output following financial crises? The term "potential output" typically refers to the level of output consistent with stable inflation and is associated with structural and institutional factors. If an economy experiences a decline in output relative to its previous trend over the medium term, it could reflect a decline in potential output, but it could also partly reflect a persistent fall in aggregate demand. The experience of a number of economies, including Japan, suggests that if output remains below its precrisis trend over the medium term, then a substantial part of the shortfall reflects lower potential. Therefore, to the extent that this

chapter identifies output losses seven years after a financial crisis, it is likely that lower potential explains most of those losses. However, attempting to precisely identify shifts in potential output is beyond the scope of this chapter.

The first section of this chapter describes key features of medium-term output dynamics following financial crises based on international experience over the past 40 years. The second section decomposes medium-term output losses into their factor components (capital, labor, and productivity), as well as their demand-side drivers (consumption, investment, exports, and imports). The third section analyzes how medium-term output performance relates to country characteristics and macroeconomic conditions prevailing before the crisis. It also examines the role of domestic policies and the external environment after the onset of the crisis, based on both case studies of successful medium-term recoveries and statistical analysis. The last section puts the recent financial crisis into historical perspective and discusses implications of the analysis for the outlook.
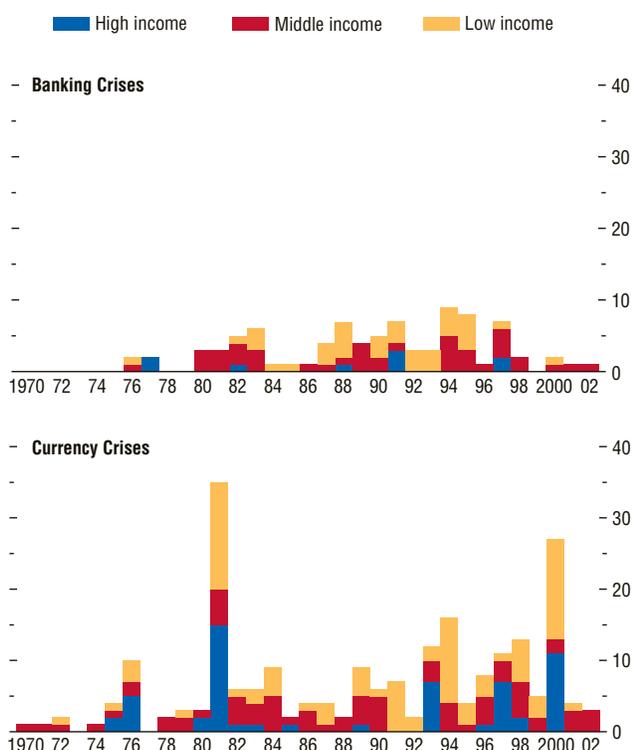
Does Output Recover over the Medium Term?

This section presents key stylized facts on the output losses associated with financial crises. We start with methodological issues and then report some stylized facts on the estimated output losses at both the country and the global levels.

The analysis focuses on banking crises, although currency crises are also considered for purposes of comparison.[3] It uses a comprehensive set of financial crisis events from the early 1970s to 2002. Banking crisis dates are taken from Laeven and Valencia (2008).[4] Currency

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[3]Currency crises seem to be a natural choice for comparison, given that they represent a different type of financial crisis.

[4]The Laeven-Valencia data set is constructed by combining quantitative indicators measuring banking sector distress, such as a sharp increase in nonperforming loans and bank runs, with a subjective assessment of the situation.

crisis dates are identified based on the method-ology of Milesi-Ferretti and Razin (1998).[5] Our sample includes 88 banking crises and 222 currency crises, distributed across high-, middle-, and low-income economies (Figure 4.2).[6] We also use a set of major international financial crises dating to the end of the 19th century to analyze the impact at the global level (Box 4.1).

We compute the medium-term output loss for each episode, as illustrated in Figure 4.3.[7] The idea is to measure the output loss associated with a crisis as the difference between the actual level of output and the level that would have been expected based on the prevailing precrisis trend. To focus on the medium term, the postcrisis window is seven years, beyond the effects of short-term fluctuations in the economy. Estimating the precrisis trend is tricky in terms of insulating the analysis from the impact of any immediate precrisis boom or slump, and there is no well-established method of doing this. We estimate a linear trend through the actual output series during a seven-year pre-crisis period that ends three years before the onset of the crisis.[8] The appeal of this approach is that it is simple, transparent, and easy to implement for a large set of economies. Given its linearity, it also facilitates the decomposition of output losses into the factors of production,

Figure 4.2. Distribution of Crises across Time and Economy Type
(Number of countries)

Sources: Laeven and Valencia (2008); and IMF staff calculations.

[5]This definition requires (1) a 15 percent minimum rate of nominal depreciation vis-à-vis the U.S. dollar, (2) a minimum 10 percent increase in the rate of depreciation with respect to the previous year, and (3) a rate of depreciation of below 10 percentage points in the previous year. For the rationale behind this definition, see Milesi-Ferretti and Razin (1998).

[6]The sample excludes transition economies, because the output developments in these economies were strongly related to the shift away from central planning rather than to financial crises. Countries with populations of less than 1 million are also dropped.

[7]See Angkinand (2008) for a literature review of alternative methods for estimating output losses associated with a crisis.

[8]In a number of cases, however, the above procedure yielded negative trend growth rates, implying that output per capita would decline indefinitely even in the absence of a crisis. In these cases, the precrisis window was extended from 10 to 20 years before the crisis and used instead if it produced a more plausible trend growth rate.

namely losses in capital, labor, and total factor productivity. The robustness of the results is checked by considering alternative approaches to estimating the precrisis trend.[9] The actual level of output is measured as the logarithm of real GDP per capita.

The key stylized facts that emerge from the analysis are as follows:

- Typically, output does not recover to its precrisis trend. On average, output falls steadily below its precrisis trend until the third year after the crisis and does not rebound thereafter (Figure 4.4).
- The medium-term output losses following banking crises are substantial. Seven years after the crisis, output has declined relative to trend by close to 10 percent on average. As indicated by the shaded area measuring the 90 percent confidence band, the average decline relative to trend is statistically significant (see Figure 4.4).
- Medium-term growth rates tend to eventually return to the precrisis rate. As illustrated in Figure 4.5, the medium-term growth rate is typically statistically indistinguishable from the precrisis trend growth rate.[10]
- The variation in outcomes is substantial. For example, whereas the change in output relative to trend following banking crises has a mean of –10 percent, the middle 50 percent of cases had a range of –26 percent to +6

[9]Several robustness checks were performed. First, the calculations were repeated with the precrisis window ending one year rather than three years before the crisis. Second, an alternative approach was applied to computing the trend growth rates, by which a longer precrisis window from $t = -20$ (rather than $t = -10$) to $t = -3$ was applied to the lowest and the highest 10 percent of trend growth rates. Third, the precrisis trend was computed based solely on the longer precrisis window (from $t = -20$ to $t = -3$). Finally, the output losses were recomputed using real-time medium-term growth projections from IMF country desk economists as the trend growth rates. Note, however, that these real-time forecasts were available only after 1989. Overall, the output losses obtained using the different approaches were highly correlated (see Appendix 4.1).

[10]The mean difference with respect to the precrisis trend growth rate is –0.2 percentage point, with a standard error of 0.4 percentage point.

Figure 4.3. Methodology Example (Korea 1997)
(First year of crisis at t *= 0; years on x-axis)*
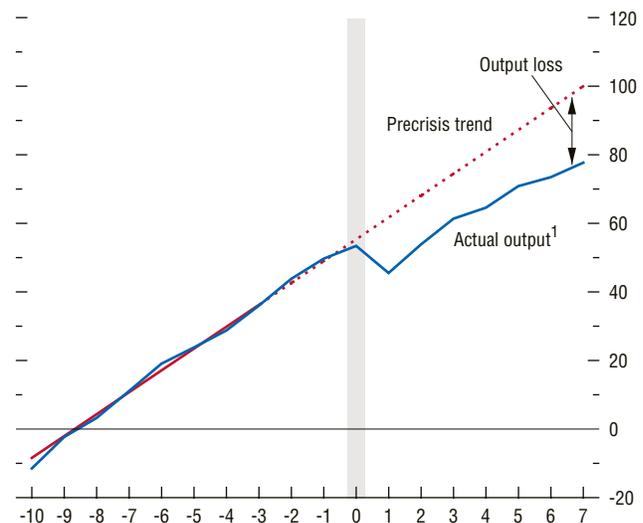
Sources: World Bank, *World Development Indicators;* and IMF staff calculations.
Note: The precrisis trend is estimated up to year $t = -3$, and is extrapolated linearly thereafter. The dotted line indicates the extrapolation of the trend up to the year $t = 7$.
[1]Output = logarithm of real GDP per capita; 100 equals trend in year 7.

Figure 4.4. Output Evolution after Banking and Currency Crises
(Percent of precrisis trend; mean difference from year t = – 1; *first year of crisis at* t = 0; *years on x-axis)*
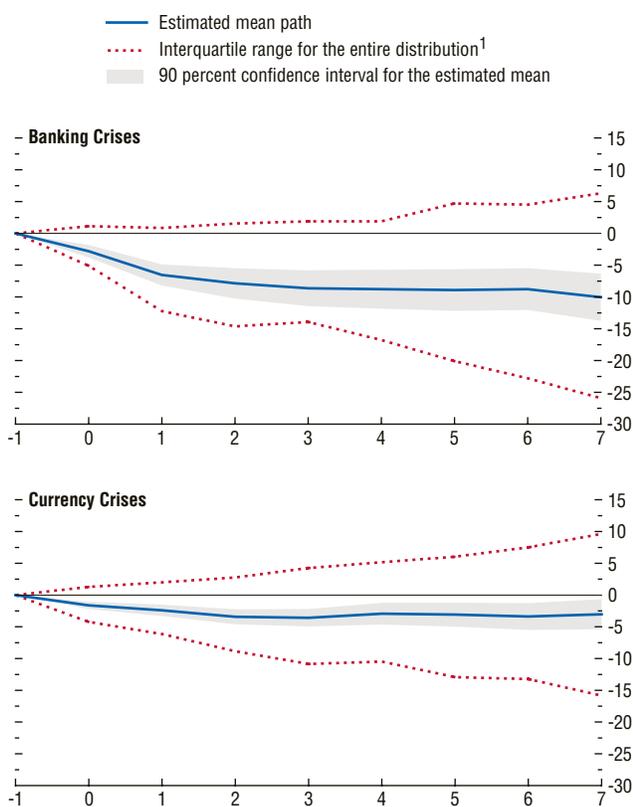
Sources: World Bank, *World Development Indicators;* and IMF staff calculations.
[1]The interquartile range indicates the middle 50 percent of all crises.

percent (see Figure 4.4).[11] On average, there is no rebound to the precrisis trend, but in more than a quarter of cases, output ultimately exceeded this level.

To put the losses associated with banking crises in perspective, Figure 4.4 also reports the evolution of output relative to trend following currency crises. Estimated losses following currency crises are much smaller, about one-third (3 percent) of the average loss associated with banking crises.

At the global level, the picture is broadly similar: major international financial crises during the past 140 years were typically followed by persistent output losses relative to precrisis trend, with gradual recoveries in output growth rates. Medium-term output losses were particularly large for both advanced and nonadvanced economies following the Great Depression (see Box 4.1).

Decompositions: Why Does Aggregate Output Fail to Recover after a Banking Crisis?

This section decomposes medium-term output losses, in terms of factor inputs and demand components, to help explain which factors drive them. Exploring these underlying forces could provide insights into both the likely trend in output after the current banking crises and the types of policies that may help reduce the ultimate losses.

Before presenting the results, we briefly review the main channels through which banking crises may affect output in the medium term.

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[11]Part of the variation in outcomes reflects the variation in the estimates of the country-specific precrisis trends and not just the heterogeneity of postcrisis output paths. However, the wide range of outcomes is robust to using alternative measures of the precrisis trends.

What Are Possible Effects on the Key Sources of Output?

A useful way to examine why output per capita often fails to recover to its precrisis trend is to analyze what happens to the key elements of an economy's production process, namely labor inputs (which can be thought of as depending on the employment rate and labor force participation), capital inputs, and total factor productivity. From a theoretical perspective, banking crises may affect these components in several ways.[12]

- *Impact on labor force participation:* In theory, the medium-term effect of a crisis on this component of labor input is uncertain. There are two opposing forces. On the one hand, grim employment prospects may discourage jobseekers and prompt employed workers to leave the labor force, especially if there are incentives to retire early. On the other hand, in times of economic hardship, second-income earners may enter the labor force to help compensate for a loss in family income or wealth.[13]

- *Impact on employment rate:* The medium-term employment rate may be adversely affected if a financial crisis leads to an increase in the underlying ("structural") unemployment rate. Why? The crisis may imply the need for a substantial reallocation of labor across sectors, something that may take time and increase medium-term frictional unemployment. Perhaps more important, the large initial increase in the actual unemployment rate induced by the crisis could persist for a long time if rigid labor market institutions (strict employment protection laws, gener-

Figure 4.5. Medium-Term Growth after Banking Crises[1]
(Difference from precrisis trend; percentage points)
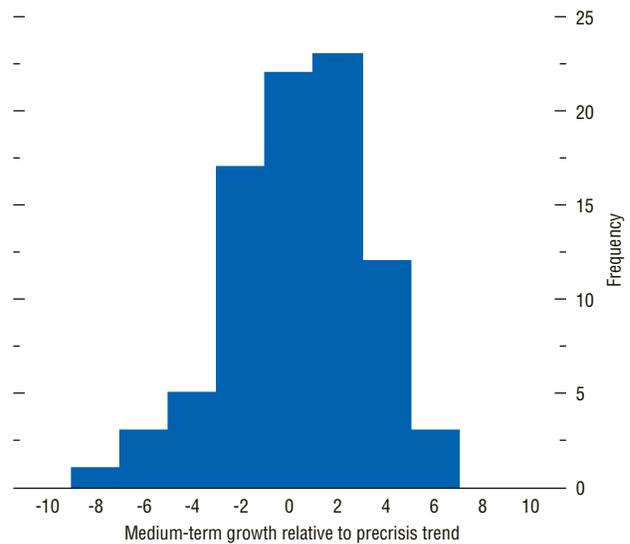
Sources: World Bank, *World Development Indicators;* and IMF staff calculations.
[1]Medium-term growth is derived as the five-year average growth starting in the fourth year after the crisis.

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[12]Changes in these components following a banking crisis could reflect a deterioration in the economy's productive potential, as well as a persistent fall in aggregate demand, although the latter is likely to explain only a small part of medium-term losses..

[13]Indeed, there is some evidence suggesting that the additional worker effect may already be playing a role in the current crisis, with the female participation rate rising as the male participation rate has fallen in the United States (see FRBSF, 2009).

Box 4.1. A Historical Perspective on International Financial Crises

International financial crises have been a feature of the global economy for a very long time. This box undertakes a historical comparison of output paths following these crises going back to 1870.[1]

Since 1870, global output has grown at an average rate of about 3 percent a year (first figure). During this period, the trend in the pace of global growth has shifted, most notably in the aftermath of the two world wars and the Great Depression and in the early 1970s. The level and the growth rate of global output were also affected to varying degrees by a number of international financial crises described below.

Following the literature, it is possible to identify at least eight episodes of major international financial crisis since 1870 (see first figure).[2] In 1873, the German and Austrian stock markets collapsed, causing declines in capital inflows, debt servicing problems, and crises throughout Europe and the Americas. In 1890, a boom in lending to the Americas came to an end, leading to debt crises in Latin America, notably Argentina, and to the near failure of the London-based Baring Brothers bank. In 1907, a fall in copper prices caused financial panic in the United States, with spillovers to a number of countries in Europe, Latin America, and Asia.

In 1929, a stock market crash in the United States ushered in the Great Depression. Monetary policy tightening during the preceding year, aimed at stemming speculation, is widely

seen as a key initial cause.[3] Debt deflation, bank runs and failures, and severe recession in the United States intensified through 1933 amid an incoherent policy response. The crisis was transmitted worldwide through wealth losses and declines in trade and capital flows, with monetary policies constrained by the gold standard.

There were another four episodes of major international financial crisis during the postwar period. The Latin American crisis began in 1981–82 and set off a nearly decade-long debt crisis across emerging economies. In 1991–92, real estate and equity price bubbles burst in Scandinavia and Japan, while the exchange rate mechanism (ERM) in Europe came under pressure. In 1997–98, the Asian and Russian crises led to widespread capital outflows from emerging economies. Finally, in 2007–08, bursting real estate bubbles and a collapse of securitization in the United States and other advanced economies marked the beginning of the current financial crisis.

To compare the output effects of these international crises, output losses following each episode are measured in the same way as in the main text. In short, the precrisis trend line is calculated by fitting a linear regression through the output series (in logs) between 10 and 3 years before the onset of the crisis; then the output loss is defined as the difference (in logs) between the actual level of output and its precrisis trend. To focus the discussion, the comparison is limited to five crises associated with major global downturns and for which sufficient data are available: the New York panic of 1907; the Great Depression; the Latin American debt crisis of the early 1980s; the Scandinavian, Japanese, and ERM crises of the early 1990s; and the current crisis.[4] It is clear that the Great

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The main author of this box is Irina Tytell. Stephanie Denis provided research assistance.

[1]Global GDP is constructed by aggregating individual country series in 2008 purchasing-power-parity dollars. The data sources are the IMF World Economic Outlook database, the Total Economy Database of the Conference Board (www.conference-board.org/economies/database.cfm), and the Historical Statistics Database of Angus Maddison (www.ggdc.net/madison).Changes in sample composition are smoothed by pasting together the aggregate growth rates before and after each change. The World War II data rely on approximations in a number of cases and should be treated cautiously.

[2]See Bordo (2006), Reinhart and Rogoff (2008a and 2008b), and references therein.

[3]See Box 3.1 in the April 2009 *World Economic Outlook* and the references therein.

[4]There is a potential bias associated with the way these crises are selected, given that they are all associated with downturns. For the current crisis, only the information available to date is used. The Asian and Russian crises were not associated with major down-

Global Real GDP[1]
(Log scale)
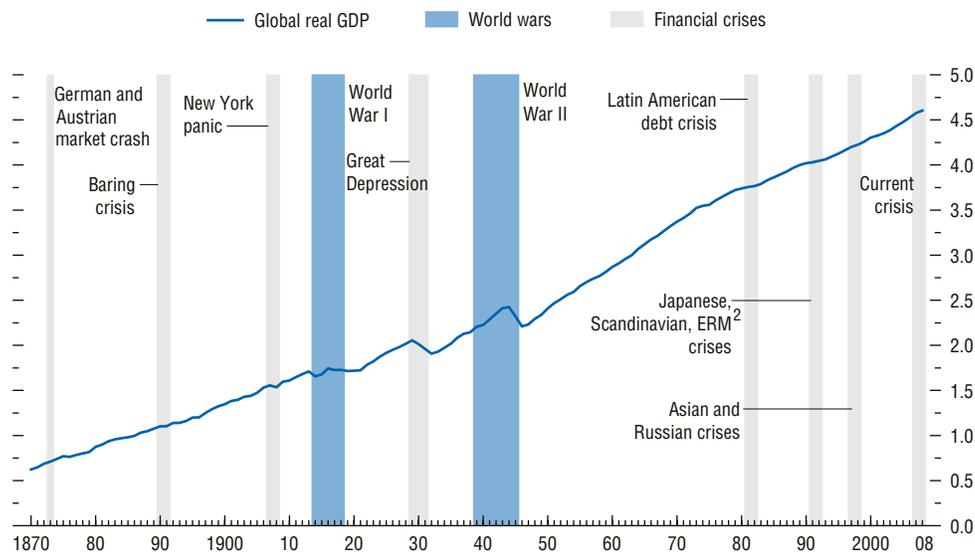
Sources: Angus Maddison, Historical Statistics Database; Bordo (2006); Conference Board, Total Economy Database; Reinhart and Rogoff (2008a and 2008b); and IMF staff calculations.
[1]For advanced economies, data start in 1870, except for Greece and Ireland data, which start in 1921. For emerging and developing economies, data start in 1950, except for Ecuador and Paraguay, which start in 1939; Poland and Romania in 1929; Bulgaria, Hungary, and Turkey in 1924; Costa Rica, Czechoslovakia, El Salvador, Guatemala, Honduras, and Yugoslavia in 1920; Malaysia, Korea, and Taiwan Province of China in 1912; Philippines in 1902; Argentina, Colombia, Mexico, Peru, and Venezuela in 1900; India in 1884; and Brazil, Chile, Indonesia, Sri Lanka, and Uruguay in 1870.
[2]ERM = European exchange rate mechanism.

Depression was associated with by far the largest medium-term output losses: 28 percent in advanced and 21 percent in nonadvanced economies in 1936, seven years after the onset of the crisis (second figure). Both country groups were least affected by the New York panic, with output losses close to zero two years after the crisis and no medium-term consequences.[5] Advanced economies experienced significant losses in

the 1990s (10 percent as of 1998), whereas the effects on emerging and developing economies were relatively short lived. However, emerging and developing economies experienced large losses after the 1980s debt crisis (13 percent as of 1988), whereas advanced economies were not affected much beyond the short term. In the current crisis, advanced economies have taken the greater hit; emerging and developing economies have fared better so far.

In all three crises associated with medium-term losses in the past—the Great Depression, the 1980s in emerging and developing economies, and the 1990s in advanced economies—output grew more slowly relative to the precrisis trend for a number of years. The fastest

turns at the global level (see Box 1.1 in the April 2009 *World Economic Outlook*). The data available at the time of the German stock market crash and the Baring crisis are not sufficient for the analysis, in part because of limited coverage of nonadvanced economies.

[5]Rising output losses in 1914 reflect the outbreak of World War I.

Box 4.1 *(concluded)*

turnaround in growth rates occurred after the Great Depression: growth returned to trend by 1934 in advanced economies and by 1936 in nonadvanced economies. However, growth rates remained about 1 percentage point below the precrisis trend seven years after the onset of the two more recent crises: the 1980s crisis in

emerging and developing economies and the 1990s crisis in advanced economies. By implication, in none of these three episodes did output growth accelerate sufficiently in the aftermath of the crisis to return output to its precrisis trend. It remains to be seen whether the current crisis will follow a similar pattern.

Output Evolution after Financial Crises
(Percent of precrisis trend; mean difference from year t = – 1; first year of crisis at t = 0; *years on x-axis)*
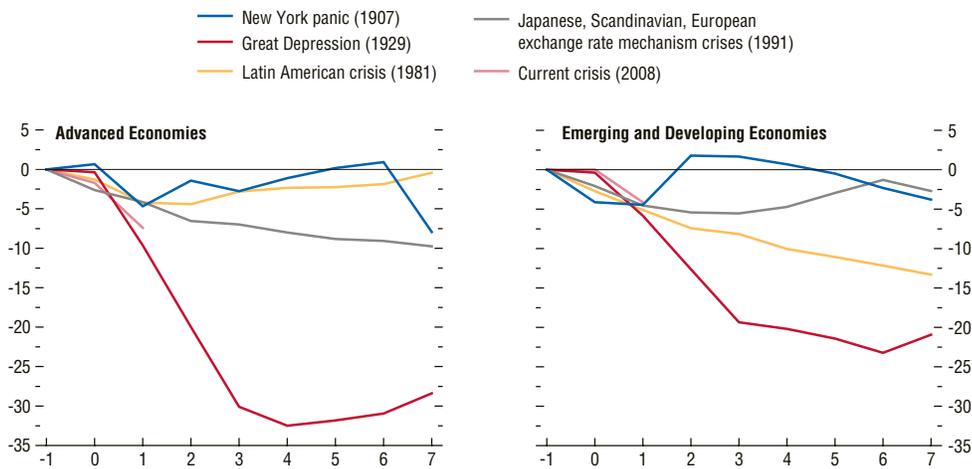
Sources: Angus Maddison, Historical Statistics Database; Bordo (2006); Conference Board, Total Economy Database; Reinhart and Rogoff (2008a and 2008b); and IMF staff calculations.

ous unemployment benefits) complicate the task of finding a new job. Long spells without employment may also impair professional and on-the-job skills, making it even more difficult for the long-term unemployed to find jobs.[14]

- *Impact on capital accumulation:* A financial crisis may depress investment and slow capital accumulation over a protracted period. As the supply of credit becomes more limited, firms face

tougher financing conditions in the form of tighter lending standards and higher effective costs of borrowing, and profit rates are likely to suffer (see Bernanke and Gertler, 1989 and 1995; and Bernanke and Blinder, 1988). The ability of firms to borrow and invest may be hampered further if the crisis leads to lower asset prices that weaken corporate balance sheets and erode collateral values (see Kiyotaki and Moore, 1997). Investment may also suffer if the crisis leads to a sustained increase in uncertainty and risk premiums.

[14]These are often called "hysteresis effects." See Blanchard and Wolfers (2000); Bassanini and Duval (2006); and Nickell, Nunziata, and Ochel (2005), among others.

- *Impact on total factor productivity:* The effect on total factor productivity is ambiguous, based on theoretical considerations. On the negative side, as it recovers from the crisis, the financial system may not be able to allocate loanable funds as productively as before the crisis, particularly if high-risk but high-return projects are discouraged by more cautious lending attitudes.[15] In addition, productivity may also suffer due to less innovation, as research and development spending tends to be scaled back in bad times (see Guellec and van Pottelsberghe, 2002). Also, high-productivity firms may go under for lack of financing. On the positive side, however, financial crises may have a cleansing effect on the economy by removing inefficient firms and activities and creating incentives to restructure and improve efficiency.[16]

What Do the Data Show?

Medium-term output losses following banking crises are decomposed into underlying components using the following approach. The starting point is the observation that the logarithm of output per capita is equal to the weighted sum of the logarithms of labor force participation, employment rate, capital-to-labor ratio, and total factor productivity.[17]

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[15]In some countries, the efficiency of financial intermediation could be low both before and after a crisis.

[16]See Caballero and Hammour (1994) and Aghion and Saint-Paul (1998). The underlying concept of "creative destruction" was first introduced by Schumpeter (1942).

[17]The decompositions are based on a Cobb-Douglas production function of the form $Y = AE^{\alpha}K^{1-\alpha}$, where A denotes total factor productivity, E denotes employment, and K denotes the capital stock. The employment share α is assumed to be 0.65. Given the assumption of constant returns to scale, the production function can be expressed in per capita terms by dividing by population, P, yielding $\frac{Y}{P} = A\left(\frac{E}{P}\right)^{\alpha}\left(\frac{K}{P}\right)^{1-\alpha}$. Finally, taking logs and noting that $\frac{E}{P} = \left(\frac{E}{LF} \times \frac{LF}{P}\right)$ and $\frac{K}{P} = \left(\frac{K}{E} \times \frac{E}{LF} \times \frac{LF}{P}\right)$ —where LF denotes the labor force—yields the decomposition used in the analysis: $\log\left(\frac{Y}{P}\right) = (1-\alpha)$ $\log\left(\frac{K}{E}\right) + \log\left(\frac{E}{LF}\right) + \log\left(\frac{LF}{P}\right) + \log\ (A)$, where $\frac{K}{E}$ rep-

Applying the same procedure for estimating precrisis trends and computing output losses to their underlying components allows us to decompose output losses into losses due to changes in the employment rate, labor force participation, capital-to-labor ratio, or total factor productivity.[18] To complement the analysis, an analogous decomposition is done for the demand-side components of output: investment, consumption, exports, and imports.[19]

The results for both types of output loss decompositions are presented in Figures 4.6 and 4.7. For each component of output, the 90 percent confidence bands are reported to indicate the statistical significance of the estimates. Note that due to limited data availability, the size of the sample shrinks from 88 to 27 observations for these decompositions.

What do the results tell us?

- The measured medium-term losses in GDP per capita can be attributed to roughly equal losses in three of the four components of output, namely, the employment rate, capital-to-labor ratio, and total factor productivity (see Figure 4.6).[20]
- After a significant initial decline, total factor productivity gradually moves closer to the precrisis trend toward the end of the seven-year horizon. This is consistent with the notion that labor hoarding decreases over time. Nevertheless, the medium-term loss in total factor productivity still accounts for about one-third of the total output loss. Its magnitude, however, is not statistically significant

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resents the capital-to-labor ratio, $\frac{E}{LF}$ is the employment rate, and $\frac{LF}{P}$ is the labor force participation rate.

[18]Specifically, for each output component, the precrisis trend is estimated over the same precrisis period as the output trend. This approach ensures that, based on the assumed Cobb-Douglas production function, the factor input contributions add up exactly to the total output loss.

[19]Because the demand components are additive, the losses of the aggregate demand components do not sum exactly to the total output loss.

[20]The contribution of labor force participation is positive, albeit small and statistically insignificant.

Figure 4.6. Output Decomposition
(Percent of precrisis trend; mean difference from year t = − 1;
first year of crisis at t = 0; *years on x-axis)*
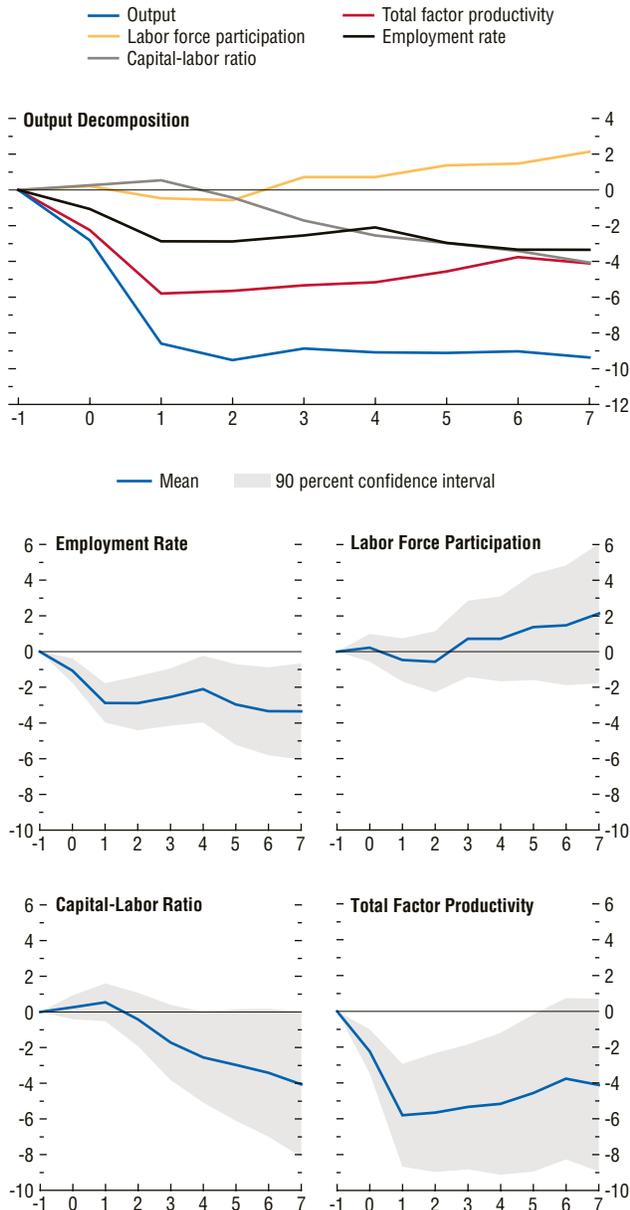
Sources: Bosworth and Collins (2003); World Bank, *World Development Indicators;* and IMF staff calculations.

seven years after the crisis, although it is in the short term.

- The initial loss in the employment rate persists into the medium term, whereas capital losses worsen steadily over time.

The finding of an adverse impact on the capital-to-labor ratio is consistent with demand-side decompositions that show a large and significant decline in investment of about 30 percent relative to its precrisis trend (see Figure 4.7). The consumption loss is also notable and significant, at about 15 percent. These losses are partially offset by an overall improvement in net exports relative to trend.

Overall, the decompositions suggest that higher unemployment rates, slower capital accumulation, and lower productivity growth play an important role in explaining medium-term output losses following banking crises. In other words, output per capita does not recover to its precrisis trend because capital per worker, the unemployment rate, and productivity do not typically return to their precrisis trends within seven years after the crisis. This finding suggests that pre- and postcrisis macroeconomic conditions and policies could play a role in shaping medium-term output dynamics—an issue examined in the next section.

What Factors Are Associated with Medium-Term Output Losses?

To explain the substantial variations in medium-term output losses across banking crises, this section explores how output losses are related to various macroeconomic, structural, and policy conditions, both before and after the crisis.

The analysis uses a broadly similar empirical strategy, which examines the associations of pre- and postcrisis macroeconomic factors with medium-run output losses as follows:

- We first present the results of small-scale ordinary least squares (OLS) regressions that consider several factors at a time. These small-scale regressions typically include one or two

variables of interest in addition to key control variables.

- We then explore the robustness of the results using a large-scale OLS regression that includes all of the factors considered simultaneously and using Bayesian model averaging (BMA). Unlike the large-scale OLS regression, BMA allows us to examine whether the associations found for each variable are robust to including additional controls in *all* the possible ways that those additional controls can be added.[21] BMA is particularly useful in our investigation because theory is not sufficiently explicit regarding which variables should be included in the "true" regression. At the same time, however, BMA has substantial data requirements that, here, reduce the number of available observations by half. This is why we use both the small-scale results (based on a broad sample) and the larger-scale models (based on a restricted sample).

- Finally, in the postcrisis analysis, we complement the statistical methods described above with a more narrative approach based on country case studies.

Do Precrisis Conditions Help to Predict Medium-Term Output Losses?

What are the precrisis factors that may explain the magnitude of the eventual output losses? Our analysis examines the importance of a range of macroeconomic, structural, and policy variables:

[21]The procedure summarizes the results obtained across all possible specifications using two key statistics: (1) the average coefficient value obtained for each variable, and (2) the probability that each variable is statistically "effective" and should be used to predict output losses. A conventional approach in the BMA literature is to refer to a variable as "effective" if its estimated inclusion probability is greater than 50 percent. For additional details on BMA, see, for example, Hoeting and others (1999) and Masanjala and Papageorgiou (2008). We are grateful to Chris Papageorgiou for providing us with R programs that implement BMA.

Figure 4.7. Demand-Side Decomposition
(Percent of precrisis trend; mean difference from year t = − 1; *first year of crisis at* t = 0; *years on x-axis)*
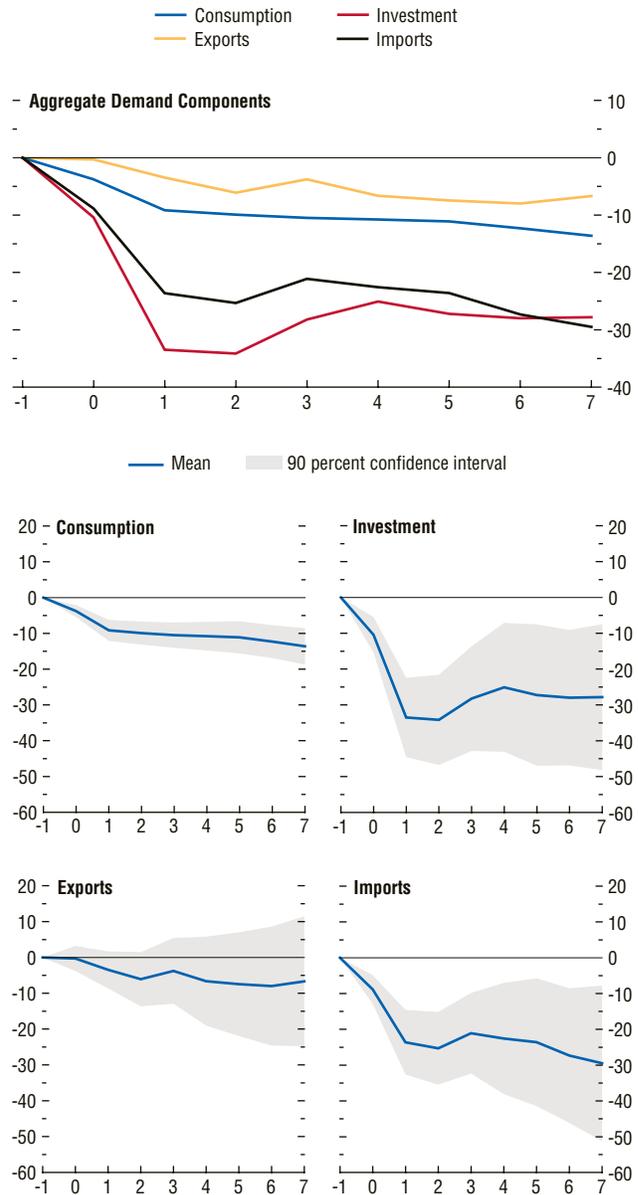
Sources: World Bank, *World Development Indicators;* and IMF staff calculations.

Table 4.1. Output Losses versus Initial Conditions
(Dependent variable: output at t=7 in percent of precrisis trend)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Investment/GDP		−0.989***										−1.211***	−1.602
			[−3.120]										[−2.825]	(1.000)
(2)	Investment/GDP gap		0.335										−1.049	−0.388
			[0.889]										[−1.671]	(0.381)
(3)	Current account/GDP			0.765**									0.063	0.000
				[2.016]									[0.167]	(0.000)
(4)	Current account/GDP gap			0.964									0.525	0.189
				[1.593]									[0.571]	(0.196)
(5)	Inflation				0.116								0.005	−0.002
					[1.500]								[0.063]	(0.042)
(6)	Inflation gap				−0.196**								−0.063	−0.032
					[−2.243]								[−0.475]	(0.258)
(7)	Fiscal balance					0.501							−0.541	0.000
						[1.205]							[−1.102]	(0.000)
(8)	Fiscal balance gap					1.256**							0.480	0.013
						[2.042]							[0.796]	(0.022)
(9)	Real exchange rate gap						−0.176						…	…
							[−1.274]							
(10)	Real interest rate gap						−0.127						…	…
							[−0.166]							
(11)	Log (PPP GDP per capita)							0.018					0.028	0.000
								[0.736]					[0.635]	(0.000)
(12)	Credit/GDP								−0.152				−0.032	0.005
									[−1.616]				[−0.299]	(0.073)
(13)	Credit/GDP gap								0.204				0.438	0.027
									[0.503]				[0.993]	(0.109)
(14)	Currency crisis									−0.141*			−0.155	−0.082
										[−1.878]			[−1.483]	(0.558)
(15)	U.S. Treasury bill rate										0.543		1.011	0.026
											[0.528]		[0.999]	(0.038)
(16)	External demand shock										−0.100		−0.113*	−0.012
											[−1.200]		[−1.960]	(0.089)
(17)	Financial openness/GDP											0.059***	0.008	0.002
												[3.031]	[0.499]	(0.094)
(18)	Trade openness/GDP											−0.133	−0.030	0.000
												[−1.549]	[−0.421]	(0.000)
(19)	Precrisis output	1.601***	1.328***	1.598***	1.027***	0.950***	1.425**	1.538***	0.900***	1.685***	1.632***	0.751**	0.901	0.916
		[3.844]	[3.875]	[4.855]	[2.691]	[3.174]	[2.435]	[3.639]	[2.700]	[3.931]	[3.807]	[2.175]	[1.437]	(0.871)
(20)	First-year output change	1.681***	1.583***	1.573***	1.781***	1.841***	1.069	1.752***	1.665***	1.552***	1.699***	1.799***	1.289***	1.175
		[3.051]	[3.551]	[3.608]	[3.406]	[3.547]	[0.992]	[3.039]	[3.280]	[2.694]	[3.046]	[3.271]	[3.379]	(1.000)
(21)	Constant term	−0.056**	0.162**	−0.018	−0.093***	−0.051*	−0.066	−0.077**	−0.021	−0.045**	−0.086	−0.049	0.125	0.337
		[−2.652]	[2.156]	[−0.726]	[−2.759]	[−1.970]	[−1.182]	[−2.036]	[−0.806]	[−2.003]	[−1.271]	[−1.159]	[0.791]	(1.000)
	Number of observations	88	85	80	87	81	26	88	77	88	88	52	44	44
	R^2	0.334	0.408	0.409	0.334	0.369	0.256	0.338	0.295	0.353	0.339	0.314	0.763	…

Source: IMF staff calculations.

Note: columns 1–12 report estimation results based on ordinary least squares with robust *t*-statistics in square brackets. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. Column 13 reports estimation results based on Bayesian model averaging with the probability of inclusion of each variable in parentheses. The term "gap" denotes the deviation of the variable from the precrisis historical average (years $t = −10$ to $t = −3$, where $t = 0$ denotes the crisis year) during the last three years preceding the crisis. PPP = purchasing power parity.

• *Output:* The precrisis output position (which identifies the starting position of output relative to trend) and the initial change in output during the first year of the crisis (which indicates the severity of the crisis in the short run) are potentially important control variables. The small-scale OLS results indicate that the severity of the crisis, measured by the first-year change in output, has strong predictive power for medium-term output losses (Table 4.1, row 20). Similarly, a depressed level of output relative to trend before the crisis appears to carry over and is associated with a significantly larger medium-

term output loss (Table 4.1, row 19).[22] Based on these results, the two initial output variables are included as controls in all remaining regressions.[23]
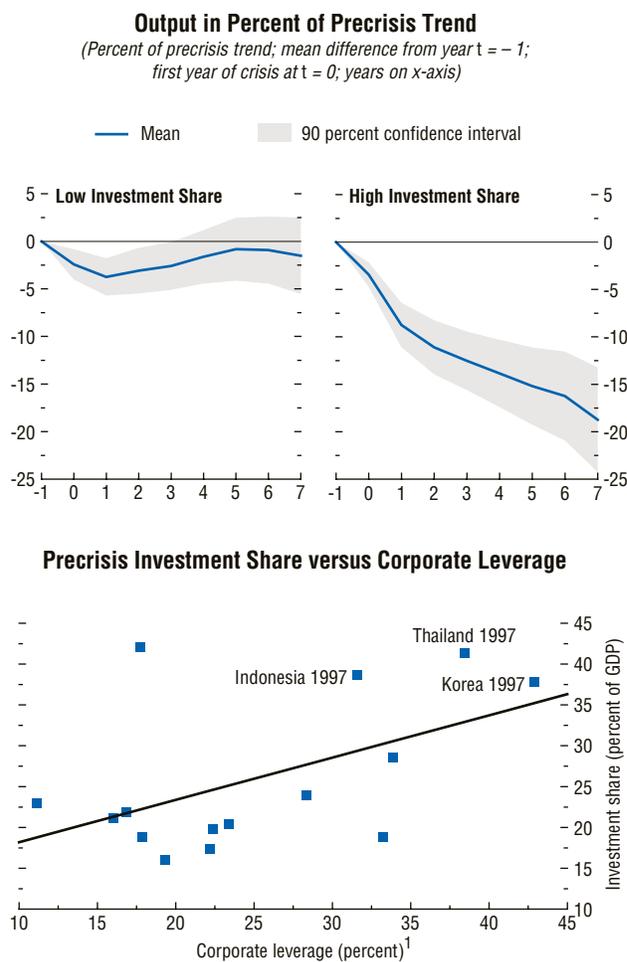
- *Investment:* The prominent role of investment and capital losses suggests that the level and evolution of precrisis investment would be good predictors of eventual output losses. Indeed, regression results provide strong evidence that economies with high precrisis investment-to-GDP ratios, measured as the average investment-to-GDP ratio during the three years before the crisis, tend to have large output losses (Table 4.1, row 1; Figure 4.8). In contrast, the investment gap, defined as the deviation from its historical average of the investment-to-GDP ratio during the three years before a crisis, is not statistically significant (Table 4.1, row 2).[24] We return to potential interpretations of these results later in this section, but it is worth mentioning that the precrisis investment share is particularly robust as a leading indicator, even after controlling for the level of the current account balance. This suggests that countries that have high investment rates tend to experience larger output declines following banking crises, irrespective of whether the investment is financed by foreign or domestic savings.

Figure 4.8. Output Evolution versus Precrisis Investment

Output in Percent of Precrisis Trend
(Percent of precrisis trend; mean difference from year t = – 1; *first year of crisis at* t = 0; *years on x-axis)*

Precrisis Investment Share versus Corporate Leverage

Sources: Ueda (2008); World Bank, *World Development Indicators;* and IMF staff calculations.
[1]Corporate leverage is measured by the debt-to-assets ratio.

[22]In the three years prior to a banking crisis, the level of output is, on average, below its trend, suggesting that banking crises are not typically preceded by a precrisis boom. In the sample of 88 banking crises, the average deviation is about –3 percent.

[23]A possible concern about controlling for short-run crisis severity, proxied by the decline in output in the crisis year, is that crisis severity could be correlated with other explanatory variables, potentially complicating the interpretation of the regression coefficients. For example, a greater precrisis investment-to-GDP ratio could be associated with a sharper short-run decline in output. To address this possible concern, all the regressions are also implemented while omitting the short-run crisis severity control variable (see Tables 4.3 and 4.4 in Appendix 4.1), and the coefficient estimates do not change substantially.

[24]The precrisis historical average level is based on the seven-year period ending three years before the crisis.
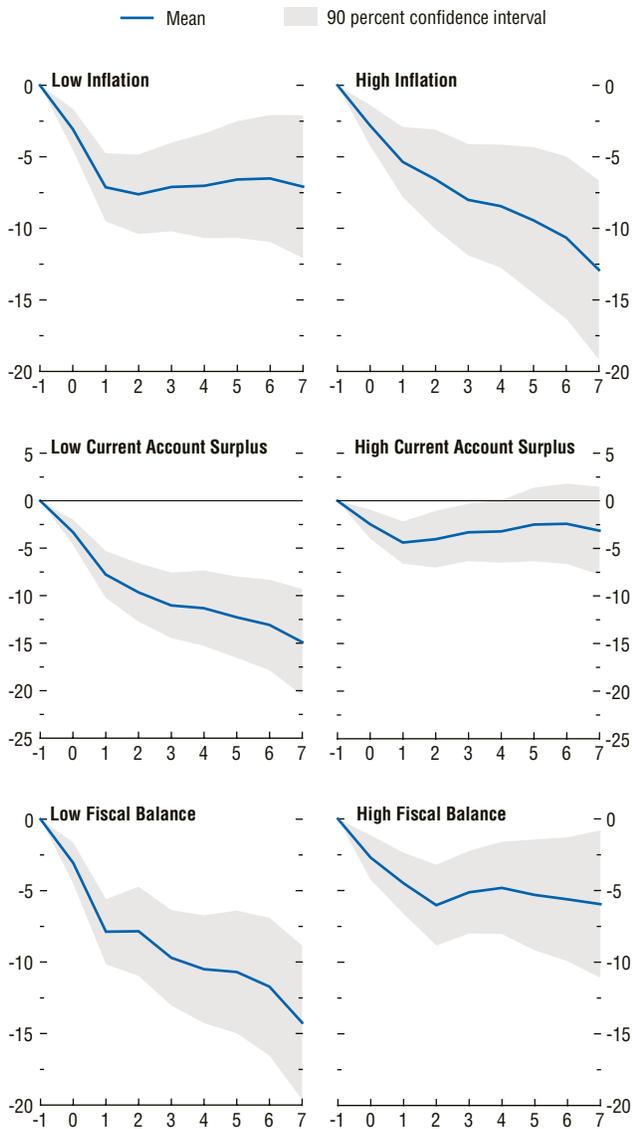
Figure 4.9. Output Evolution versus Precrisis Imbalances[1]

(Output in percent of precrisis trend; mean difference from year t = – 1; *first year of crisis at* t = 0; *years on x-axis)*

Sources: World Bank, *World Development Indicators;* and IMF staff calculations.
[1]The figure reports the output evolution for banking crises with inflation, current account, and fiscal balance below and above the sample median, respectively. Inflation and fiscal balance are measured in deviation from country-specific historical averages.

- *Policy room:* By limiting the room for policy maneuver, the buildup of macroeconomic imbalances may also imply higher medium-term output losses after a crisis. We consider the precrisis levels and dynamics of several variables—inflation, current account balance, fiscal balance, real exchange rate, and real interest rate—that may capture the notion of macroeconomic imbalances.[25] We find mixed evidence that rising imbalances are associated with larger output losses, and, by implication, that more limited policy room that constrains the ability of countries to run countercyclical macroeconomic policies is associated with larger output losses. In particular, the results based on the small-scale regressions suggest that economies with larger current account deficits, rising inflation, and a deteriorating fiscal balance before a crisis experienced significantly larger output losses (Table 4.1, rows 3, 6, 8; Figure 4.9). But the results from the BMA analysis (Table 4.1, column 13) are less conclusive. Here it is important to bear in mind that having more policy room does not necessarily mean using that policy room—an issue addressed later.[26]
- *Level of income and financial development:* Postcrisis output losses are not significantly correlated with the level of income (Table 4.1, row 11). In fact, the evolution of output after

[25]The dynamics are captured by considering the deviations of these variables from their country-specific historical averages during the precrisis period (the "gaps"). Using country-specific averages allows for the possibility that different countries may have different explicit or implicit inflation targets or fiscal rules. For example, a 3 percent inflation rate may imply less room for monetary easing in an economy with inflation normally at 1 percent than in an economy with an inflation norm of 5 percent. For each variable, the "gap" value is constructed as a deviation of the average precrisis value (from $t = -3$ to $t = -1$) from the country-specific average value (from $t = -10$ to $t = -3$). Using government debt to measure fiscal room was not possible for the sample of economies considered here due to data limitations.

[26]Two other domestic policy variables—the real interest rate and real exchange rate before the crisis, measured relative to their historical averages—do not appear to have predictive power for medium-term output losses (see Figure 4.1, rows 9, 10).

banking crises for upper-income, middle-income, and low-income economies is similar (Figure 4.10). At the same time, there is weak evidence that a higher precrisis level of financial development is associated with larger output losses (Table 4.1, row 12; Figure 4.10).[27]

- *Openness, external conditions, and currency crises:* Currency crises that coincide with banking crises—"twin crises"—are robustly associated with larger output losses (Table 4.1, row 14, Figure 4.11). The results for the openness indicators, on the other hand, are mixed (Table 4.1, rows 17, 18; Figure 4.11). The small-scale regression approach suggests that financial openness is associated with smaller losses and is consistent with recent work that finds that deeper financial integration reduces the risk of a sudden stop in capital flows and enhances the ability to smooth spending.[28] However, the evidence is weaker based on the broader specification. Evidence for trade is even weaker. Turning to external conditions, the U.S. Treasury bill rate before the crisis is not found to be a significant predictor of output losses (Table 4.1, row 15). The evidence that an adverse external demand shock occurring at the time of a banking crisis is correlated with larger output losses is mixed (Table 4.1, row 16).

- *Structural policy environment:* The precrisis levels of various structural policy reform indicators are not significantly correlated with medium-run output losses and are not presented in Table 4.1.[29] Nevertheless, one

[27]The analysis also considers whether an increase in the credit-to-GDP ratio relative to each country's own historical average level (the credit-to-GDP "gap") plays a role and finds it to be statistically insignificant. The question of whether there is a nonlinear link between the level of financial deepening and output losses is left for further research.

[28]See Calvo, Izquierdo, and Mejía (2008) and Abiad, Leigh, and Mody (2009).

[29]The analysis draws on the database of structural reforms prepared by the Research Department of the IMF. It covers 150 industrial and developing economies and eight sectors. In this chapter, we use the domestic financial sector reform index (which includes measures of securities markets and banking sector reforms) and the

Figure 4.10. Output Evolution versus Financial Development and Income[1]

(Output in percent of precrisis trend; mean difference from year t = – 1; *first year of crisis at* t = 0; *years on x-axis)*
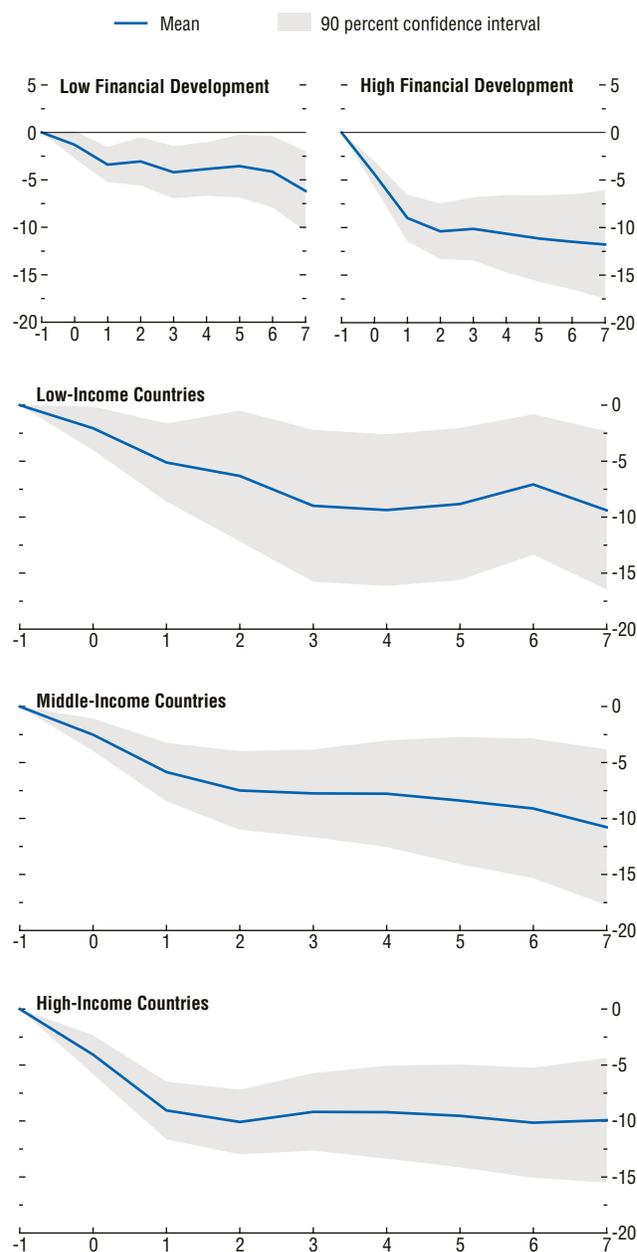
Sources: World Bank, *World Development Indicators;* and IMF staff calculations.
[1]The figure reports the output evolution for banking crises with financial development below and above the sample median and by income level. Financial development is measured by the credit-to-GDP ratio. Income level is measured by real purchasing-power-parity GDP per capita.

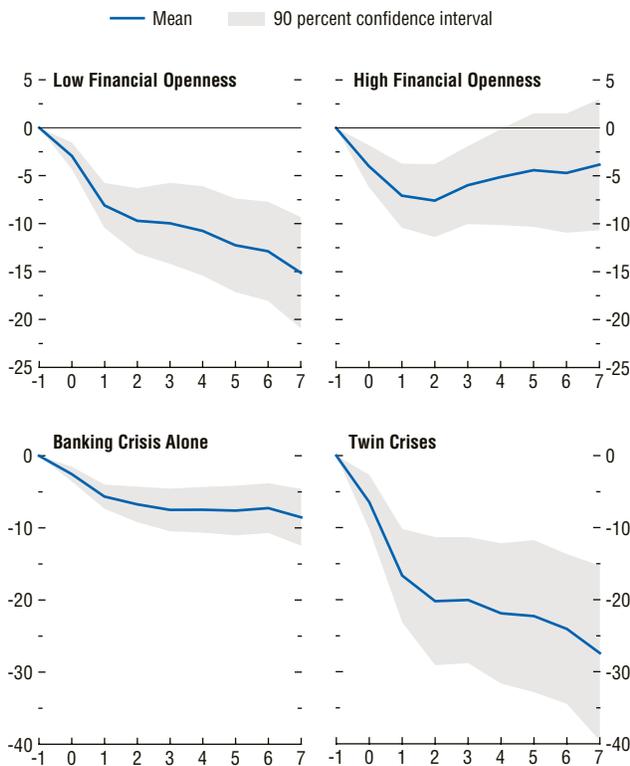**Figure 4.11. Output, Twin Crises, and Financial Openness[1]**

(Output in percent of precrisis trend; mean difference from year t = – 1; *first year of crisis at* t = 0; *years on x-axis)*

Sources: Lane and Milesi-Ferretti (2006); and IMF staff calculations.
[1]Financial openness is measured using the ratio of external assets and liabilities to GDP. Twin crises are defined as simultaneous banking and currency crises. The figure reports output evolution for banking crises and twin crises and for crises with financial openness below and above the sample median, respectively.

finding is worth highlighting: countries with higher precrisis levels of employment protection tend to experience larger postcrisis employment losses. This link is illustrated for OECD economies that have experienced banking crises, using the OECD's comprehensive measure of employment protection, and for the broader banking crisis sample using a cruder measure (Figure 4.12).[30] Because this result is based on a smaller sample, it needs to be interpreted cautiously.

What do the regression results tell us?

The empirical analysis suggests that the first-year loss is important in predicting the eventual output losses following a banking crisis. This is consistent with the notion that output dynamics are especially persistent following large shocks. What could explain this? Some possible candidates include (1) bankruptcies that lead to fire sales of capital assets that have significant sunk costs and take time to rebuild, (2) an impaired financial system that needs time to heal before it can intermediate financial capital effectively, and (3) labor and product market rigidities that impede the necessary reallocation of labor and capital following a crisis. These explanations are consistent with the finding that all factors of production contribute to medium-term output losses.

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capital account liberalization index (which summarizes a broad set of restrictions), the trade liberalization index (based on average tariffs), and the fiscal sector reform index (based on tax rates and the efficiency of revenue collection and public spending). We also use various measures of labor market flexibility, including for employment protection, unemployment benefit replacement ratios, and tax wedges. See IMF (2008) and Giuliano, Mishra, and Spilimbergo (2009) for more details. The indices for product market reforms were not used in the analysis because of insufficient data coverage.

[30]The OECD employment protection legislation (EPL) strictness index is produced annually and generally goes back to the mid-1980s. It is a summary indicator of EPL strictness, which weights 14 subcomponents (on dismissal procedures for regular contracts and the use of temporary contracts). For the broader sample, two of the subcomponents that are used to construct this index are available (on notice periods required and severance payments involved in employment termination).

Related to the dynamics of capital accumulation, the precrisis investment share is a particularly robust predictor of the postcrisis output loss. This finding, together with the earlier result that investment and the capital-to-labor ratio decline over the medium term following banking crises, is consistent with a number of potential interpretations. In some cases, it may be that the output loss reflects the unwinding of excessive investment built up over a protracted period, such as the real estate bubble in the case of Thailand's 1997 crisis.[31] Corporate sector indebtedness may also play a role. Figure 4.8 shows a link between the precrisis investment-to-GDP ratio and the level of precrisis corporate leverage. During the bubble period, when collateral may be valued excessively, some firms issue debt in order to invest. When the bubble bursts, these same firms have to delever, which may take time, leading to a stagnation of investment over the medium term. For economies affected during the Asian crisis, such as Indonesia, Korea, and Thailand, there is some firm-level evidence supporting this hypothesis (Coulibaly and Millar, 2008). Nevertheless, these interpretations may not fully explain the remarkably strong correlation between the precrisis investment share and medium-term output losses—an issue that merits further investigation.

Regarding employment dynamics, there is some tentative evidence linking eventual employment losses to the level of employment protection. Theoretically, employment protection has an ambiguous effect because it reduces inflows to and outflows from employment. However, while the effect on the steady-state employment rate is unclear, many academic papers argue that stricter employment protection makes the labor market less effective at reallocating labor after a shock.[32] Specifically, in the immediate aftermath of a banking crisis,

Figure 4.12. Employment Losses and Employment Protection Legislation
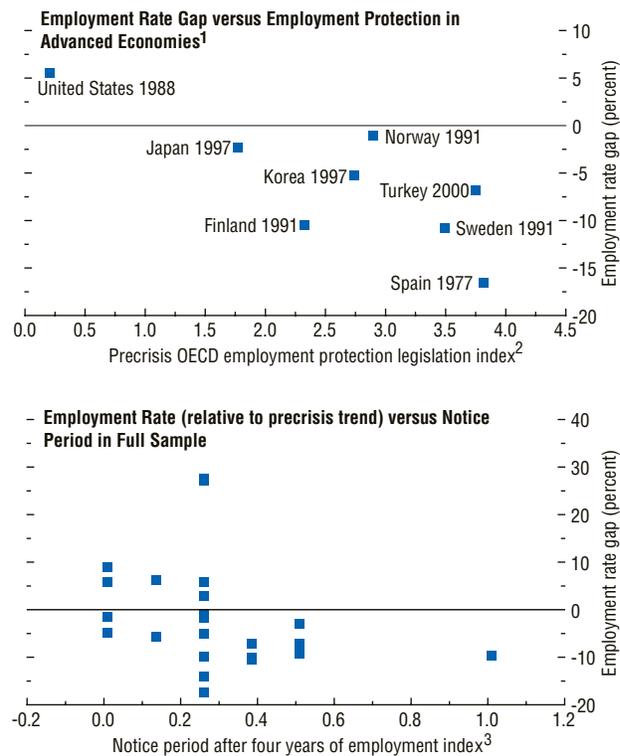
Sources: IMF, Structural Reform Database; and IMF staff calculations.
[1]The employment rate gap measures the employment rate relative to its precrisis trend.
[2]The index is a summary indicator of the OECD employment protection legislation strictness. Because employment protection legislation index data start in the mid-1980s, the 1985 observation is used for Spain 1977.
[3]The index is constructed based on the notice period required to terminate employment.

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[31]To the extent that some investment during the precrisis period was wasteful, output losses may have taken place even without a crisis, albeit gradually.
[32]See Blanchard and Portugal (2001) and Balakrishnan and Michelacci (2001), for example.

unemployment may rise independently of the level of protection because firms can more easily justify layoffs during crises (or are more willing to pay firing costs) and because the number of bankruptcies rises. After the crisis, however, countries with stricter employment protection may experience lower job creation, explaining the larger overall employment rate losses.

After the Crisis: Which Policies Are Associated with Lower Output Losses?

What role do policies play in mitigating the ultimate output loss after a crisis? It is important to acknowledge that the following discussion seeks to identify patterns rather than establish causality between policies and postcrisis output trends.[33] The discussion focuses on domestic macroeconomic policies and structural reforms and on external conditions and policies abroad. As in the analysis of precrisis factors, we present the regression results, which are supplemented by some relevant charts. As before, all regressions control for key initial output variables.

- *Macroeconomic policy support:* Short-run demand management policies (monetary and fiscal) implemented after the beginning of a crisis may play a role both in reducing the size of the initial output loss and in aiding the recovery. Dependent on data availability, we measure the monetary policy stance as the change in real lending rates. To measure changes in discretionary fiscal policy, we follow the approach of the April 2009 *World Economic Outlook* and use the growth in real government consumption. In both cases, to capture the short-term response of macroeconomic policies, the variables are computed for the

first year of the crisis and the following three years. The variables are designed to measure a notion of stimulus (rather than policy room) and thus differ from those used in the precrisis analysis. We find that a stronger short-term fiscal policy response (a larger increase in government consumption) is significantly associated with smaller medium-term output losses (Table 4.2, row 1; Figure 4.13).[34] The evidence on the monetary policy stance is mixed, possibly reflecting a weaker monetary policy transmission mechanism after banking crises. A decline in real lending rates is associated with smaller output losses, but only in some specifications (Table 4.2, row 2; Figure 4.13). There is also some mixed evidence that real exchange rate depreciations are associated with smaller output losses (Table 4.2, row 3).

- *Structural reforms:* Structural reforms may also play a role in boosting output during the postcrisis period. We consider reform efforts in several areas, such as domestic financial reform, capital account and trade liberalization, and structural fiscal reform. In each case, the reform effort is measured as the *change* in various indices mentioned earlier during the postcrisis period (rather than

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[33]As discussed in the literature, the two-way relationship between postcrisis policies and outcomes complicates any causal inference. For example, is it that financial reform during or after a banking crisis leads to increased financial intermediation and a lower output loss? Or that a lower output loss leads to higher demand and thus higher financial intermediation and also gives the authorities the policy room to implement important financial sector reforms? These difficult questions cannot be answered within our regression framework.

[34]The results imply that raising government consumption by 1 percent of GDP is associated with a reduction in the medium-term output loss of about 1.5 percentage points. The change in government consumption, rather than the change in tax revenue or the fiscal balance, is used as a measure of fiscal stimulus, because it lessens reverse-causality concerns. Measuring fiscal stimulus based on the change in tax revenue or the change in the fiscal balance would be problematic. A larger deterioration in output implies a greater deterioration in tax revenue and the fiscal balance, complicating the interpretation of the regression coefficients. As expected, repeating the analysis using the change in the fiscal balance yields a regression coefficient that is statistically indistinguishable from zero. Exploring the possibility of "expansionary contractions" associated with cuts in government spending, or of "crowding-out" effects associated with fiscal stimulus in economies with unsustainable government debt levels, was complicated by insufficient data on government debt. Some evidence of such effects is presented in Chapter 3 of the April 2009 *World Economic Outlook.*

the levels, which were used in the precrisis analysis).[35] Overall, there is mixed evidence that structural reform efforts are significantly associated with smaller output losses. Liberalization of the capital account is highly correlated with smaller output losses in small-scale regressions, although its statistical significance declines when considered in larger-scale frameworks (Table 4.2, row 4; Figure 4.14). Domestic financial reforms are also significantly associated with output losses in small-scale regressions, but less so in larger-scale frameworks (Table 4.2, row 5; Figure 4.14). Trade liberalization is not significantly related to output losses (Table 4.2, row 6). Finally, there is some positive evidence of a link between improvements in government efficiency and output losses, although the increased significance of this structural variable in the broader specifications appears to be partly due to the change in the sample composition (as the number of observations drops to 30).

- *External conditions:* Policies and conditions abroad may also be important in reducing output losses by improving the external environment during the postcrisis period. The results indicate that larger domestic output losses are significantly related to the occurrence of adverse external demand shocks, defined as very low partner growth during the postcrisis period (Table 4.2, row 9). In addition, there is weak evidence that larger output losses are significantly associated with higher global short-term interest rates (Table 4.2, row 8).[36]

How should we interpret these empirical findings? Overall, our findings suggest that

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[35]Regarding labor market liberalization indicators, data availability is limited for the sample of banking crisis countries. Moreover, when data are available, there is often little change after a crisis. For both these reasons, we do not report results for postcrisis labor market indicators.

[36]Unlike in the small-scale regressions, the global interest rate is significantly related to output losses in the large-scale OLS regression and has a relatively high probability of inclusion (0.63) in the BMA framework.

Figure 4.13. Output Losses and Macroeconomic Stimulus[1]

Expansionary macroeconomic policies are associated with smaller output losses.

Real Interest Rate

Government Consumption
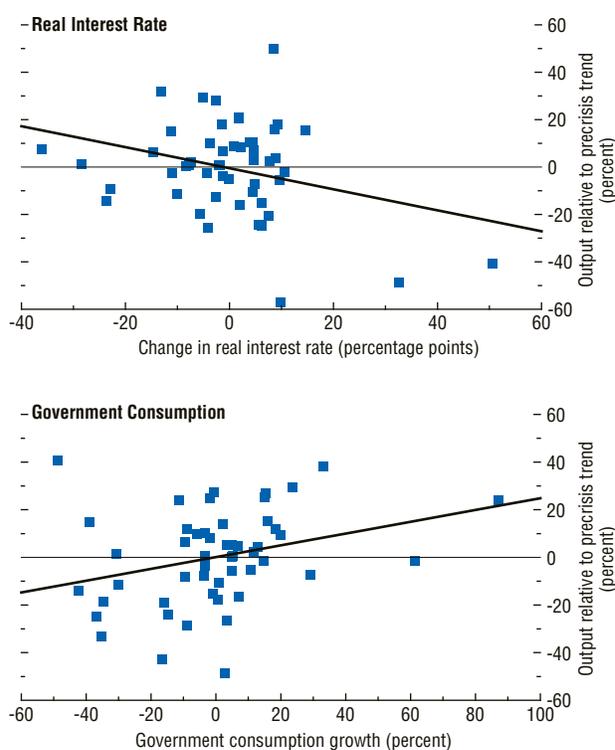
Sources: World Bank, *World Development Indicators;* and IMF staff calculations.
[1]Scatter plots report conditional plots that take into account the effect of several other controlling variables (as reported in column 11 of Table 4.2). The change in the real interest rate and the growth of government consumption is measured over the crisis year and the following three years.

Figure 4.14. Postcrisis Associations of Key Variables with Output Losses

- **Exports and Real Export Growth**

Exports (relative to precrisis trend)

Mexico 1994

Average postcrisis growth of real exports of goods (percent)

- **Output Losses versus Capital Account Reform Effort**

Chile 1981

Uganda 1994

Tunisia 1991

Output (relative to precrisis trend)

beta = 0.11
t-stat = 1.61

Change in postcrisis capital account liberalization index

- **Output Losses versus Domestic Financial Reform Effort**

Tunisia 1991

Argentina 1989

Output (relative to precrisis trend)

beta = 0.40
t-stat = 3.01

Change in postcrisis domestic finance reform index

Sources: IMF, Structural Reform database; World Bank, *World Development Indicators;* and IMF staff calculations.

expansionary short-term macroeconomic policies are associated with smaller medium-term output losses. This is consistent with the notion that countercyclical fiscal and monetary policies may help cushion the downturn after the crisis, which would carry over into smaller measured output losses in the medium term. At the same time, these results do not imply that countercyclical macroeconomic stimulus is the right solution for all economies at all times—it is likely to depend on country-specific characteristics, such as the credibility of fiscal and external sustainability and borrowing costs. In fact, fiscal expansions in economies with unsustainable debt levels could be counterproductive—an issue that is not explored here because of data limitations.

The relationship between postcrisis structural policy reform and output losses is somewhat weaker. However, this could be the result of well-known difficulties in measuring the timing, magnitude, and sequencing of structural reforms,[37] as well as the possibility that structural reforms and capacity building may take longer than seven years to bear fruit in terms of output. At the same time, the spillover effects of global conditions may be important, given the association between the external environment and the eventual output losses.

What about the role of structural policies based on country experiences?

To gain further insight into the effects of structural policy reform, we supplement the regression analysis by looking at the experiences of several countries. Specifically, we focus on episodes—such as Chile (1981) and Mexico (1994) in Figure 4.1—that were followed by significant

[37]Measurement error in the structural reform indicators will bias the regression coefficients toward zero, making it more difficult to find that the results are statistically significant. Also, the size of the bias depends directly on the magnitude of the measurement error, which is likely to be much larger for unobserved structural reform indicators (such as labor market flexibility or financial sector reform) than for macroeconomic variables (such as government consumption or interest rates).

Table 4.2. Output Losses versus Postcrisis Conditions and Policies

(Dependent variable: output at t=7 in percent of precrisis trend)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Real government consumption growth	0.202** [2.520]									0.244* [1.843]		0.405** [2.264]	0.263 (0.648)
(2) Change in real interest rate		−0.085 [−0.404]								−0.493** [−2.280]		−0.580 [−1.577]	−0.530 (0.708)
(3) Real appreciation			0.135* [1.785]							−0.011 [−0.075]		−0.418* [−2.047]	−0.038 (0.166)
(4) Change in capital account liberalization index				0.166*** [4.267]							0.147** [2.290]	0.030 [0.433]	0.007 (0.085)
(5) Change in financial liberalization index					0.108** [2.583]						0.017 [0.302]	0.149* [1.769]	0.002 (0.044)
(6) Change in trade liberalization index						−0.046 [−0.950]					−0.063 [−1.123]	−0.122 [−1.506]	−0.013 (0.149)
(7) Change in government efficiency index							−0.005 [−0.077]				0.0132 [0.213]	0.129* [2.044]	0.078 (0.608)
(8) U.S. Treasury bill rate								−1.404 [−1.012]		0.490 [0.178]		−4.459 [−1.524]	−2.820 (0.400)
(9) External demand shock									−0.960*** [−3.156]	−1.161 [−1.611]		−1.073 [−1.668]	−0.415 (0.411)
(10) Precrisis output	1.213*** [4.666]	1.038*** [2.791]	1.371*** [4.292]	1.079*** [3.537]	0.997*** [4.358]	1.384*** [4.456]	1.162** [2.398]	1.601*** [3.783]	1.753*** [4.427]	1.137*** [3.453]	1.124*** [3.061]	0.907 [1.687]	0.143 (0.184)
(11) First-year output change	2.032*** [3.396]	2.107*** [2.941]	1.750*** [2.884]	2.191*** [3.560]	2.262*** [3.529]	2.145*** [3.526]	1.749** [2.591]	1.714*** [3.158]	1.875*** [3.558]	2.365** [2.667]	2.220*** [3.330]	3.136*** [2.889]	2.693 (1.000)
(12) Constant term	−0.056** [−2.065]	−0.047** [−2.059]	−0.034 [−1.471]	−0.093*** [−4.010]	−0.088*** [−3.510]	−0.020 [−0.869]	−0.054 [−1.485]	0.023 [0.284]	−0.004 [−0.177]	−0.037 [−0.260]	−0.079* [−1.964]	0.064 [0.385]	0.052 (1.000)
Number of observations	77	59	74	65	65	78	53	88	88	50	49	30	30
R^2	0.398	0.283	0.342	0.459	0.397	0.388	0.281	0.344	0.396	0.506	0.450	0.709	. . .

Source: IMF staff calculations.

Note: Columns 1–12 report estimation results based on ordinary least squares with robust *t*-statistics in square brackets. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. Column 13 reports estimation results based on Bayesian model averaging with the probability of inclusion of each variable in parentheses. Structural reform variables (trade, financial, capital account, and government efficiency) measure change in index from $t = 0$ to $t = 7$, where $t = 0$ denotes the crisis year.

output gains (based on our measure of medium-term output losses) and try to identify associated major policy reforms. The following experiences are interesting.

- *Mexico (1994):* Mexico bounced back rapidly from its banking crisis in 1994 and indeed registered a significant output gain relative to precrisis trend (see Figure 4.1). Compared with most other banking crisis countries, Mexico had much stronger export growth following its crisis (see Figure 4.14). Yet partner growth—particularly in the United States— did not increase notably after 1994, suggesting that the implementation of a major trade reform—the signing of the North American Free Trade Agreement in January 1994— was the key driver of spectacular export growth, along with the impact of a substantial exchange rate depreciation during the first few years following the crisis.[38]

- *Uganda (1994):* Uganda had a significant output gain after its banking crisis in 1994. It also significantly liberalized its capital account, freeing its exchange rate and then completing the liberalization of the exchange and payments systems after the crisis. This is reflected as major capital account reform according to the structural reform index (see Figure 4.14). Uganda also implemented other important reforms, such as divesting or liquidating 115 of 150 public enterprises and liberalizing its trade regime (IMF, 2006).

[38]See for example, Kose, Meredith, and Towe (2004).

- *Argentina (1989):* After its banking and currency crisis of 1989, Argentina undertook major liberalization that led to a spectacular increase in financial intermediation (see Figure 4.14) and investment and imports, which may be observed as a significant output gain relative to the precrisis trend seven years after the crisis. The country implemented major financial reforms in the early 1990s, introducing capital and reserve requirements and increasing banking competition by allowing foreign entry. On the capital account side, restrictions on the entry and exit of portfolio and direct investment were lifted and the convertibility plan was adopted (introduction of the currency board). Trade was also liberalized, as export taxes were eliminated and import restrictions/duties lifted (see Pou, 2000).
- *Chile (1981):* Chile implemented some important structural reforms in the 1980s, including major pension and tax reforms, and registered a significant medium-term output gain. However, in the aftermath of its major financial and balance of payments crises in 1981, Chile also partially reversed major trade and capital account reforms that were implemented in the 1970s. During the late 1970s, combined with a fixed exchange rate and high real indexation, trade and capital account liberalization facilitated rising current account deficits, which were financed by large amounts of foreign lending. The imbalances continued to grow, which, combined with high global interest rates and a collapse of commodity prices, led to faltering confidence, capital flight, and a major recession. The authorities reacted by increasing tariffs and severely restricting capital flows and holdings of foreign assets by residents. The latter can be seen as a major reversal of capital account liberalization relative to how other countries reacted to banking crises (see Figure 4.14). Of course, the trade and capital account restrictions imposed after the crisis were gradually lifted during the 1980s and 1990s (Le Fort, 2005).

Overall, the case studies show that there is certainly no "one size fits all" when it comes to explaining the factors behind strong performances after banking crises. Big neighbors and trade agreements can play a role (Mexico), as can liberalization (Argentina and Uganda). Nevertheless, it is not easy to draw strong general conclusions about the growth impact of postcrisis structural reforms. Moreover, there are countries for which other factors help to explain the significant output gains relative to precrisis trend (for example, Zambia after 1995 and El Salvador after 1989).[39]

What is the bottom line?

The results suggest that proactive domestic macroeconomic policies in the short term may mitigate medium-term output losses. There is also some evidence of the beneficial role of structural policy reform and favorable global conditions. However, there is still much to learn about the processes and interactions that lead to strong growth performance.

Implications for the Outlook after the Current Financial Crisis

This section discusses some tentative implications for output in the wake of the current crisis and how policy can be used to help mitigate medium-term output losses.

For the most part, the implications of our analysis are sobering for the medium-term output prospects in economies with recent banking crises. The historical evidence suggests that output in many of these economies may remain well below precrisis trends in the medium run. The associated losses in capital, employment, and total factor productivity could be long-lasting, leaving an enduring imprint on the productive capacity of these economies. Medium-term

[39]After its banking crisis in 1991, Tunisia also had a significant output gain. In the years following the crisis, the country ratified the agreement to establish the African Union, established a free trade zone with the European Union, and implemented major financial and capital account reforms (see Figure 4.14).

output dynamics may also be affected at the global level. The combined output of economies currently in the midst of a banking crisis comprises close to one-half of real GDP for the advanced economies and one-quarter of world GDP. This suggests that real output in advanced economies is unlikely to rebound to its precrisis trend, which was the experience of emerging economies following the 1980s debt crises (see Box 4.1). The global nature of the current crisis also implies that external demand is less likely to play the same role it did in many of the previous banking crises in mitigating output losses.

For policymakers, the prospects of large permanent output losses raise major challenges. The macroeconomic policy response has been forceful so far, in the form of substantial fiscal and monetary stimulus. However, it remains uncertain how much potential output has been reduced by the recent financial crisis, which makes it difficult to measure the amount of slack in the economy, the so-called output gap. This makes calibrating macroeconomic policy especially challenging. Looking ahead, the timing for the withdrawal of the extraordinary amount of monetary and fiscal stimulus that has been implemented in many countries will be important. On the one hand, a premature exit could stifle the recovery. On the other hand, delaying the withdrawal of stimulus could be inflationary.

At the same time, the dramatic increase in fiscal deficits and government debt levels exacerbates sustainability concerns for a number of economies. These pressures will worsen if output losses are permanent and constrain government revenues in the future. A fall in medium-term output would also worsen the expected deterioration in government debt dynamics due to factors related to population aging.

These concerns underscore the importance of implementing reforms to help raise medium-term output and facilitate the shift of resources across sectors. On the employment side, previous crises suggest that medium-term employment losses will be large, a prediction seemingly confirmed by recent unemployment dynamics. As discussed in Chapter 1, this pros-

pect highlights the importance of labor market policies that facilitate the requisite adjustment of workers and jobs across sectors within crisis-hit economies and thereby avert increases in structural unemployment.

Appendix 4.1. Data Sources and Methodologies

The main author of this appendix is Daniel Leigh.

This appendix provides details on the data used in the analysis. It also reports the results of robustness exercises on measuring output losses and on the estimation results reported in Tables 4.1 and 4.2.

Data Sources

The main data sources for this chapter are the IMF's World Economic Outlook (WEO) and International Financial Statistics (IFS) databases and the World Bank's World Development Indicators (WDI) database. Additional data sources are listed in the table.

Data on real GDP and its demand components are from the WDI and are spliced with WEO data for observations after 2007 for which WDI data are unavailable. The current account balance, the GDP deflator, and the fiscal balance are also taken from the WEO database; the exchange rate series are taken from the IFS database. The domestic real interest rate is defined as the difference between the nominal lending rate, taken from the IFS, and GDP deflator inflation.

For the growth accounting exercises, the capital stock data are taken from Bosworth and Collins (2003). For observations not included in the Bosworth and Collins data set, the capital stock is constructed using the perpetual inventory method, with a depreciation rate of 5 percent, and real investment data. The employment and labor force data come from the WEO database.

Financial development is measured using the ratio of bank credit to GDP. Bank credit to the private nonfinancial sector is taken from the IFS database. Breaks in these data are identified

Variable	Source
Real GDP	World Bank World Development Indicators (WDI) database, World Economic Outlook (WEO) database
Population	WDI database, WEO database
Real consumption	WDI database, WEO database
Real government consumption	WDI database, WEO database
Real private investment	WDI database, WEO database
Real exports	WDI database, WEO database
Real imports	WDI database, WEO database
Current account balance	Christiansen and others (forthcoming)
GDP deflator	WEO database
Fiscal balance	WEO database
Real exchange rate	International Financial Statistics (IFS) database
Nominal exchange rate vis-à-vis U.S. dollar	IFS database
Nominal lending rate	IFS database
Capital stock	Bosworth and Collins (2003)
Employment	WEO database
Labor force	WEO database
Bank credit	WDI database, IFS database
Corporate leverage	Brooks and Ueda (2005)
Financial openness	Lane and Milesi-Ferretti (2006)
Partner-country growth	WDI database, WEO database
U.S. Treasury bill rate	Thomson Datastream
Trade liberalization index	IMF
Financial liberalization index	IMF
Capital account liberalization index	IMF
Government efficiency index	IMF
Employment protection legislation index	Organization for Economic Cooperation and Development
Employment notice period index	IMF

using the IFS *Country Notes* publication, and data are growth-spliced at these points.

Financial openness is calculated as the sum of foreign assets and foreign liabilities divided by GDP, using the External Wealth of Nations Mark II Database (see Lane and Milesi-Ferretti, 2006). Trade openness is defined as the sum of exports and imports divided by GDP. Partner-country

growth, used to compute external demand shocks, is taken from the WEO database; the three-month U.S. Treasury bill rate is obtained from Thomson Datastream.

The structural reform indicators measuring trade liberalization, capital account liberalization, financial liberalization, and government efficiency come from the IMF, and are described in greater detail by Giuliano, Mishra, and Spilimbergo (2009) and IMF (2008).

Robustness: Alternative Measures of Output Losses

The baseline measure of the output loss is compared with the following four alternative measures based on different versions of the precrisis trend.

- *Alternative 1: Precrisis window ending one year before crisis.* Here, the precrisis trend is computed as in the baseline, except that the estimation window for the precrisis trend ends one year before the crisis, rather than three years before as it does in the baseline.
- *Alternative 2: Longer estimation window application.* As in the baseline, an initial estimate of the precrisis trend is obtained based on the seven-year sample ending three years before the crisis. In the baseline approach, initial estimates that were negative were replaced with trends based on a longer precrisis window going back 20 years before the crisis. Here, the longer precrisis window is applied to the lowest and the highest 10 percent of the initial estimates of the trend growth rates. As in the baseline approach, if the trend estimate based on the longer sample is unavailable, or even farther from zero than the initial estimate, the initial estimate is kept.
- *Alternative 3: Longer estimation window applied to all crises.* Here, the estimate of the precrisis trend is obtained based solely on the longer precrisis window going back 20 years before the crisis and ending three years before the crisis.
- *Alternative 4: Precrisis trend based on real-time IMF country desk forecasts.* Here, the output losses

were recomputed using the real-time medium-term growth projections of IMF country desks prepared for the April 2009 *World Economic Outlook* in the year before the crisis. In particular, the precrisis trend growth rate is defined as the desk forecast for real GDP growth in year $t = 4$ made in year $t = -1$, where $t = 0$ is the year of the crisis. The corresponding per capita growth forecast is obtained by subtracting population growth in year $t = -1$. Note that these real-time forecasts were available only for the post-1989 period.

As Figure 4.15 illustrates, the output losses obtained using the different approaches were highly correlated and all confirm the finding of large and statistically significant output losses after banking crises. The 90 percent confidence bands for each measure overlap with the 90 percent confidence band of the baseline measure. In the case of alternatives 1, 2, and 3, the overlap is substantial, and the mean output losses are statistically indistinguishable from the baseline. In the case of alternative 4, the average output loss is even greater than in the baseline. This is because the IMF country desk forecasts were, on average, more optimistic than the baseline precrisis trend. Therefore, the corresponding underperformance relative to the forecast (output loss) is, on average, significantly greater than in the baseline.

Estimation Results without Controlling for Short-Term Crisis Severity

The short-term crisis severity variable, measured by the change in output relative to trend in the crisis year, was found to be a strong predictor of medium-term output losses (Tables 4.1 and 4.2). However, there is a possible concern that short-term crisis severity may be correlated with other explanatory variables included in the regression, potentially complicating the interpretation of the regression coefficients. To address this concern, the regressions are repeated with the omission of the short-term crisis severity variable, and the results are reported in Tables 4.3 and 4.4. Overall, the coefficients are similar.

Figure 4.15. Output Evolution after Banking Crises: Alternative Measures of Precrisis Trend
(Percent of precrisis trend; mean difference from year t = − 1; *first year of crisis at* t = 0; *years on x-axis)*
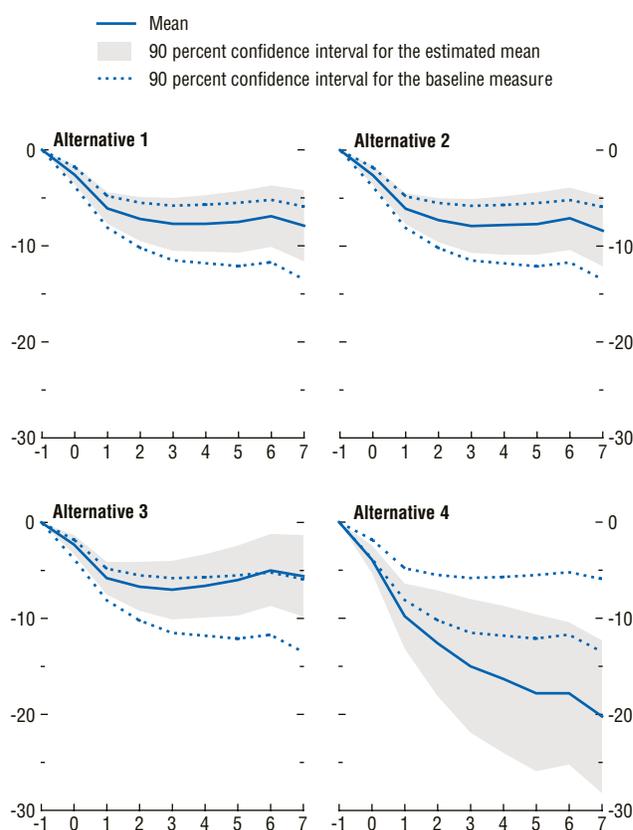
Sources: World Bank, *World Development Indicators;* and IMF staff calculations.

However, given the strong predictive power of the short-term crisis severity variable, the regression fit, measured by the R^2 statistic, declines substantially relative to the baseline specifications, in some cases by more than one-half.

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Table 4.3. Robustness: Output Losses versus Initial Conditions, Crisis Severity Omitted
(Dependent variable: output at t = 7 in percent of precrisis trend)

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Investment/GDP		−1.242***										−0.930	−1.167
			[−4.195]										[−1.660]	(0.962)
(2)	Investment/GDP gap		0.687										−1.233*	−0.698
			[1.597]										[−1.724]	(0.575)
(3)	Current account/GDP			0.677*									−0.002	−0.002
				[1.848]									[−0.003]	(0.019)
(4)	Current account/GDP gap			1.245*									1.178	0.037
				[1.814]									[0.819]	(0.070)
(5)	Inflation				0.145*								0.018	0.000
					[1.781]								[0.221]	(0.054)
(6)	Inflation gap				−0.246***								−0.081	−0.023
					[−3.004]								[−0.668]	(0.199)
(7)	Fiscal balance					0.428							−0.247	−0.012
						[0.754]							[−0.354]	(0.064)
(8)	Fiscal balance gap					0.983							0.006	0.000
						[1.032]							[0.008]	(0.000)
(9)	Real exchange rate gap						−0.182							...
							[−1.143]							...
(10)	Real interest rate gap						−0.184							...
							[−0.232]							...
(11)	Log (PPP GDP per capita)							−0.005					0.001	0.000
								[−0.225]					[0.0137]	(0.044)
(12)	Credit/GDP								−0.191				−0.021	0.001
									[−1.583]				[−0.192]	(0.022)
(13)	Credit/GDP gap								0.041				0.398	0.016
									[0.095]				[0.923]	(0.083)
(14)	Currency crisis									−0.201***			−0.255**	−0.217
										[−2.729]			[−2.292]	(0.962)
(15)	U.S. Treasury bill rate										0.082		0.295	0.005
											[0.063]		[0.215]	(0.023)
(16)	External demand shock										−0.093		−0.117	−0.015
											[−0.908]		[−1.601]	(0.108)
(17)	Financial openness/GDP											0.026	−0.022	0.000
												[1.675]	[−1.149]	(0.044)
(18)	Trade openness/GDP											−0.126	−0.040	−0.001
												[−1.483]	[−0.442]	(0.032)
(19)	Precrisis output	1.695***	1.421***	1.833***	1.138**	1.189***	1.386**	1.712***	1.117***	1.804***	1.707***	1.057***	1.283*	1.225
		[4.127]	[3.751]	[5.138]	[2.569]	[3.289]	[2.220]	[4.199]	[2.961]	[4.266]	[4.048]	[3.267]	[1.759]	(0.958)
(20)	constant term	−0.099***	0.176**	−0.061**	−0.147***	−0.098***	−0.104*	−0.093**	−0.047	−0.079***	−0.100	−0.070*	0.168	0.219
		[−3.974]	[2.497]	[−2.651]	[−4.170]	[−2.717]	[−1.892]	[−2.221]	[−1.375]	[−2.935]	[−1.179]	[−1.770]	[0.817]	(1.000)
	Number of observations	88	85	80	87	81	26	88	77	88	88	52	44	44
	R^2	0.214	0.294	0.282	0.185	0.201	0.195	0.214	0.135	0.254	0.218	0.134	0.676	...

Note: columns 1–12 report estimation results based on OLS with robust *t*-statistics in square brackets. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. Column 13 reports estimation results based on Bayesian model averaging with the probability of inclusion of each variable in parentheses. The term "gap" denotes the deviation of the variable from the precrisis historical average (years *t* = −10 to *t* = −3, where *t* = 0 denotes the crisis year). PPP = purchasing power parity.

Table 4.4. Robustness: Output Losses versus Postcrisis Conditions, Crisis Severity Omitted

(Dependent variable: output at t = 7 in percent of precrisis trend)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Change in trade liberalization index	−0.045 [−0.806]										−0.052 [−0.714]	−0.0547 [−0.448]	−0.003 (0.059)
(2) Change in financial liberalization index		0.114** [2.243]									−0.004 [−0.0631]	0.0586 [0.509]	0.000 (0.045)
(3) Change in capital account liberalization index			0.179*** [3.684]								0.183** [2.276]	0.0371 [0.343]	0.003 (0.068)
(4) Change in government efficiency index				−0.030 [−0.489]							−0.025 [−0.386]	0.125 [1.352]	0.053 (0.402)
(5) Real government consumption growth					0.270** [2.257]					0.366** [2.270]		0.491 [1.459]	0.368 (0.751)
(6) Change in real interest rate						0.0016 [0.009]				−0.367 [−1.677]		−0.515 [−1.571]	−0.392 (0.595)
(7) Real appreciation							0.148* [1.689]			0.023 [0.157]		−0.196 [−0.944]	−0.001 (0.061)
(8) U.S. Treasury bill rate								−1.142 [−0.783]		0.535 [0.176]		−2.199 [−0.537]	−1.330 (0.100)
(9) External demand shock									−0.735** [−2.133]	−0.930 [−1.138]		−1.002 [−1.035]	−0.234 (0.251)
(10) Precrisis output	1.620*** [4.410]	1.274*** [4.327]	1.357*** [3.534]	1.450*** [3.228]	1.377*** [4.485]	1.165*** [2.873]	1.518*** [3.782]	1.694*** [4.076]	1.817*** [4.668]	1.230*** [3.646]	1.627*** [3.669]	1.133* [1.869]	0.373 (0.0322)
(11) Constant term	−0.074*** [−2.968]	−0.142*** [−4.906]	−0.147*** [−4.657]	−0.088* [−1.990]	−0.105*** [−3.345]	−0.098*** [−3.289]	−0.075*** [−2.670]	−0.036 [−0.414]	−0.064** [−2.426]	−0.089 [−0.602]	−0.125*** [−2.980]	−0.080 [−0.376]	−0.116 (1.000)
Number of observations	78	65	65	53	77	59	74	88	88	50	49	30	30
R^2	0.204	0.167	0.243	0.126	0.246	0.105	0.204	0.219	0.250	0.343	0.203	0.440	...

Note: columns 1–12 report estimation results based on ordinary least squares with robust *t*-statistics in square brackets. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. Column 13 reports estimation results based on Bayesian model averaging with the probability of inclusion of each variable in parentheses. Structural reform variables (trade, financial, capital account, and government efficiency) measure change in index from *t* = 0 to *t* = 7, where *t* = 0 denotes the crisis year.

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