CHAPTER 4

DO FINANCIAL CRISES HAVE LASTING EFFECTS ON TRADE?

This chapter looks at trade dynamics following banking and debt crises, to help us understand how trade might evolve for economies recently affected by such crises. Imports of the crisis economy tend to fall substantially in the short term—beyond what would be expected from the decline in output—and they stay depressed through the medium term. In contrast, exports of the crisis economy are not as badly affected. These findings suggest that the recovery of import demand in the United States and much of western Europe may be even more anemic than suggested by their relatively weak projected output recoveries. Thus, the narrowing of the large current account deficits of some crisis countries such as the United States that occurred in 2009 may prove to be quite durable. For economies that experience a crisis, the chapter underscores the importance of embracing structural reforms to help support the recovery of output and trade. For economies that rely heavily on external demand for their growth, the chapter's findings highlight the urgency of reorienting growth by strengthening domestic demand.

One of the most notable features of the Great Recession was the "sudden, severe, and synchronized" collapse in trade in late 2008 and early 2009 (Baldwin, 2009). In the half-year encompassing the last quarter of 2008 and the first quarter of 2009, the annualized drop in world imports was more than 30 percent, with roughly equal declines experienced by advanced and emerging economies (Figure 4.1). The fall in trade spared no one—all economies experienced a drop in both exports and imports during this period. Likewise, growth in trade in virtually all product categories went from positive in the second quarter of 2008 to negative by the first quarter of 2009.

The rapid recovery in trade that began in the second half of 2009 has been remarkable as well. World imports grew at an annualized rate of more than 20 percent in the last two quarters of 2009 and the first quarter of 2010. However, as this chapter shows, trade remains below its precrisis trend, and for some economies—particularly those hit by a banking crisis—it remains below precrisis levels. Because the recent crises occurred in large, advanced economies that account for a substantial portion of global demand, the speed and extent of their trade recovery will affect the growth prospects not only of the crisis economies but also of their trading partners.

This chapter looks at trade dynamics following banking and debt crises, to help us understand how trade might evolve for economies that are affected by such crises. It continues the research agenda pursued in recent issues of the *World Economic Outlook* to analyze the medium-term macroeconomic consequences of crises. This chapter addresses the following questions:

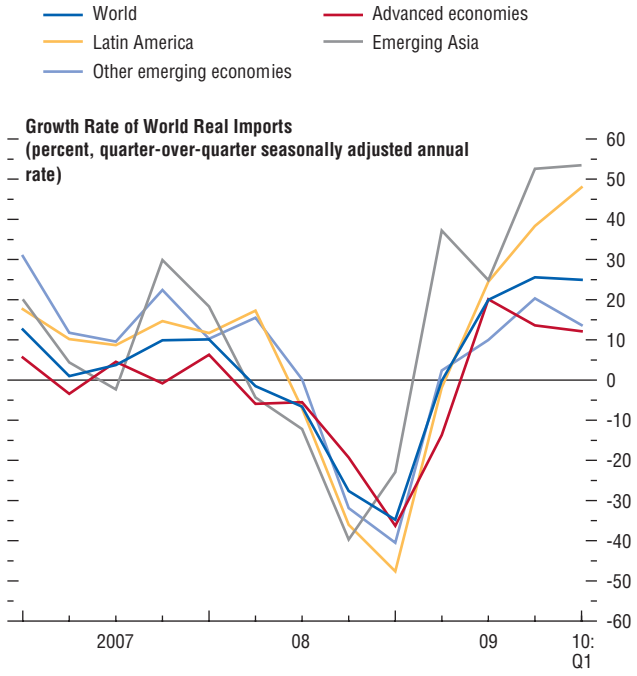
- To what extent has trade recovered from the recent global recession? Have the speed and extent of the recovery differed among economies, particularly between those that suffered a banking crisis and those that did not? Has the recovery varied across different product groups?
- How has trade behaved in the wake of previous banking and debt crises? Do such crises have lasting effects on trade?
- What factors apart from the level of output are associated with sharp declines in trade following a crisis? And what role can postcrisis policies and conditions play in enhancing the recovery of trade?
- What are the implications for the recovery of trade from the recent crisis? And what lessons can be drawn for the future?

Much of the recent literature on trade and crises has focused on the recent global downturn and specifically on explaining the "Great Trade Collapse"—that is, on why world trade fell by much more than

The main authors of this chapter are Abdul Abiad, Prachi Mishra, and Petia Topalova, with support from Gavin Asdorian, Stephanie Denis, and Andy Salazar. Donald Davis was the external consultant.

Figure 4.1. The Great Trade Collapse

The collapse in world trade in late 2008 and early 2009 was sudden, severe, and synchronized.



Sources: CPB Netherlands Bureau of Economic Policy Analysis; and IMF staff calculations.

GDP.[1] Only a few papers have looked at the full dynamics of trade—both declines and recoveries—following earlier crises. Among these, Freund (2009) describes the evolution of world trade following four previous global downturns. She finds that the size of the decline in world trade during these episodes is almost five times the corresponding decline in world GDP. She also finds that, while world trade growth resumes quickly following a global downturn, it takes more than three years for trade to reach predownturn levels. This chapter does not focus on trade dynamics following global downturns but instead on what happens to the trade of individual economies that experience a banking or debt crisis; it should thus be seen as a complement to Freund's work.[2]

This chapter uses a methodology derived from the "gravity model," the standard workhorse for modeling trade flows. The gravity model is widely used to explain the level of bilateral trade flows on the basis of individual characteristics of each partner (size and level of economic development) as well as the characteristics of the country pair (distance between them and whether they share a common border, language, or currency). However, the standard gravity model best describes patterns of trade between economies rather than over time and therefore may not provide an accurate picture of what happens to aggregate trade for a particular economy in the aftermath of a crisis. This chapter therefore uses a "collapsed" version of the gravity model, estimated in differences, that analyzes changes in aggregate trade flows.[3] We examine episodes of banking and debt crises over the past 40 years and track the changes in imports and exports both to estimate the overall trade declines and to measure the association of various factors

[1]See Baldwin (2009) and papers therein for a comprehensive analysis of the recent collapse in global trade.

[2]Similar in spirit and methodology to this chapter is the analysis by Berman and Martin (2010) of the vulnerability of sub-Saharan African economies to financial crises in advanced economies. They find that a financial crisis has a moderate but long-lasting effect on trading partners' exports but that the effect is larger for African exporters.

[3]Estimating the "full" bilateral gravity model in differences gives similar results, as described in Appendix 4.2, which outlines the robustness tests performed as part of this analysis.

such as output and exchange rate dynamics with the postcrisis behavior of trade.

The main findings of the chapter are as follows:

- There is a sharp decline in an economy's imports following a crisis—16 percent, on average—and this decline is persistent, with imports remaining below normal (that is, below their predicted level in the absence of a crisis) even over the medium term. Depressed output does not explain the entire decline in postcrisis imports.
- Exports of the crisis economy are not as adversely affected. There is a small and gradual decline in exports, so that, in the medium term, exports are on average about 8 percent below their predicted level in the absence of a crisis. And unlike for imports, all of the export decline can be explained by adverse output dynamics; after controlling for output declines, export performance is no different from normal.
- Weak output remains the most important factor in the decline of imports in both the short and the medium term, but other factors also play a role. In particular, impaired credit conditions are associated with a weaker recovery in imports (above and beyond the impact of weak credit on output), especially in the medium term. In the short term, increased exchange rate volatility and currency depreciation are associated with import losses. There is no evidence that tariffs and antidumping measures rise, on average, during crisis periods. There is also evidence to suggest that "the composition effect" can account for at least a portion of postcrisis import losses: during crises, demand falls primarily in products that comprise a larger share of trade than of output, such as durables.
- Pre- and postcrisis conditions and policies affect the behavior of trade following a crisis. Import losses tend to be greater for economies entering a crisis with a relatively weak current account position—suggesting that external imbalances tend to diminish following a crisis. Imports also fare worse when the crisis is accompanied by greater currency depreciation and exchange rate volatility, relatively weaker credit conditions, and larger increases in protectionism.

These findings suggest that the full recovery of import demand in countries that recently suffered a banking crisis—including the United States and the United Kingdom—may be even more protracted than suggested by their relatively slow projected output recovery. Thus, the narrowing of the large current account deficits in some crisis countries such as the United States that occurred in 2009 may prove to be quite durable. For economies that experience a crisis, the chapter underscores the importance of embracing structural reforms to help support the recovery of output and trade. For economies that rely heavily on demand from those countries for their growth, the chapter's findings highlight the urgency of rebalancing growth by strengthening domestic demand.

It is important to emphasize from the outset that this chapter seeks to identify patterns and correlations rather than to establish causality between various policies and initial conditions on one hand and postcrisis trade dynamics on the other. Many of the variables we explore, including credit and the exchange rate, are likely to be simultaneously determined with trade. For example, do adverse credit conditions in the aftermath of a crisis hinder trade finance and reduce trade flows? Or are weak credit and anemic trade both manifestations of depressed postcrisis economic conditions? Sorting out these possibilities is beyond the scope of this chapter.

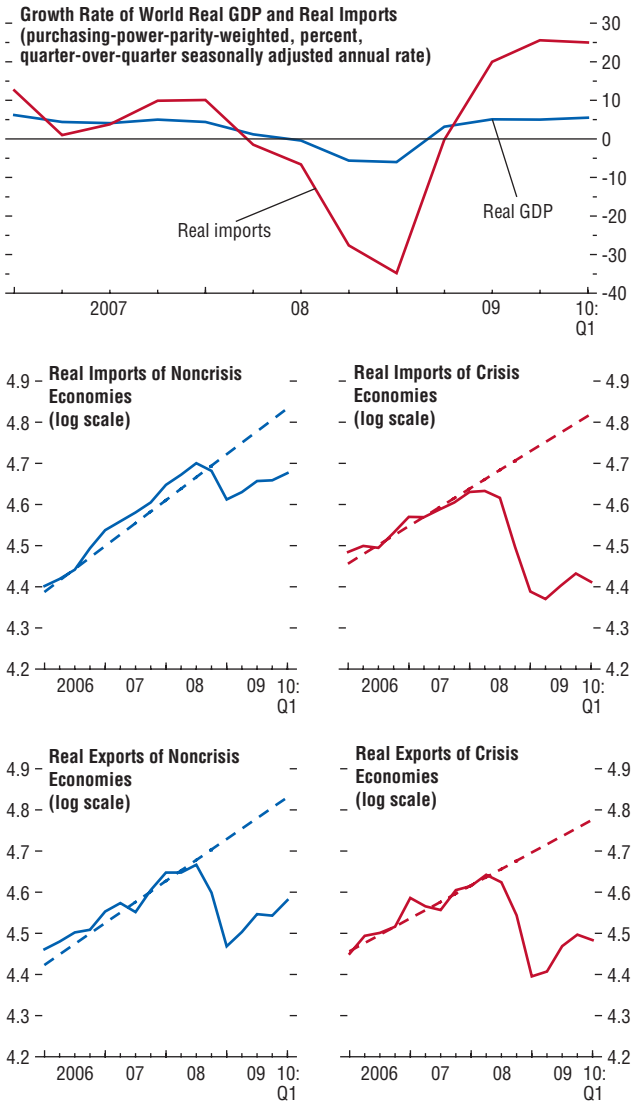
The remainder of the chapter is structured as follows. The first section describes the behavior of trade following the recent global downturn, documenting both the collapse in trade and the recovery to date, and exploring differences across economies and product categories. The second section uses a regression framework to analyze earlier crisis episodes, providing estimates of the size of import and export losses in both the short and medium term. The third section examines the extent to which postcrisis import dynamics are associated with various factors such as credit, protection, and exchange rate dynamics. The fourth section discusses implications for the global economic outlook.

Has Trade Recovered?

As noted above, the collapse in trade between late 2008 and early 2009 was quite severe. The annual-

Figure 4.2. The Recovery in Trade

Growth in world trade is now above precrisis rates. But trade has not fully recovered, with substantial differences between economies that had a financial crisis and those that did not.



Sources: CPB Netherlands Bureau of Economic Policy Analysis; Haver Analytics; IMF, *Direction of Trade Statistics;* and IMF staff calculations.

Note: The precrisis linear trend, denoted by the dashed line, is based on data between January 2001 and December 2007.

ized quarter-over-quarter drop in global real GDP in the last quarter of 2008 and the first quarter of 2009 averaged just under 6 percent, but the drop in global real imports was five times as large, averaging over 30 percent (Figure 4.2, top panel). The emerging consensus is that much of the outsize decline in trade can be explained by the "composition effect." That is, the increased uncertainty following the bankruptcy of Lehman Brothers in September 2008 and the subsequent freezing of credit markets led to a collapse in demand for "postponable" items such as capital goods and consumer durables. And because those items account for a much larger share of trade than of GDP, the former fell by much more than the latter.[4] Box 4.1 discusses the role of the composition effect and vertical linkages—the use of imported intermediate goods to produce exports—in the recent trade collapse.

The recovery in world trade began in the second half of 2009 and appears quite strong: the annualized growth in world real imports in the last two quarters of 2009 and the first quarter of 2010 was over 20 percent. So has trade fully recovered? Unfortunately, it has not, and the extent of the recovery differs substantially across economies and across products. An important distinction across economies seems to be whether an economy recently went through a banking crisis.[5] In economies that avoided a crisis, imports are just slightly below the precrisis peak reached in the second quarter of 2008, although this still leaves them almost 15 percent below a simple extrapolation of the 2001–07 precrisis trend (Figure 4.2, middle panels).[6] In contrast, imports in the crisis economies remain more than 20 percent below their precrisis levels and almost 40 percent below their precrisis trend. Because the crisis economies include the United States and much of western Europe,

[4]A related but distinct explanation is that firms chose to run down inventories in response to increased uncertainty; see Alessandria, Kaboski, and Midrigan (forthcoming) for evidence from the United States.

[5]As discussed below, our banking crisis episodes are taken from Laeven and Valencia (2010).

[6]Of course, the precrisis trend may reflect unsustainable growth dynamics that ultimately led to a crisis and hence may not be considered "normal." The methodology used in this chapter does not rely on deviations from precrisis trends, but estimates normal trade flows given countries' fundamentals.

Box 4.1. The Role of the Composition Effect and Intermediate Goods in the Great Trade Collapse

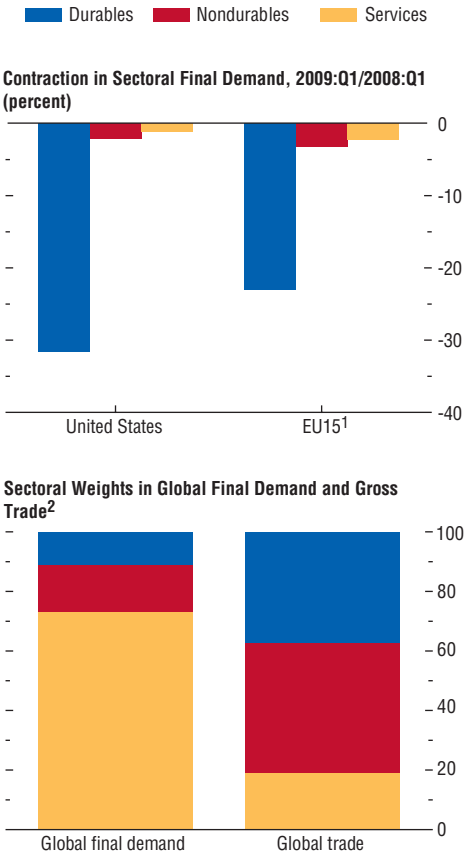
The Great Recession was accompanied by a collapse in global trade. This box documents the role of two sets of forces in the trade collapse.[1] The first is the "composition effect" and its contribution to the outsize decline in global trade relative to GDP. The second is the extent to which trade in intermediate goods made global trade more or less resilient to the global recession.

The focus on these two forces is motivated by two key facts:

- The contraction in final demand during the recent crisis was asymmetric across sectors, with demand for durables falling by considerably more than demand for nondurables or services. For example, demand for durables in the United States and the European Union fell by more than 30 percent and 20 percent, respectively, whereas demand for nondurables and services fell by only 1 to 3 percent (first figure, top panel).[2] Because durable goods have a larger weight in trade flows than in final demand (bottom panel), the asymmetrical changes in demand across sectors caused global trade to fall by more than aggregate demand.
- Two-thirds of global trade comprises intermediate inputs to production rather than final goods, and these two categories respond differently to a contraction in final demand. Intermediate goods are linked only indirectly to final demand, whereas final goods are linked directly. In addition, durables, nondurables, and services have different weights in overall trade flows for final and intermediate goods.

We use a multicountry, three-sector (durables, nondurables, services) framework to compute the relative contributions of these two factors to the collapse in global trade during 2008–09. Our framework combines information from national input-output matrices with detailed data on bilateral trade flows for both intermediate and final goods to establish various interrelationships—for example, the extent to which durable goods imported from Mexico into the United States are used to produce services that are subsequently exported to Canada.[3]

Ingredients of the Composition Effect



Source: Bems, Johnson, and Yi (forthcoming).
[1]EU15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.
[2]Data based on the most recent national input-output tables, which for most economies cover the post-2000 period.

The authors of this box are Rudolfs Bems, Robert C. Johnson, and Kei-Mu Yi.

[1]The discussion is based on Bems, Johnson, and Yi (forthcoming).

[2]The United States and European Union together account for more than half of global demand and are representative of the observed sectoral demand contraction in the rest of the world.

[3]See Johnson and Noguera (2010) for details. The framework is parameterized by combining national input-output tables with bilateral trade data, both obtained from the Global Trade Analysis Project.

Box 4.1 *(continued)*

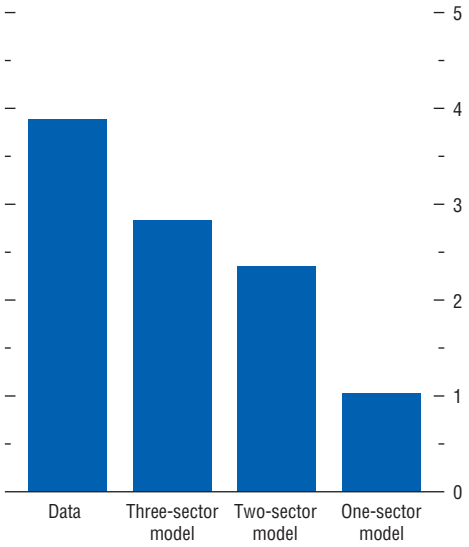
In this framework, changes in final demand shape trade flows through two channels: (1) Imports of final goods change proportionally to domestic final demand within each sector. (2) Imports of intermediate goods change proportionally to gross production within each sector, which itself responds to changes in final demand at home and abroad. If final demand changes symmetrically across sectors, then trade flows are proportional to aggregate production and GDP. However, with asymmetrical demand changes, this proportionality does not hold.

How Important Was the Composition Effect?

To estimate the size of the composition effect, we calculate how much output and trade would fall under our framework given the observed sector-specific final demand changes in the United States, the European Union, and the rest of the world. We then compare the simulated response of trade and output to what actually happened during the Great Recession. Our framework estimates a fall in global trade that exceeds the fall in global GDP by a factor of 2.8, explaining more than 70 percent of the observed trade elasticity in the data (second figure). For comparison, a more restrictive, two-sector framework with the same size demand changes for durables and nondurables accounts for 60 percent of the collapse; and a one-sector framework, which eliminates all composition effects, generates a fall in trade that is roughly proportional to GDP.

These results are consistent with other recent efforts to quantify composition effects. Eaton and others (2010) find that asymmetrical demand changes account for 80 percent of the global decline in the trade-to-GDP ratio during the crisis in a three-sector Ricardian trade framework. Levchenko, Lewis, and Tesar (forthcoming) report that, for the U.S. economy, sectors with larger reductions in domestic output had larger drops in trade.

Elasticity of Global Trade to GDP[1]



Source: Bems, Johnson, and Yi (forthcoming).
[1]Data refer to 2009:Q1/2008:Q1. One-sector and two-sector models use the same change in final demand as the three-sector model but impose restrictions on its distribution across sectors. The two-sector model restricts the demand change to be equal for durables and nondurables. The one-sector model restricts the change to be equal for durables, nondurables, and services.

How Important Was Trade in Intermediate Goods?

To gauge the role of intermediate goods trade in the crisis, we compare the responses of trade in intermediate and final goods to crisis-induced changes in final demand. As noted, both intermediate and final goods trade would respond proportionally, which account for a sizable portion of global import demand, exports remain substantially below trend for crisis and noncrisis economies alike (Figure 4.2, bottom panels). In both sets of economies, exports remain about 25 to 30 percent below precrisis trends.

The extent of the recovery has also differed across various product categories. Among the four categories shown in Figure 4.3, consumer nondurables declined the least during the collapse, and the subsequent recovery has brought trade in these products almost completely back to its precrisis trend. Primary goods (a category that includes commodities and that went through a boom just prior to the crisis) and intermediate goods both experienced sharp declines,

tionally to demand changes that were symmetric across sectors. With asymmetrical demand changes and given the assumptions of our framework, the response of trade in final goods depends on the size of sectoral *demand* asymmetries and sectoral trade weights, whereas the response of trade in intermediate goods depends on the size of sectoral *supply* asymmetries and sectoral trade weights. All the necessary ingredients for the estimation are obtained from the framework.

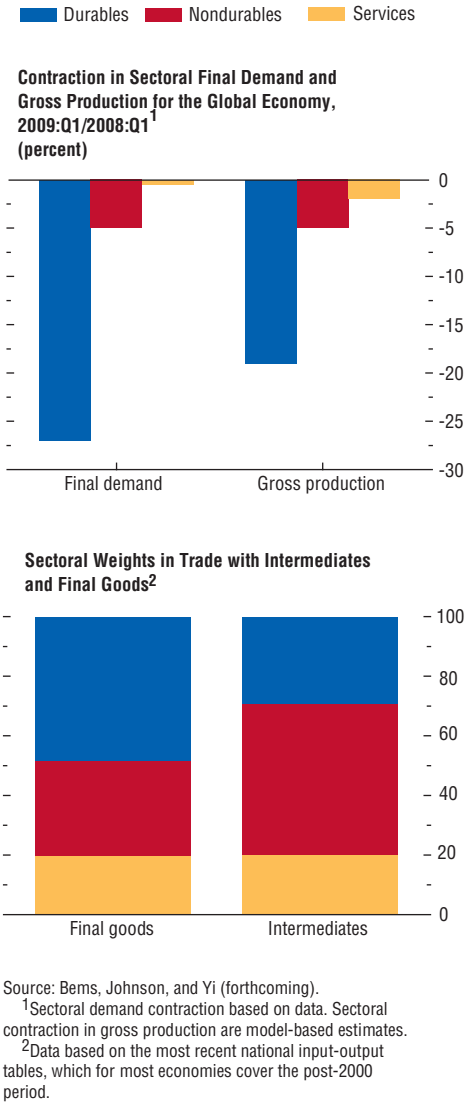
Simulations show that trade in intermediate goods was more resilient to the decline in final demand during the recent global downturn. The relative resilience of trade in intermediates to observed changes in final demand can be explained by two factors:

- The sectoral asymmetries for changes in gross production (derived from our framework) are smaller than the observed sectoral asymmetries in final demand (third figure, top panel).[4]
- Durables have a smaller weight in intermediate goods trade relative to their weight in final goods trade (bottom panel).

The differences in the responses of trade in intermediate and final goods are quantitatively large. The elasticity of global trade in final goods to GDP is estimated at 4.3, whereas the same elasticity for trade in intermediates is 2.0. These results are broadly consistent with the chapter's finding that, in crisis episodes, trading partners with greater production sharing show smaller declines in exports to the crisis economy.

[4]This result follows from the observation that services constitute a relatively large input in the production of durables and, as a result, a contraction in final demand for durables can significantly decrease the gross production of services.

The Composition Effect for Trade in Final Goods and Intermediates



Source: Bems, Johnson, and Yi (forthcoming).
[1]Sectoral demand contraction based on data. Sectoral contraction in gross production are model-based estimates.
[2]Data based on the most recent national input-output tables, which for most economies cover the post-2000 period.

but both are less than 10 percent below their precrisis trend. In contrast, and as mentioned earlier, the largest collapse was in capital and consumer durables, and while there has been some recovery, trade in that product category still remains almost 20 percent below its precrisis trend.

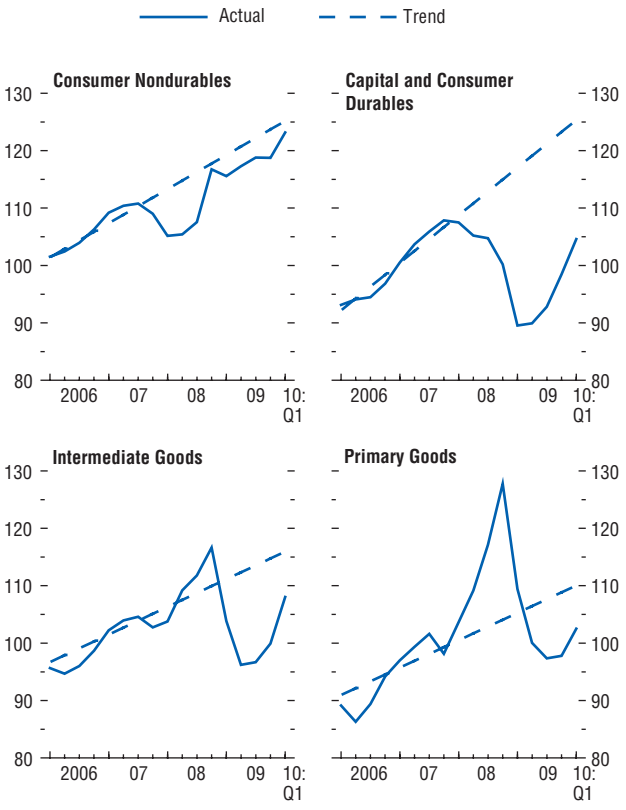
In sum, while the global trade collapse spared no one, import dynamics were particularly adverse for economies that went through a banking crisis. And while the recovery in trade has commenced, it is highly uneven, with imports of crisis economies still substantially below precrisis trends or even precrisis levels. Finally, among product groups, capital and

consumer durables remain farthest from closing the gap. Are these just transitory deviations from normal, or might these gaps persist? Where might trade be headed from here? The following section examines the historical record for some clues.

Figure 4.3. Trade Dynamics in Different Product Groups

(Trade volume index, 2008:Q1 = 100)

The recent collapse and recovery in trade has been uneven across products. Consumer nondurables were least affected, and trade in these products is now close to its precrisis trend. In contrast, trade in capital and consumer durables suffered the largest decline and remains substantially below trend.



Sources: Global Trade Atlas; and IMF staff calculations.

Note: The precrisis linear trend is based on data between January 2001 and December 2007. Data only cover imports of the following: Argentina, Australia, Brazil, Canada, China, Japan, Korea, Russia, South Africa, Turkey, and United States.

Trade Dynamics following Previous Crises

The global reach and scale of the recent financial crisis have few precedents, but history is replete with individual economies experiencing either a banking or a debt crisis. Laeven and Valencia (2008, 2010), whose crisis dates are used in this chapter, identify 129 episodes of systemic banking crises since 1970—defined as situations in which the financial sector experiences a large number of defaults, nonperforming loans increase sharply, and all or most of the aggregate banking system capital is used up. They also identify 63 episodes of sovereign debt crises over the same period—defined as an episode of sovereign debt default and/or restructuring.[7] We focus here on banking and sovereign debt crises because the most recent crises in the large advanced economies have been systemic banking crises and because the prospect of a sovereign debt crisis in a number of economies has been increasing. The chapter does not focus on currency crises, because trade dynamics following such crises are fundamentally different—the most important characteristic of currency crises is, by definition, a large exchange rate decline, which greatly influences the postcrisis dynamics of both imports and exports. In addition, large and abrupt depreciations did not characterize the most recent financial crises in advanced economies. Nevertheless, in this analysis we investigate the role of the exchange rate—changes in both its level and its volatility—in influencing the behavior of trade following banking and debt crises.

Our methodology for analyzing postcrisis trade is derived from the gravity model, the standard work-

[7]Among the banking and debt crises in the Laeven-Valencia data set are 10 cases in which the two coincide. An analysis of these "twin banking and debt crises" suggests that trade dynamics following these episodes were qualitatively similar to those with only one type of crisis, although the effects were slightly more accentuated. We do not highlight these in the chapter, however, given the limited number of observations.

horse in the empirical trade literature.[8] The gravity model relates the level of bilateral trade flows—or alternatively, import and export flows separately—to characteristics of the importing and exporting economies (most notably size and level of development) as well as to country-pair characteristics such as distance between them and whether they share a common border or language. These and other time-invariant country-pair characteristics can also be controlled for by the inclusion of country-pair dummy variables. The gravity model has been in use since the 1960s, and its popularity has derived in large part from its ability to empirically fit the trade data, that is, to describe what normal bilateral trade flows should be, given economies' fundamentals. The literature has used this framework to investigate a number of questions, including the impact of trade agreements (Frankel, Stein, and Wei, 1996), currency unions (Rose, 2000), exchange rate volatility (Thursby and Thursby, 1987), and war (Glick and Taylor, 2010; and Martin, Mayer, and Thoenig, 2008). The use of the gravity model has also been supported by recent attempts to strengthen its theoretical microfoundations (see Anderson and Van Wincoop, 2003, among others).

The approach taken in this paper is a collapsed version of the gravity model that uses aggregate imports or exports of a given economy rather than bilateral trade flows. This is done because our primary concern is in describing the evolution of aggregate trade, not bilateral trade. And the model is estimated in growth rates rather than in levels to better model the dynamics of trade over time. The results are robust to estimating the standard bilateral gravity model in changes as well as to other changes in specification. (Appendix 4.2 outlines the econometric specifications used and the robustness of the main results to alternative econometric specifications.)

Our sample consists of 154 advanced as well as emerging and developing economies covering the period 1970–2009. Bilateral and aggregate import and export flows for each economy are obtained from the IMF's Direction of Trade Statistics (DOTS) database. We also extend the NBER-UN World Trade Flows database (Feenstra and others, 2005) to analyze trade patterns by product category. (Data sources are outlined in Appendix 4.1.) Growth in aggregate imports and exports is then modeled as a function of contemporaneous and lagged values of a crisis dummy variable, changes in economic fundamentals (primarily economic size, as proxied by GDP), and changes in the (import- or export-weighted) characteristics of its trading partners.[9] To control for economies' characteristics that do not change over time, country dummies are also included. Finally, all our specifications include time dummies to control for factors that affect all economies' trade simultaneously, such as global downturns or increases in global uncertainty or risk aversion.

What Happens to Imports and Exports after a Crisis?

We first estimate the *unconditional* behavior of an economy's imports and exports—that is, without controlling for output—to gauge the extent to which trade is affected in the aftermath of a crisis. On average, imports fall by about 8 percent in the crisis year (Figure 4.4, top-left panel; Table 4.1). An additional drop of about 8 percent occurs the following year. There is little sign of recovery in subsequent years, so that by the fifth year after the crisis, imports remain about 19 percent below their level predicted in the absence of a crisis. That pattern—a sharp short-term drop in imports followed by little or no recovery in the medium term—is also evident when looking at debt crises and banking crises separately, although medium-term effects are more adverse for the former (Figure 4.4, middle-left and bottom-left panels). The differences in import dynamics between the two types of crisis are not statistically significant, however.

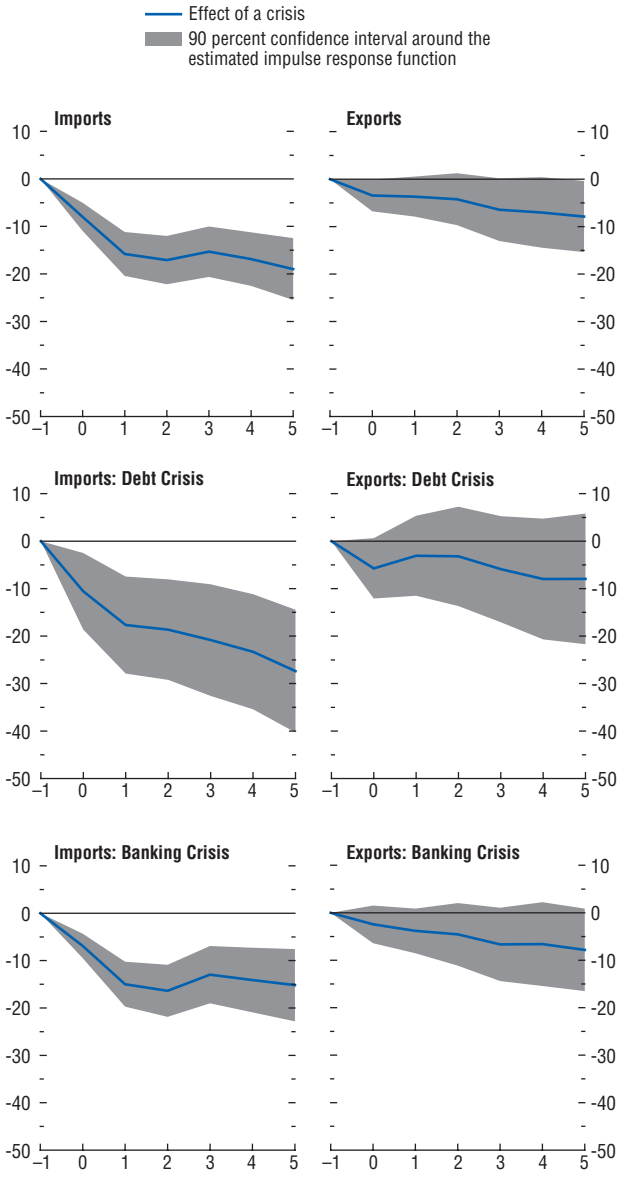
[8]See Baldwin and Taglioni (2006) for a survey of the use of gravity models in the literature, as well as the pitfalls faced in estimating them.

[9]Most gravity models in the literature are typically estimated in levels and also include GDP per capita. When estimating the model in changes, however, there is a very high correlation between the growth rates of GDP and GDP per capita, and so we exclude the latter in our baseline specification. The results reported below are very similar if one includes own and trading partners' growth in GDP per capita.

Figure 4.4. Import and Export Losses, Not Controlling for Output

(Percent deviation from normal; years on x-axis; crisis begins at t = 0)

There is a sharp and significant decline in imports in the first two years after a crisis and no recovery in subsequent years. Exports exhibit a smaller and more gradual decline, which is marginally significant in the medium term. Trade dynamics are similar following debt and banking crises, although the adverse dynamics of imports and exports are slightly (but not significantly) more severe following debt crises.



Source: IMF staff calculations.

Note: Blue lines indicate the impulse response function – the effect of a crisis on imports and exports relative to what would be predicted in the absence of a crisis. Predictions are based on contemporaneous and lagged crises, and country and time dummies.

The effect on exports is smaller and more gradual (Figure 4.4, top-right panel). There is no sharp drop in exports in the short term; exports drop by only 3 percent on average at the onset of a crisis. There is, however, a gradual deterioration in exports, so that by the fifth year after a crisis, exports are on average about 8 percent lower than normal, and the difference is marginally significant. The smaller decline in exports relative to imports implies that, on average, the external trade balance tends to improve after a crisis. Similar patterns of gradual export decline are observed for debt and banking crises separately, although the variation in export losses is larger following debt crises (Figure 4.4, middle-right and bottom-right panels). As was the case for imports, the differences in export dynamics between the two types of crisis are not statistically significant, and in the subsequent analysis we simply look at banking and debt crises together.[10]

These results are robust to the use of a number of alternative methodologies for estimating losses. The first and simplest methodology for calculating losses, adopted from Chapter 4 of the October 2009 *World Economic Outlook*, looks at deviations of imports and exports from a precrisis trend. A second robustness test is to include autoregressive terms in the estimation to more closely parallel the specification used in studies such as Romer and Romer (2010) and Cerra and Saxena (2008). Third, the full bilateral gravity model in changes is estimated, using both the full sample and the top 20 partners of each country. Finally, to address the concern that our findings may be driven by large depreciations accompanying banking and debt crises, we isolate episodes that did not coincide with currency crises. All methodologies produce qualitatively similar results. Further details on these robustness tests are reported in Appendix 4.2.

[10]The larger and more persistent losses in imports relative to exports may reflect the consequences of weak balance sheets (or other financial difficulties) for domestic demand. Although lower domestic demand directly reduces import volumes, it may also reduce residents' consumption of exportable goods, freeing up room for more exports.

Table 4.1. Baseline Regressions and Implied Changes in the Levels of Imports and Exports

	Imports				Exports			
	Unconditional		Conditional		Unconditional		Conditional	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Coefficient	IRF[1]	Coefficient	IRF[1]	Coefficient	IRF[1]	Coefficient	IRF[1]
Crisis at t	–0.080***	–0.080***	–0.040**	–0.040***	–0.034	–0.034	–0.007	–0.007
	(0.018)	(0.018)	(0.017)	(0.017)	(0.020)	(0.020)	(0.020)	(0.020)
Crisis at $t-1$	–0.078***	–0.158***	–0.034**	–0.073***	–0.002	–0.037	0.019	0.012
	(0.018)	(0.029)	(0.016)	(0.026)	(0.017)	(0.026)	(0.017)	(0.027)
Crisis at $t-2$	–0.013	–0.171***	–0.003	–0.077***	–0.006	–0.042	0.003	0.015
	(0.016)	(0.031)	(0.015)	(0.030)	(0.019)	(0.033)	(0.019)	(0.034)
Crisis at $t-3$	0.018	–0.153***	0.014	–0.063*	–0.022	–0.064	–0.018	–0.003
	(0.014)	(0.032)	(0.013)	(0.034)	(0.020)	(0.040)	(0.021)	(0.041)
Crisis at $t-4$	–0.016	–0.169***	–0.014	–0.077**	–0.006	–0.070*	0	–0.003
	(0.013)	(0.034)	(0.012)	(0.035)	(0.015)	(0.045)	(0.015)	(0.046)
Crisis at $t-5$	–0.021	–0.190***	–0.012	–0.089**	–0.009	–0.079*	–0.001	–0.004
	(0.015)	(0.040)	(0.014)	(0.039)	(0.014)	(0.046)	(0.013)	(0.047)
R^2	0.12		0.21		0.11		0.18	
N	4,754		4,754		4,753		4,753	

Source: IMF staff calculations.

Note: The table presents the results of regressing the growth in imports/exports on an indicator for crisis and its five lags, country, and year fixed effects. Robust standard errors clustered by country are reported in parentheses. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. Columns (3) and (7) control for own and partner growth in GDP, and for measures of trade-weighted crises in partner countries and their lags. The implied changes in the levels of imports/exports in columns (2), (4), (6), and (8) are calculated as the cumulative sum of the estimated coefficients on the crisis indicator and its lags from the regressions shown in columns (1), (3), (5), and (7), respectively.

[1]Impulse response function.

Does Output Fully Explain the Behavior of Imports and Exports?

Previous studies, including Chapter 4 of the October 2009 *World Economic Outlook* and Cerra and Saxena (2008), find that output declines significantly following financial crises and stays depressed over the medium term. Is the behavior of trade described above simply a reflection of these postcrisis output dynamics? To address this issue, we control for output by adding GDP of both the home economy and trading partners. Whereas standard gravity models assume that the elasticity of trade to output is uniform across economies and over time, we relax this assumption in our analysis because these elasticities are crucial for assessing whether trade behavior is fully explained by output.[11] The top panel of Figure 4.5 and Table 4.1 suggest that while depressed output contributes significantly to the adverse evolution of imports, it does not explain all of it. Controlling for output reduces the estimated import losses substantially—by about 10 percentage points in both the short and the medium term (Table 4.1). However, the import losses remain significantly different from zero.

The finding that output does not explain all of the adverse behavior of imports is robust to several tests. One possibility is that the estimated elasticity of imports to output picks up the sensitivity of imports to long-term or trend movements in output; if the elasticity of imports to cyclical fluctuations or during crisis periods is larger, then imposing a fixed elasticity would result in large unexplained declines in imports during cyclical downturns or crises, even after controlling for output. To test for this, we allow the coefficient on output to vary during crisis and noncrisis

[11]Specifically, we allow the elasticity to vary across regions as defined in the World Economic Outlook database (defined in Appendix 4.1) and also to vary between the pre-1990 and post-1990 periods. Assuming a uniform elasticity results in larger estimated import losses, as reported in Appendix 4.2.

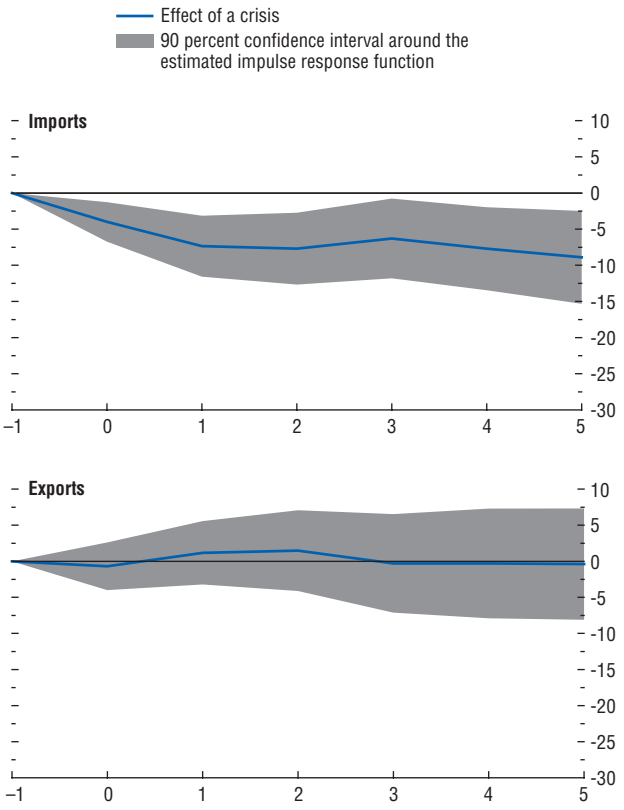
periods; we also allow it to vary across the trend and cyclical components of output, where the trend and cycle were separated using a Hodrick-Prescott filter. In both cases, the elasticity of imports to higher-frequency movements in output was indeed found to be significantly higher. Finally, we include lags of GDP growth in the specification. Nevertheless, the adverse behavior of imports remained, even after controlling for output. It is also robust to the use of alternative methodologies described in Appendix 4.2.

In contrast to import behavior, much of the behavior of exports following a crisis seems to be associated with adverse output dynamics (Figure 4.5, bottom panel). After controlling for output, exports are close to normal, and the estimated deviation is not statistically different from zero either in the short or the medium term. Because of this, the remainder of the chapter focuses on imports, which seem to bear the primary impact of crises.

Figure 4.5. Import and Export Losses, Controlling for Output

(Percent deviation from normal; years on x-axis; crisis begins at t *= 0)*

Imports remain depressed even after controlling for output and other standard gravity controls. In contrast, exports are no longer significantly different from zero when these controls are added.



Source: IMF staff calculations.

Note: Blue lines indicate the impulse response function – the effect of a crisis on imports and exports relative to what would be predicted in the absence of a crisis. Predictions are based on a collapsed gravity model in changes, with contemporaneous and lagged crises, home and trade-weighted partner output, a trade-weighted partner crisis dummy, and country and time dummies.

Do Dynamics Differ across Products, Trading Partners, and Crises?

The previous section noted significant differences in the behavior of trade in various product categories during the most recent global downturn. Is this pattern also borne out in earlier crises? Figure 4.6 shows some similarities between the most recent global downturn and earlier crises, but it also shows some differences.[12] In the past, as in the more recent global downturn, capital and consumer durables experienced the largest short-term decline, with an average drop of almost 15 percent in the second year after the crisis, even after controlling for changes in output. There was little sign of recovery in imports for this product category over the medium term. The other three product categories also experienced significant drops in the short term but of less than 10 percent. However, these product categories exhibited further deterioration over

[12]It should be noted that the behavior of imports illustrated in Figure 4.3 covers only 13 economies and includes both crisis and noncrisis economies, whereas Figure 4.6 shows the behavior of imports in these product groups for crisis economies only. In addition, Figure 4.3 presents unconditional import losses, whereas Figure 4.6 shows losses after controlling for output and other variables.

the medium term, which is somewhat puzzling, especially because the analyses that find these losses already control for output.[13]

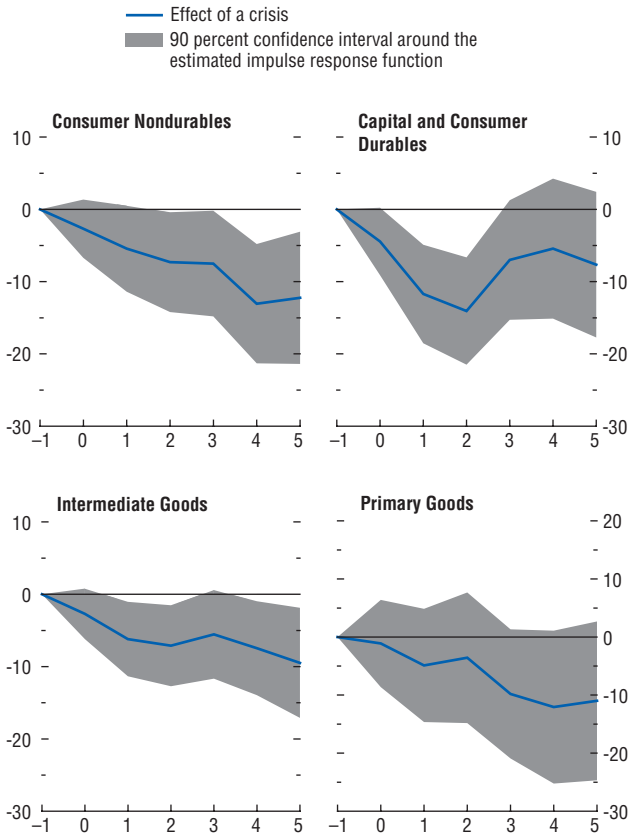
It is also possible that different trading partners' exports to the crisis economy are affected in different ways. Are some trading partners' exports more resilient than others? One factor that does seem to matter is the strength of international production linkages—the use of intermediate imported goods in the production of exports.[14] Greater production sharing tends to make trade more resilient: the more vertically integrated a crisis economy is with a trading partner, the smaller the decline in imports from that trading partner (Figure 4.7). The finding is consistent with the idea of a "beachhead effect," with firms that have incurred the sunk costs of entering a relationship unwilling to leave simply because conditions turn bad.[15]

Finally, we evaluate whether trade dynamics differ if a crisis coincides with a global downturn, where the latter is defined as in Freund (2009).[16] About one-fifth of earlier crisis episodes occurred during years of global downturns. Economies that

Figure 4.6. Import Losses in Different Product Groups, Controlling for Output

(Percent deviation from normal; years on x-axis; crisis begins at t = 0*)*

Imports of capital and consumer durables fall most sharply in the short term, as in the recent crisis. Imports in other product groups fall more gradually but steadily over time.



Source: IMF staff calculations.

Note: Blue lines indicate the impulse response function – the effect of a crisis on imports relative to what would be predicted in the absence of a crisis. Predictions are based on a collapsed gravity model in changes, with contemporaneous and lagged crises, home and trade-weighted partner output, a trade-weighted partner crisis dummy, and country and time dummies.

[13]If past crises typically occurred in lower-income countries with weak social safety nets, it is possible that crises and the resulting (uncushioned) rise in unemployment would lead to declines even in consumer nondurables. See, for example, Friedman and Levinsohn (2003) for an analysis of the impact of the 1997 Asian crisis on Indonesian households. The effects would remain even in the regressions that control for output if the measured GDP decline failed to adequately capture the adverse impact on poorer households.

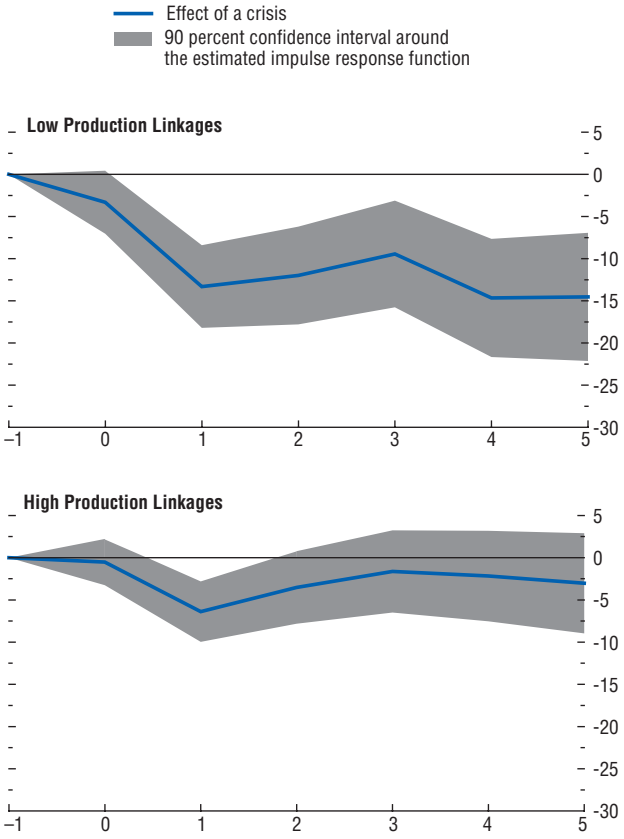
[14]We measure the intensity of production linkages between two countries by the ratio of value-added to exports (VAX) of Johnson and Noguera (2010). The VAX ratio, constructed from input-output tables and bilateral trade across a large sample of countries, captures the extent to which the exports from country A to country B are used as intermediate goods in the production of country B's exports.

[15]See Baldwin (1988), who proposed beachhead effects as one potential explanation for hysteresis in international trade. Our findings are also consistent with other studies, such as that by Altomonte and Ottaviano (2009), who note the resilience of trade between western and central Europe during the recent crisis, and Bernard and others (2009), who document the resilience of intra-Asian "supply chain" trade following the Asian crisis.

[16]Specifically, Freund (2009) defines global downturns as years when world real GDP growth is (1) below 2 percent, (2) more than 1.5 percentage points below the previous five-year average, and (3) at its minimum relative to the previous two years and the following two years. The procedure identifies the following global downturns: 1975, 1982, 1991, 2001, and 2008.

Figure 4.7. Import Losses and Production Linkages, Controlling for Output
(Percent deviation from normal; years on x-axis; crisis begins at t = 0)

Stronger production linkages between economies tend to make trade more resilient. The more vertically integrated a crisis economy is with a trading partner, the smaller the decline in imports from that trading partner.



Sources: Johnson and Noguera (2010); and IMF staff calculations.
Note: Blue lines indicate the impulse response function – the effect of a crisis on imports relative to what would be predicted in the absence of a crisis. Predictions are based on a gravity model in changes, with contemporaneous and lagged crises, home and partner output and output per capita, partner crisis dummies, and importer-exporter and time dummies. Importer-exporter pairs are split into those with above-median value-added-to-exports ratios as of 2006 (low production linkages) and those below the median (high production linkages). The value-added-to-exports ratios are from Johnson and Noguera (2010).

experienced a crisis during a global downturn had deeper import and export losses, both unconditionally and after conditioning on output (Figure 4.8). The unconditional import losses remain larger than the export losses, and so, even in these cases, net exports of the crisis economies still tend to improve. This suggests that such financial crises may result in deeper trade losses than historical episodes that did not coincide with a global downturn.

Do Precrisis Conditions Matter?

The import dynamics in Figures 4.4 and 4.5 present only the average behavior across all historical crisis episodes. But might import dynamics differ depending on precrisis conditions? For example, an economy that entered the crisis with a relatively deteriorated current account balance may see more of an adjustment in relative prices, so that imports may fare relatively worse than in an economy that entered a crisis with a more favorable current account position. The top panels of Figure 4.9 suggest that this is the case. For the subsample of crisis episodes with above-median precrisis current account balances, there was no deterioration in imports after controlling for output; for the subsample with below-median precrisis current account balances, the import loss after controlling for output was much larger and more persistent.

Similarly, economies with a higher degree of financial or trade openness entering the crisis seemed to experience a smaller import loss (Figure 4.9, middle and bottom panels). While the exact nature of the association between precrisis openness and postcrisis trade dynamics is unclear, we have two conjectures. First, greater financial openness could mean less dependence on the domestic banking sector, especially for trade finance. If this is the case, then a banking crisis that damages the domestic financial sector could have less of an impact in more financially open economies. Second, the association between trade openness and postcrisis dynamics could be related to the greater trade resilience of more vertically integrated economies, because economies with the strongest production linkages also tend to have relatively high measured levels of trade integration.

What Factors Are Associated with Postcrisis Import Dynamics?

If output does not explain all the behavior of imports following a crisis, then what does? Potential additional explanations, which have been discussed in the context of the recent crisis, include the following:

- *Impaired credit:* Banking crises in particular are associated with a tightening of credit conditions—Abiad, Dell'Ariccia, and Li (forthcoming) find that when a downturn is associated with a banking crisis, a "creditless recovery" (one in which real credit growth is negative) becomes twice as likely. If the downturn is also preceded by a credit boom, the likelihood of a creditless recovery quadruples and becomes a near certainty. Difficulty in obtaining credit may have deleterious effects on imports, above and beyond any effects weak credit might have on aggregate demand.[17]
- *Increased protectionism:* In the aftermath of a crisis, interest groups that favor protecting domestic production may be strengthened.[18] Increased protection need not come in the form of increased tariffs; it may also be manifest in increased use of antidumping measures and other forms of "murky protectionism," such as clauses in stimulus packages that restrict spending to domestic producers. Box 4.2 discusses the use of protectionist measures and their effect on trade in the wake of the recent crisis.
- *Exchange rate dynamics:* Imports may be adversely affected by changes in both the level and the volatility of exchange rates. Kaminsky and Reinhart (1999) note that many banking crises are also associated with sharp depreciations of the currency; in such cases the swing in relative prices would hurt imports but boost exports. In addition, exchange rate variability may increase during crisis periods, and increased variability has

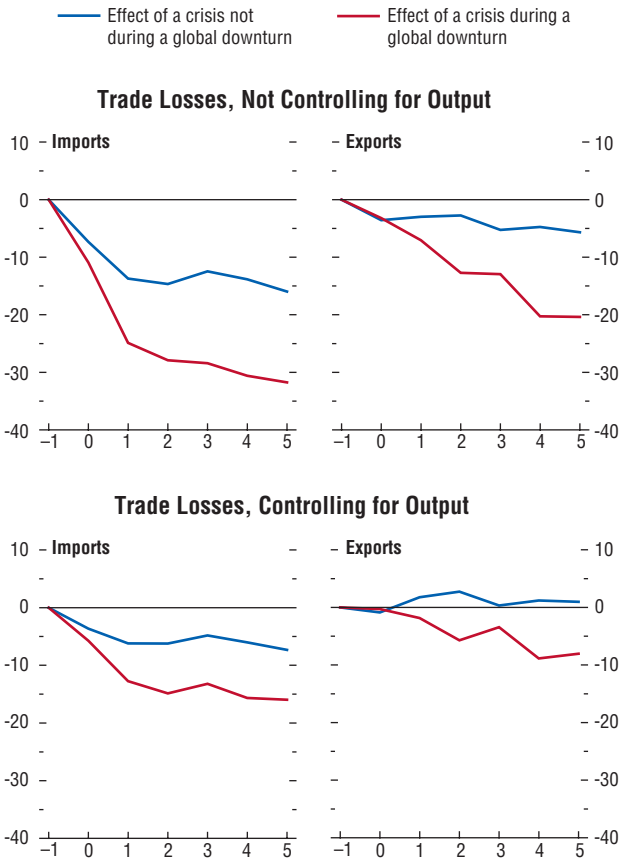
[17]See Amiti and Weinstein (2009), Iacovone and Zavacka (2009), and Chor and Manova (2010) for the importance of trade finance and credit in explaining export performance during crises.

[18]For example, the Great Depression was followed by a "wholesale rise in protectionism," which not only slowed the process of economic recovery but created lasting protectionist legacies in a number of countries (see O'Rourke, 2009).

Figure 4.8. Trade Losses during Global Downturns

(Percent deviation from normal; years on x-axis; crisis begins at t = 0)

Import and export losses are higher after crises that occur during global downturns.



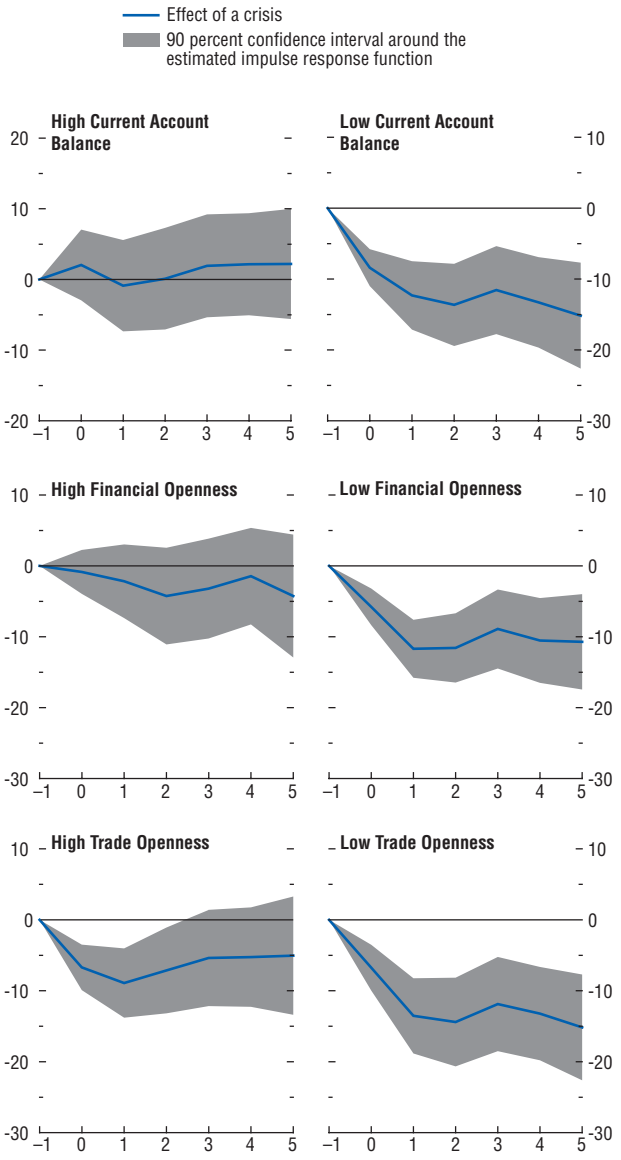
Source: IMF staff calculations.

Note: Lines indicate the impulse response function—the effect of a crisis on imports and exports relative to what would be predicted in the absence of a crisis. Predictions of unconditional losses are based on contemporaneous and lagged crises, country and time dummies, and interactions of contemporaneous and lagged crises with years of global downturns. Predictions of conditional losses are based on a collapsed gravity model in changes, with contemporaneous and lagged crises, home and trade-weighted partner output, a trade-weighted partner crisis dummy, country and time dummies, and interactions of contemporaneous and lagged crises with years of global downturns. The definition of global downturns follows Freund (2009), and includes 1975, 1982, 1991, 2001, and 2008.

Figure 4.9. Precrisis Characteristics and Import Losses, Controlling for Output

(Percent deviation from normal; years on x-axis; crisis begins at t = 0)

Economies that entered a crisis with a low current account balance or a lesser degree of trade or financial openness experienced deeper import losses even after controlling for output and other standard gravity controls.



Source: IMF staff calculations.

Note: Blue lines indicate the impulse response function – the effect of a crisis on imports relative to what would be predicted in the absence of a crisis. Predictions are based on a collapsed gravity model in changes, with contemporaneous and lagged crises, home and trade-weighted partner output, a trade-weighted partner crisis dummy, and country and time dummies. Crisis episodes are split into those for which the current account balance, degree of financial openness, and trade openness are, respectively, above or below the crisis sample median in year $t-1$.

been shown to adversely affect trade (Thursby and Thursby, 1987).

- *The composition effect:* Because certain product categories represent a greater share of trade than of output, a fall in demand for these products will result in a larger drop in trade than in output. Crises may lead to a greater fall in demand for goods than for services, for example, and most trade is in goods, whereas services account for the bulk of output. And within goods, durables form a larger share of trade than of output. As noted in Box 4.1, the composition effect seem to explain much of the outsize drop in trade during the recent crisis. Unfortunately, the lack of comprehensive historical data on the composition of demand precludes a detailed investigation of this particular mechanism, but below we present some evidence that suggests that composition effects played at least a partial role even in earlier crises.

For these mechanisms to be associated with the observed postcrisis import dynamics, not only should these factors have an adverse effect on imports, they should also tend to worsen during crisis periods. To investigate the role of each of these mechanisms, we follow a three-step approach. In the first step, we estimate impulse-response functions to gauge how credit, protection, and exchange rate dynamics evolve in the aftermath of a crisis. In the second step, we estimate the elasticity of imports with respect to these factors. The third step combines the first two steps to obtain an estimate of how much each mechanism can account for postcrisis import dynamics. Details are described in Appendix 4.2. It should be emphasized that none of this analysis attempts to identify causation, only association; we want to know how much of an import decline we would predict given the behavior of the various correlates.

The results of the first step of this three-step methodology are shown in Figure 4.10, which shows how the level and volatility of the real effective exchange rate (REER), credit, and tariffs evolve on average following a crisis. The REER depreciates in the short term by about 6 percent on average in the first two years of the crisis and stays depreciated in subsequent years, but the variation around this average is quite large. There is also a significant increase

in the volatility of the REER in the short term that declines over the medium term. Credit to the private sector, measured relative to GDP, steadily declines in the years following a crisis, with an average decline of more than 15 percentage points by the fifth year. Although the magnitude of this decline looks quite large, it should be noted that many banking crises were preceded by excessive credit growth. Finally and somewhat surprisingly, there is no evidence that protectionism, as measured by the average tariff level, increases following a crisis. There is a statistically insignificant change in average tariffs following a crisis in both the short and medium term.[19] This last finding, however, should not be interpreted to mean that overall protection does not rise, given that increased protectionism may manifest itself in "murky" forms (mentioned above), which are difficult to detect in the data.

The estimated elasticity of imports to mechanisms other than output is outlined in Table 4.2.[20] The estimated elasticity of imports to the REER, at about 0.09, is substantially smaller than estimates from other studies. This may be due to the fact that the model estimates only the contemporaneous association between the REER and imports.[21] The

Table 4.2. Estimated Elasticity of Imports

REER[1]	0.09*
Volatility of REER	–0.05***
Credit-to-GDP ratio	0.10***
Tariffs	–0.03

Source: IMF staff calculations.

Note: Elasticity is estimated by regressing the log of imports on the log of the variables of interest and economy- and year-fixed effects. ***, **, and * indicate significance at the 1, 5, and 10 percent level, respectively. Standard errors (not reported) are clustered by economy and corrected for heteroscedasticity.

[1]Real effective exchange rate.

[19]The number of antidumping measures imposed by a country also does not increase significantly following crises.

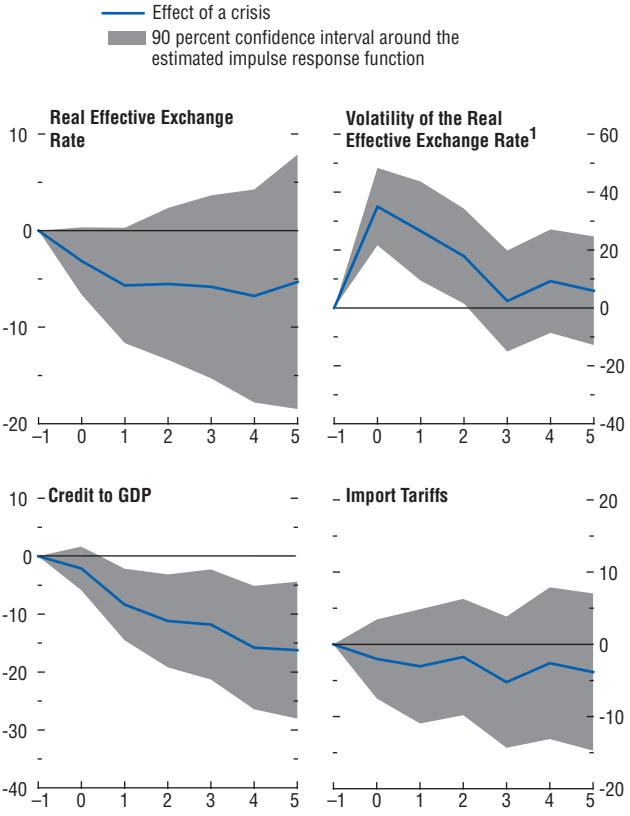
[20]As noted above, the estimated elasticity of imports with respect to output in the baseline specification varies across regions and over time. These elasticities are discussed in Appendix 4.2.

[21]Estimates of this elasticity in the literature vary by horizon (Senhadji, 1998, for example, finds an elasticity close to zero in the short term but higher than 1 in the long term), as well as across countries (Kwack and others, 2007, have elasticities that range from 0.4 to 1.2 across a wide range of countries). Using the higher estimates found in the literature will, of course, increase the fraction of import loss that can be accounted for by postcrisis declines in the REER.

Figure 4.10. The Postcrisis Evolution of Various Mechanisms

(Percent deviation from normal; years on x-axis; crisis begins at t = 0)

Crises are followed by persistent declines in credit as a share of GDP, as well as temporary rises in exchange rate volatility. There is a small and statistically insignificant real depreciation and no evidence of significant changes in import tariffs.



Source: IMF staff calculations.

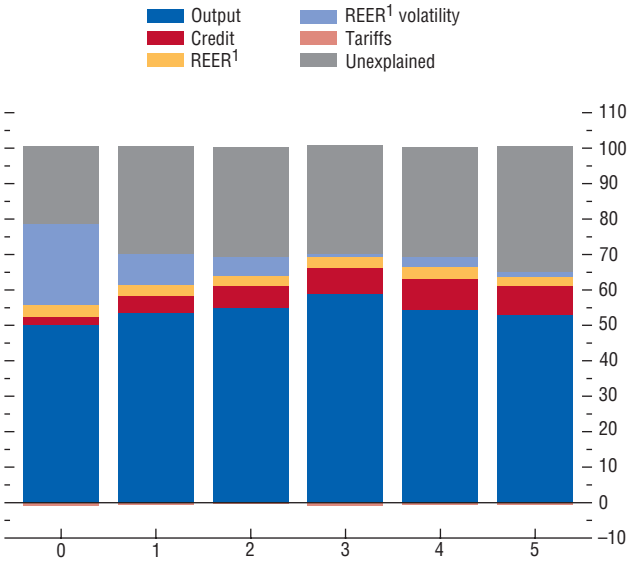
Note: Blue lines indicate the impulse response function—the effect of a crisis relative to what would be predicted in the absence of a crisis. Predictions are based on contemporaneous and lagged crises and country and time dummies.

[1]Exchange rate volatility is measured as the annual standard deviation of monthly real effective exchange rate depreciation.

Figure 4.11. Decomposition of Import Losses

(Percent; years on x-axis; crisis begins at t = 0)

Output declines account for the biggest share of import losses in the aftermath of crises. However, the temporary rise in exchange rate volatility and persistent impairment of credit also contribute. Controlling for these potential explanations still leaves a portion of import losses unexplained, which may reflect composition effects.



Source: IMF staff calculations.

Note: Unconditional import losses (see Figure 4.4) are decomposed into changes attributable to the fall in output and credit, a rise in exchange rate volatility, depreciation, and changes in tariffs. The contribution of output is computed as the difference between the unconditional and conditional import losses (see Table 4.1). The contribution of the remaining factors is calculated as the product of the elasticity of imports with respect to each factor and the change in the factor following crises (depicted in Figure 4.10), as a percent of the unconditional change in imports after crises.

[1]REER = real effective exchange rate.

estimated elasticity of imports to REER volatility and credit are both statistically significant and of the expected sign. The estimated elasticity of imports to tariffs, while negative as expected, is not statistically significant.

Combining these results allows us to estimate the average contribution of these various mechanisms (Figure 4.11). The estimated contribution of output is derived as the difference between the unconditional import loss reported in Figure 4.4 and the import loss controlling for output in Figure 4.5. At the onset of a crisis (year *t*), the decline in output accounts for about half of the overall loss in imports in that year; increased exchange rate volatility accounts for another one-fifth of the import loss. Real depreciation and weak credit together account for less than 10 percent of the loss in the crisis year, so that about 20 percent of the import loss in the year of the crisis remains unaccounted for. In subsequent years, output remains the most important contributor to depressed imports, accounting for anywhere between 50 and 60 percent of the total import loss. The role of exchange rate volatility diminishes over time, a reflection of the fact that the surge in volatility in the immediate aftermath of a crisis subsides over time. The role of credit, in contrast, increases over time because credit steadily worsens following a crisis; by the fifth year, weak credit conditions account for about 10 percent of the total import loss.

Although these mechanisms help account for a significant portion of the estimated postcrisis import loss, between 20 and 35 percent of the latter remains unexplained. To what extent might the composition effect account for the unexplained component? This chapter's focus on trade in goods, and the lack of detailed historical data on the demand share of durables and nondurables for a wide range of economies preclude inclusion of composition effects in our three-step methodology. But there is some evidence to suggest that such effects were important in earlier crises as well.[22] Imports fall much more than output if two conditions are

[22]Box 4.1 uses a more sophisticated framework and more disaggregated data to obtain more precise estimates of the role of the composition effect in explaining the most recent trade collapse.

satisfied: demand for some goods must fall more than for others, and those goods must account for a larger share of trade than of output. Across a sample of 48 economies and 26 crisis episodes for which data are available, tradable investment goods (machinery and equipment) account for 18 percent of trade but only 8 percent of GDP (Figure 4.12). And the postcrisis decline in machinery and equipment is much larger—imports of these goods decline by more than one-third by the second year after a crisis, more than 10 times the postcrisis decline in the rest of GDP over the same period.[23] Calculations in Appendix 4.2 suggest that, even when focusing narrowly on these investment durables, the composition effect can explain at least a portion of the postcrisis fall in imports.

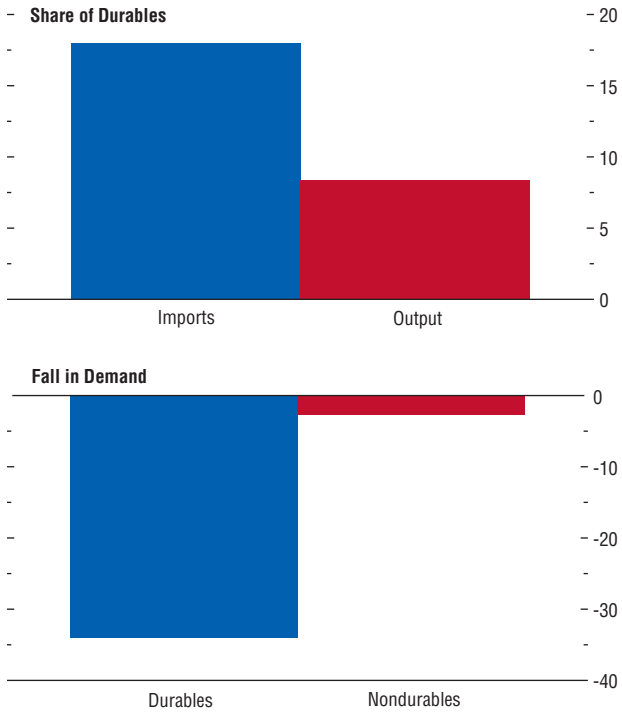
The three-step methodology provides only an estimate of the average contribution of the various mechanisms to import dynamics. For example, although the size of the average depreciation is small following a crisis, it is also clear from Figure 4.10 that there is substantial variation around this average. Is it possible that economies whose currencies depreciated more substantially had imports that evolved differently than those whose currencies did not depreciate as much? Figure 4.13 sheds some light on these possibilities; once again, all the reported import losses already control for output. Crisis episodes with a relatively large depreciation seem to be associated with more depressed imports than those with smaller depreciations (top panels). Crises during which the increase in exchange rate volatility was lower, or credit conditions were better, seem to be associated with less import deterioration (middle panels).[24] Finally, there is evidence that crises during which tariffs increased by relatively more were associated with worse import performance, particularly in the short term, consistent with the findings in Box 4.2 regarding the recent crisis.

[23]One possibility is that a decline in credit availability following a crisis affects demand for durables more than demand for other goods.

[24]These findings are robust to the use of alternative proxies that more closely track trade finance as opposed to the measure of general credit conditions that is used here. Specifically, it is robust to using the change in the outstanding stock of external short-term debt, which includes short-term credit for trade (Ronci, 2004).

Figure 4.12. Import Losses and Composition Effects
(Percent)

Durables comprise a much larger share of trade than of output. In addition, demand for durables declines substantially more than demand for nondurables following crises. These two facts suggest that composition effects may play an important role in postcrisis import losses.



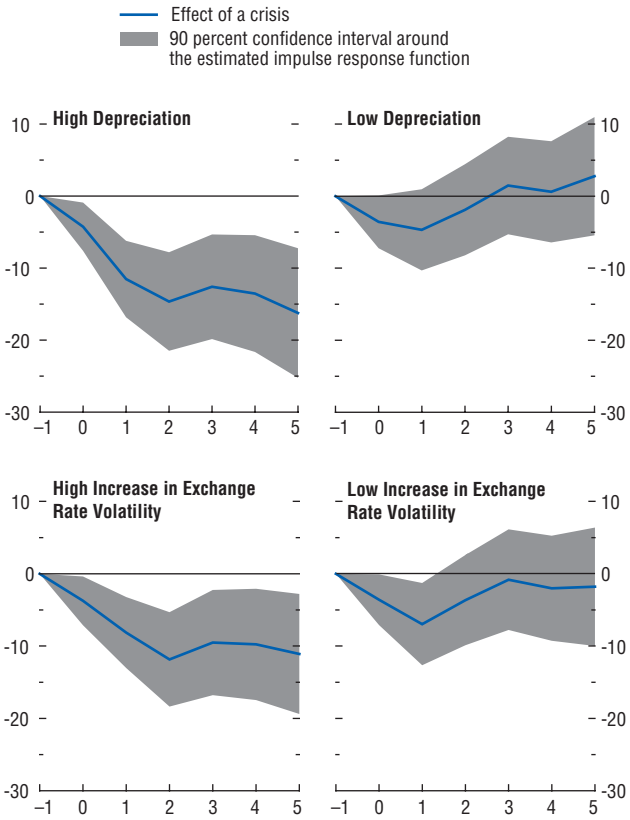
Source: IMF staff calculations.

Note: The average share of machinery and equipment in GDP and share of capital durables in imports in a sample of 48 countries is shown in the top panel. The estimated impulse response two years after a crisis is shown in the bottom panel. The estimated impulse response function is based on contemporaneous and lagged crises and country and time dummies.

Figure 4.13. Postcrisis Characteristics and Import Losses, Controlling for Output

(Percent deviation from normal; years on the x-axis; crisis begins at t = 0)

The evolution of imports following crises is associated with postcrisis economic conditions and policies. Imports fare worse when a crisis is accompanied by a larger depreciation, greater exchange rate volatility, a sharper decline in credit, or a greater increase in protectionism.



Source: IMF staff calculations.

Note: Blue lines indicate the impulse response function – the effect of a crisis on imports relative to what would be predicted in the absence of a crisis. Predictions are based on a collapsed gravity model in changes, with contemporaneous and lagged crises, home and trade-weighted partner output, a trade-weighted partner crisis dummy, and country and time dummies. Crisis episodes are split into those during which depreciation, the change in real effective exchange rate volatility, and the change in credit to GDP between $t = 0$ and $t = 5$ are, respectively, above or below the crisis sample median. In the case of tariffs, the figure reports conditional imports after crises with a change in the trade liberalization index above and below the 75th percentile.

Summary and Implications for the Outlook

This analysis finds that crises tend to depress imports substantially in the short term—above and beyond any import compression due to lower output—and that imports tend to stay depressed through the medium term. Imports tend to decline more if the economy entered the crisis with a relatively unfavorable current account balance and if the crisis resulted in a relatively large decline in the REER or poor credit conditions. Finally, exports exhibit a smaller and more gradual decline that can be fully accounted for by changes in output.

How do those results inform the outlook for trade? As the world economy emerges from the Great Trade Collapse of 2008–09, recent data make it just as easy to view the trade recovery glass as being half full as it is to view it as half empty. Optimists can point to strong growth in world trade since the second half of 2009, while pessimists can lament that imports and exports remain far below precrisis trends, or even below precrisis levels for some economies. Which perspective is justified? Although caution should be exercised when drawing implications for the recent, more global crisis from historical crisis episodes, we use the evidence in this chapter to try to shed light on where trade might be headed.

The recent financial crisis has been concentrated in many large, advanced economies (Table 4.3), and so this chapter's findings have implications not just for individual economies but also for the global recovery and for global trade patterns. The 13

Table 4.3. Systemic Banking Crises, 2007–09

Systemic Cases	Borderline Cases
Austria	France
Belgium	Greece
Denmark	Hungary
Germany	Kazakhstan
Iceland	Portugal
Ireland	Russia
Latvia	Slovenia
Luxembourg	Spain
Mongolia	Sweden
Netherlands	Switzerland
Ukraine	
United Kingdom	
United States	

Source: Laeven and Valencia (2010).

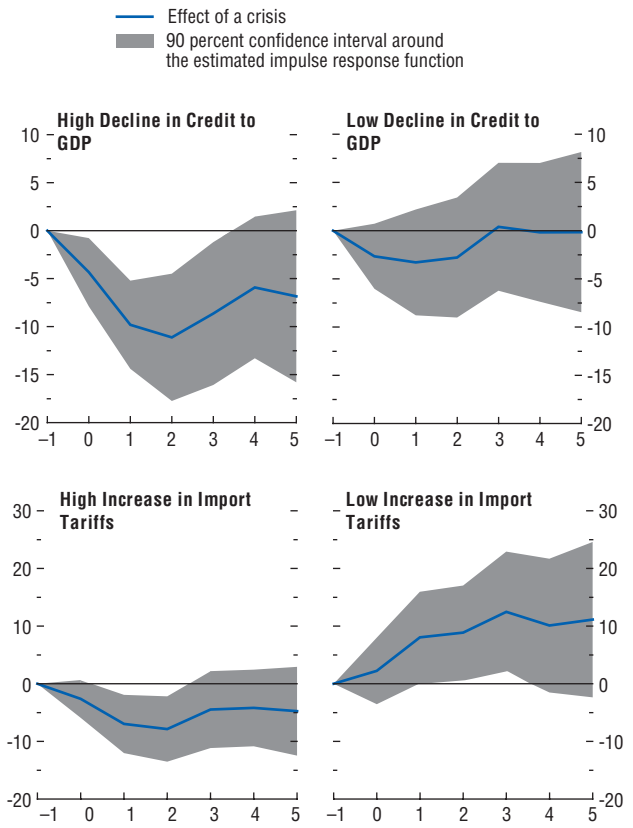
Note: Laeven and Valencia (2010) define systemic banking crises as cases in which at least three of their listed interventions took place, whereas borderline cases are those that "almost meet" their definition of a systemic crisis.

countries that recently had a systemic banking crisis account for about 40 percent of global demand, with the three largest countries—Germany, the United Kingdom, and the United States—accounting for more than one-third of global demand. Including 10 additional countries that Laeven and Valencia (2010) identify as having had a "borderline" systemic banking crisis, the recent crisis countries account for over half of world demand and output. This chapter's estimates of postcrisis trade dynamics are consistent with the sharp and substantial drop in import demand that has been evident in these countries. More important for the outlook, this analysis suggests that these countries' imports are likely to remain depressed for a number of years, even more than their tempered output projections would suggest. If, in addition, some economies fall into a sovereign debt crisis—which this analysis finds to be associated with more acute import losses—prospects for global import demand will dim even further. For economies that rely heavily on external demand for growth, the chapter's findings underscore the importance of rebalancing toward domestic sources of growth or, more generally, of developing "twin engines" of growth.

The analysis also suggests that import dynamics may differ across the crisis countries. For countries that entered the crisis with a relatively weak current account, such as the United Kingdom and the United States, import demand is likely to be even more anemic. Exports to the United Kingdom are also weighed down by the substantial depreciation of the pound sterling since 2008. Finally, real credit in these two economies is decelerating or even contracting, which the chapter suggests will also weaken imports beyond its effects on output.

The fact that these countries' exports are not expected to decline nearly as much as their imports implies a likely improvement in the external balances of the crisis countries and a deterioration in the balances of their partners. Because the United States accounted for a large part of the global imbalances that widened substantially in the early 2000s, a silver lining from the recent crisis is the narrowing of the U.S. external deficit, and this chapter suggests that this narrowing may be more durable than

Figure 4.13. (concluded)



Source: IMF staff calculations.

Note: Blue lines indicate the impulse response function—the effect of a crisis on imports relative to what would be predicted in the absence of a crisis. Predictions are based on a collapsed gravity model in changes, with contemporaneous and lagged crises, home and trade-weighted partner output, a trade-weighted partner crisis dummy, and country and time dummies. Crisis episodes are split into those during which depreciation, the change in real effective exchange rate volatility, and the change in credit to GDP between $t = 0$ and $t = 5$ are, respectively, above or below the crisis sample median. In the case of tariffs, the figure reports conditional imports after crises with a change in the average tariff above and below the 75th percentile.

Box 4.2. Protectionism in the Recent Crisis

The extent of trade protectionism before and during the recent crisis has been subject to significantly different interpretations. This box addresses the question by drawing on recent research by IMF staff (Gregory and others, 2010). New trade restrictions have so far been limited to a small share of global trade but have had a strong negative impact on trade flows. This box suggests ways for economies to avoid allowing rising trade protectionism to interfere with the recovery.

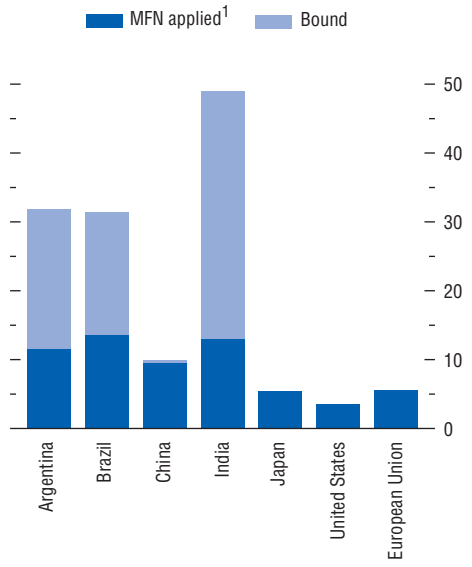
Trade became much freer during the second half of the 20th century. Among major western European and North American countries, average tariffs fell from 15 to 4 percent between the 1950s and mid-2000s. In many major developing economies, tariffs increased or remained very high until the 1980s but have since come down sharply. Nonetheless, the pace of trade reforms waned after the mid-2000s as protectionist sentiment began to increase, and so substantial trade restrictions were still in place when the crisis hit. Moreover, gaps in World Trade Organization (WTO) commitments leave a wide scope for legal backsliding on trade policy. Tariffs—the most transparent and easily monitored trade policy instrument—provide an illustrative example. Some economies can raise tariffs substantially without exceeding their WTO bindings (first figure).

Once the crisis took hold in mid-2008, political leaders' awareness of the risks of protectionism, backed by increased monitoring activities, helped limit the protectionist response. Mindful of both the disastrous results of protectionism during the 1930s and the contribution of trade to macroeconomic performance, the Group of 20 (G20) economies pledged in November 2008 to "refrain from raising new barriers to investment or to trade in goods and services, imposing new export restrictions, or implementing WTO inconsistent measures to stimulate exports." In April 2009 and again in June 2010, G20 leaders extended this pledge and asked the WTO and other institutions to monitor adherence.

Several other factors have worked to limit the protectionist response to the crisis:

The main author of this box is Robert Gregory.

Simple Average Tariff Rates: 2008
(Percent)



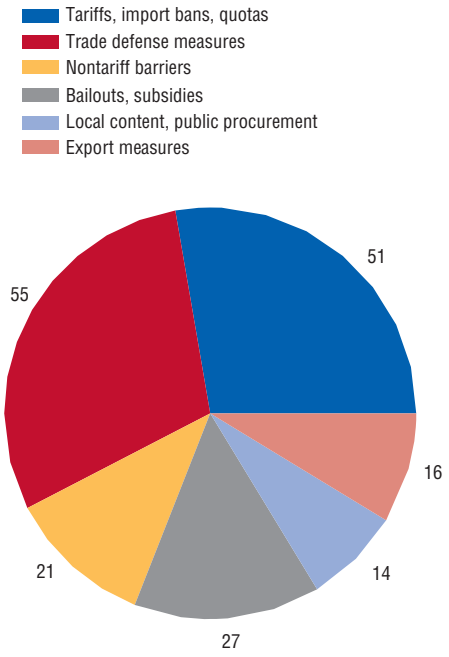
Source: World Trade Organization, *World Tariff Profiles 2009*.
[1]MFN = Most favored nation.

- Multilateral rules and institutions have clarified the types of policy actions considered responsible. The strong WTO-based trade system has been central.
- Trade declined much more rapidly than overall economic activity. The ratio of imports to GDP declined as well. Although job losses mounted, they were not, by and large, blamed on trade.
- Macroeconomic and financial sector policies were supportive of trade.

Even so, once the crisis took hold, a number of trade restrictions were introduced. The sharp rise in unemployment and its continued high levels may help explain the increased frequency of industry requests for trade remedies. In addition, there was increased use of unconventional measures, which are harder to quantify.

However, the extent of trade restrictions is unclear, and various monitoring efforts have come to quite different conclusions. None of the watchdogs suggest that we have seen, or are likely

Measures included in Gregory and Others (2010)
(Number of measures)



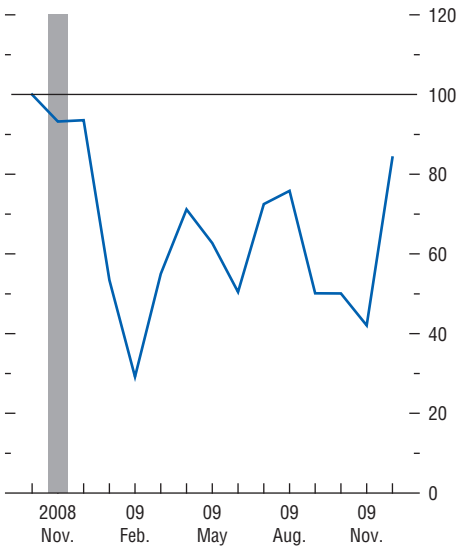
Source: Global Trade Alert Database.

to see, an extreme protectionist surge like that of the 1930s, but their assessments differ markedly. The June 2010 joint report of the WTO, Organization for Economic Cooperation and Development (OECD), and United Nations Conference on Trade and Development (UNCTAD) indicates that "protectionist policy responses have been limited, although there are still instances of restrictive measures taken… [T]here continues to be few instances of new import restrictions and a greater use of export restrictions, but some G20 governments have also taken steps to facilitate trade" (WTO, OECD, and UNCTAD, 2010). In contrast, the sixth report of Global Trade Alert (GTA), which is associated with the London-based Centre for Economic Policy Research and supported by the World Bank, also released in June 2010, concludes that "as far as open markets were concerned, 2009 was a terrible year" and that "much of the discrimination put in place then has yet to be removed" (GTA, 2010).

Gregory and others (2010) explore the impact of both conventional and more unconventional "behind the border" measures highlighted in the GTA reports, such as technical barriers to trade, procurement, and regulatory measures. The analysis matches data from GTA monitoring of measures taken between mid-2008 and late 2009 with detailed product-level data on bilateral monthly trade flows.[1] The second figure illustrates the varied nature of these protectionist measures. There is strong evidence that, after an economy imposed import restrictions on a particular product, its imports fell in succeeding months relative to world trade in the same product (third figure). Allowing for various time-varying fixed effects, more sophisticated econometric analysis suggests that trade in the affected products dropped an average of 3 to 8

[1]Extending the data set through May 2010 does not substantially change the results of the analysis.

Bilateral Trade Flows subject to Measures Implemented in November 2008
(Index, October 2008 = 100)



Source: IMF staff calculations.

Box 4.2 *(continued)*

percent after the imposition of restrictions. However, in the aggregate, restrictions implemented during the study period decreased trade by 0.25 percent, because these measures affected only a small share of global trade.

Looking ahead, sustained high unemployment, uneven growth, an unwinding of government stimulus measures, and growing economic imbalances may increase protectionist pressure. In some economies, such pressure may also emerge from high commodity prices or a surge in capital inflows, which may lead to rapid currency appreciation.

Gaps in WTO commitments leave ample scope for further trade restrictions, and a failure by all economies to vigorously resist protectionism could threaten the economic recovery and slow future growth. Maintaining and enhancing the monitoring of protectionist measures and sustaining high-level political awareness of the associated macroeconomic risks will help. But the surest way to avoid such a downside scenario is to tighten multilateral trade commitments by completing the WTO Doha Round. This can be viewed as a key part of the exit strategy from the global economic crisis.

in the absence of a financial crisis. On the other hand, the finding that imports decline mostly for investment-related goods suggests that the post-crisis outlook for innovation and potential growth could be diminished.

Domestic policymakers who might be concerned about the harmful effects of a financial crisis on exports may be reassured by the chapter's findings that declines in exports are, on average, small and gradual. Moreover, these effects can be accounted for by weaker output, suggesting that addressing the factors that depress output on the supply side will help exports recover as well.

Finally, although domestic policymakers may care more about the consequences for exports than for imports, the global nature of the recent crisis means that a coordinated and protracted slump in import demand across a wide swath of economies bodes ill for the global recovery. Not surprisingly, the chapter finds that boosting output will considerably help imports to recover. In that regard, productivity-enhancing structural reforms could help raise growth. The chapter's findings suggest that, beyond supporting domestic demand, taking steps to improve credit conditions, keeping protectionist tendencies at bay, and avoiding excessive exchange rate volatility may help support the recovery of trade. A conclusion of the Doha Round of global trade talks would also reinforce the revival of global trade.

Appendix 4.1. Data Sources

The primary data sources for the chapter are the IMF's Direction of Trade Statistics (DOTS), World Economic Outlook (WEO), and International Financial Statistics (IFS) databases; the NBER-UN World Trade Flows database (2005); and Laeven and Valencia (2008, 2010). Additional data sources are listed in Table 4.4, and the WEO analytical regions are in Table 4.5.

Crisis indicators are from Laeven and Valencia (2008, 2010). Laeven and Valencia (2010) present new and comprehensive data on the starting dates and characteristics of systemic banking crises over the period 1970–2009, building on earlier work by Caprio and others (2005), Laeven and Valencia (2008), and Reinhart and Rogoff (2009). They update the Laeven and Valencia (2008) database on systemic banking crises to include the recent episodes following the U.S. mortgage crisis of 2007 and identify 129 episodes since 1970.

Laeven and Valencia (2008) also identify debt crisis episodes based on sovereign debt default and restructuring by relying on information from Beim and Calomiris (2001), World Bank (2002), Sturzenegger and Zettelmeyer (2006), and IMF staff reports. The information compiled includes the year of sovereign default on private lending and the year of debt rescheduling. Using this approach, they identify 63 episodes of sovereign debt default and restructuring since 1970.

Table 4.4. Data Sources

Variable	Source
Annual Data	
Real Exports and Imports	Direction of Trade Statistics (DOTS) Database
Real GDP in U.S. Dollars	World Economic Outlook (WEO) Database
Real GDP per Capita in U.S. Dollars	WEO Database
World Import/Export Price Deflator	International Financial Statistics (IFS) Database
Real Effective Exchange Rate	IMF
Product-Level Imports and Exports	Feenstra and others (2005), COMTRADE, Pula and Peltonen (2009)
Current Account Balance	WEO Database
Financial Openness	Lane and Milesi-Ferretti (2007)
Trade Liberalization	IMF
Bank Credit	IFS Database
Production Sharing	Johnson and Noguera (2010)
Debt Crisis Indicators	Laeven and Valencia (2008)
Banking Crisis Indicators	Laeven and Valencia (2010)
Investment Durables (machinery and equipment)	Organization for Economic Cooperation and Development, Eurostat, Haver Analytics
High-Frequency Data	
Real Exports and Imports	CPB Netherlands Bureau of Economic Policy Analysis, DOTS Database, Global Trade Atlas, Haver Analytics
Antidumping Data	Bown (2010)
World Import/Export Price Deflator	IFS Database, CPB Netherlands Bureau of Economic Policy Analaysis

Data on bilateral and aggregate imports and exports from the DOTS database are reported in current U.S. dollars. These are deflated using the world import and export price deflators from the IFS database, to determine each economy's real imports and exports. The series on real GDP in U.S. dollars is from the WEO database. Import- and export-weighted partner GDP and GDP per capita are constructed using real GDP in U.S. dollars and import and export weights from the DOTS database. These weights vary each year according to the actual import and export flows between economies.

Data on imports and exports by product category are constructed from the NBER-UN World Trade Flows database (see Feenstra and others, 2005). The database is first extended using the UN COMTRADE database. The codes from the Standard International Trade Classification, Revision 2, that identify products in the NBER-UN trade data are matched to the UN Broad Economic Classification (BEC) codes. These are then classified into Capital Goods, Consumer Durables, Consumer Nondurables, Intermediate Goods, and Primary Goods, following Pula and Peltonen (2009).

The current account balance is taken from the WEO database. Trade openness is measured as the ratio of the sum of imports and exports to GDP. Financial openness is calculated as the sum of foreign assets and foreign liabilities divided by GDP, using the updated and extended External Wealth of Nations Mark II Database (see Lane and Milesi-Ferretti, 2007).

Bank credit to the private nonfinancial sector is taken from the IFS database. Breaks in these data are identified using the *IFS Country Notes* publication, and data are growth-spliced at these points. The real effective exchange rate (REER) data are from the IMF's Information Notice System. The volatility of the REER is calculated as the standard deviation of the monthly REER change in each year. The measure of trade liberalization is from the IMF Structural Reforms Database and is described in IMF (2008).

Bilateral data on production sharing are from Johnson and Noguera (2010).

Table 4.5. Country Groupings

Advanced Economies
Australia
Austria
Belgium
Canada
Cyprus
Czech Republic
Denmark
Finland
France
Germany
Greece
Hong Kong SAR
Iceland
Ireland
Israel
Italy
Japan
Korea
Luxembourg
Malta
Netherlands
New Zealand
Norway
Portugal
Singapore
Slovak Republic
Slovenia
Spain
Sweden
Switzerland
Taiwan Province of China
United Kingdom
United States

Developing Asia
Afghanistan, Islamic Republic of
Bangladesh
Bhutan
Brunei Darussalam
Cambodia
China
Fiji
India
Indonesia
Kiribati
Lao People's Democratic Republic
Malaysia
Maldives
Myanmar
Nepal
Pakistan
Papua New Guinea
Philippines
Samoa
Solomon Islands
Sri Lanka
Thailand
Timor-Leste
Tonga
Tuvalu
Vanuatu
Vietnam

Central and Eastern Europe
Albania
Bosnia and Herzegovina
Bulgaria
Croatia
Estonia
Hungary
Kosovo
Latvia
Lithuania
Macedonia, Former Yugoslav Republic of
Montenegro
Poland
Romania
Serbia
Turkey

Africa
Angola
Benin
Botswana
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Comoros
Congo, Democratic Republic of
Congo, Republic of
Côte d'Ivoire
Djibouti
Equatorial Guinea
Eritrea
Ethiopia
Gabon
The Gambia
Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Liberia
Madagascar
Malawi
Mali
Mauritius
Mozambique
Namibia
Niger
Nigeria
Rwanda
São Tomé and Príncipe
Senegal
Seychelles
Sierra Leone
South Africa
Sudan
Swaziland
Tanzania
Togo
Uganda
Zambia
Zimbabwe

Commonwealth of Independent States, Georgia, Mongolia
Armenia
Azerbaijan
Belarus
Georgia
Kazakhstan
Kyrgyz Republic
Moldova
Mongolia
Russian Federation
Tajikistan
Turkmenistan
Ukraine
Uzbekistan

Middle East
Bahrain
Egypt
Iran, Islamic Republic of
Jordan
Kuwait
Lebanon
Oman
Qatar
Saudi Arabia
Syrian Arab Republic
United Arab Emirates
Yemen, Republic of

Maghreb
Algeria
Libya
Mauritania
Morocco
Tunisia

South America
Argentina
Bolivia
Brazil
Chile
Colombia
Ecuador
Paraguay
Peru
Uruguay
Venezuela

Central America
Costa Rica
El Salvador
Guatemala
Honduras
Mexico
Nicaragua
Panama

Caribbean
Antigua and Barbuda
The Bahamas
Barbados
Belize
Dominica
Dominican Republic
Grenada
Guyana
Haiti
Jamaica
St. Kitts and Nevis
St. Lucia
St. Vincent and the Grenadines
Suriname
Trinidad and Tobago

The Global Trade Atlas data at the four-digit level of the Harmonized Commodity Description and Coding System (HS) are used to trace trade in types of products since 2001. These data cover the following: Argentina, Australia, Brazil, Canada, China, Japan, Korea, Russia, South Africa, Turkey, and the United States. The monthly data are converted to a quarterly frequency, deflated by specific commodity price deflators—from the WEO database for selected primary goods and from the CPB Nether-

lands Bureau of Economic Policy Analysis for the remaining products—and are seasonally adjusted. The HS four-digit codes are matched to the BEC and classified into Capital Goods, Consumer Durables, Consumer Nondurables, Intermediate Goods, and Primary Goods, following Pula and Peltonen (2009).

Appendix 4.2. Methodology and Robustness Tests

Estimating Unconditional Import Losses

The analysis[25] first estimates the unconditional dynamics of imports in the aftermath of crises using a "collapsed" gravity model of trade in changes. In the baseline regression specification in the text, the growth in an economy's aggregate imports, $\Delta \ln M_{it}$, is expressed as a function of a dummy variable indicating whether a crisis started in year t, five lags of this dummy variable, and country and time dummies:

$$\Delta \ln M_{it} = \alpha_i + \pi_t + \sum \alpha_k \, crisis_{i,t-k} + \varepsilon_{it}. \quad (4.1)$$

The robustness of the estimated unconditional import losses from the baseline specification is verified by using the following five alternative specifications:

- *Alternative 1: Deviation from precrisis trend*—This procedure measures import loss as a simple deviation of $\ln M_{it}$ from a precrisis trend, $\ln Tr_{it}$, where the latter is a linear trend based on a precrisis window from $(t-7)$ to $(t-1)$. The mean import loss k years after a crisis is just the average of this import loss, $(\ln M_{it} - \ln Tr_{it})$, across all crisis episodes. This is equivalent to estimating the following equation, either in levels or changes:

$$\ln M_{it} - \ln Tr_{it} = \sum \beta_k \, crisis_{i,t-k} + \varepsilon_{it}. \quad (4.2)$$

  This procedure is similar to the procedure used in Chapter 4 of the October 2009 *World Economic Outlook* for estimating output losses following a crisis.[26] In contrast to the baseline, this methodology allows for an episode-specific trend, as opposed to the country-specific trend that is captured by α_i in the baseline specification. However, it does not control for global conditions as is done in the baseline.
- *Alternative 2: Baseline specification with autoregressive terms*—The baseline specification is augmented by including four lags of the growth of imports on the right-hand side, paralleling the specifications used in Romer and Romer (2010) and Cerra and Saxena (2008):

$$\Delta \ln M_{it} = \alpha_i + \pi_t + \sum \rho_l \Delta \ln M_{i,t-1} + \sum \alpha_k \, crisis_{i,t-k} + \varepsilon_{it}. \quad (4.3)$$

- *Alternative 3: Bilateral gravity in changes*—A directional gravity model (that is, one with bilateral imports or exports as opposed to bilateral trade) is estimated in changes. The growth in bilateral imports of an economy from each trading partner, $\Delta \ln M_{imp,exp,t}$, is regressed on a crisis indicator and its lags, as well as on time and importer-exporter pair dummies:

$$\Delta \ln M_{imp,exp,t} = \alpha_{imp,exp} + \pi_t + \sum \alpha'_k \, crisis_{imp,t-k} + \varepsilon_{imp,exp,t}. \quad (4.4)$$

- *Alternative 4: Bilateral gravity in changes, using top 20 partners*—This specification is identical to the directional gravity model in changes as described in equation (4.4) but focuses only on the top 20 partners from which an economy imports. This is done because our primary concern is in describing the behavior of aggregate trade, rather than average bilateral trade. The standard gravity model weights all bilateral trade observations equally, regardless of the size of the bilateral trade

[25]We focus on import dynamics here, since the chapter's results suggest that imports are where the impact of a crisis on trade is primarily manifested.

[26]The results from estimating equation (4.2) in levels or changes are identical because, as in Chapter 4 of the October 2009 *World Economic Outlook,* the import losses are normalized so that the loss in the year before the crisis $(t-1)$ is zero. The primary differences between the procedure used here and in Chapter 4 of the October 2009 *World Economic Outlook* are the following: (1) the definition of crisis (debt crises combined with banking crises versus banking crises only), (2) the precrisis window used to calculate the trend [$(t-7)$ to $(t-1)$ versus $(t-10)$ to $(t-3)$], and (3) the choice of dependent variable (imports versus GDP per capita).

relationship. But trade is highly uneven—in the sample used in this chapter, the top 20 trading partners account for 89 percent of an economy's total imports, on average, even though the average economy imports from 175 economies. In other words, about 90 percent of the observations in a typical gravity model account for only 10 percent of total trade. The behavior of aggregate trade will more closely follow the dynamics of larger trading partners.

- *Alternative 5*: *Baseline specification, excluding banking and debt crises that were accompanied by a currency crisis*—This specification is identical to the baseline equation (4.1) but focuses only on "pure" banking and debt crises. More specifically, we exclude banking and debt crisis episodes that were accompanied or preceded by a currency crisis as defined in Laeven and Valencia (2008).

As Table 4.6 and Figure 4.14 illustrate, the estimated impulse response functions of imports using these different approaches are similar both qualitatively and quantitatively. This confirms the finding that there are large and statistically significant unconditional import losses after crises.

Import Losses Controlling for Output

The import losses controlling for output are also computed using the baseline model in changes, this time with a set of controls derived from the standard gravity model. Specifically, the growth of imports, $\Delta \ln M_{it}$, is modeled as a function of the growth in the economy's output, $\Delta \ln GDP_{it}$, its partners' import-weighted output, $\Delta \ln PGDP_{it}$, contemporaneous and lagged values of a dummy variable indicating a crisis in the economy, $crisis_{i,t-k}$, an import-weighted indicator of incidence of crises in trading partners (plus five lags), $pcrisis_{i,t-k}$, and country and time dummies α_i and π_t:

$$\Delta \ln M_{it} = \alpha_i + \pi_t + \sum \alpha_k \, crisis_{i,t-k} + (\beta_{1r} + \beta_{2r} \times D_{t \geq 1990}) \Delta \ln GDP_{it} + \beta_3 \Delta \ln PGDP_{it} + \sum \delta_k \, pcrisis_{i,t-k} \, \varepsilon_{it}. \quad (4.5)$$

As discussed in the text, the elasticity of imports to output is crucial for assessing whether the evolution of trade is fully explained by output. To be as general as possible, we allow the output elasticities of imports and exports in the baseline specification to vary across the 10 WEO analytical regions described in Table 4.5. We also allow each of these regional elasticities to vary between the pre- and post-1990 periods. The estimated elasticities, shown in Table 4.7, range from 0.8 to 4.5 and are in general higher for the post-1990 period.

The following tests were performed to check the robustness of the conditional import losses presented in the text:

- *Robustness Test 1: Distributed lag specification*—We augment the specification to include lagged output growth. The elasticity of imports to contemporaneous and lagged output is allowed to vary across regions and between the pre- and post-1990 periods.

Table 4.6. Unconditional Import Losses: Estimated Impulse Response Functions Using Alternative Methodologies

Time	Baseline	Deviation from Trend	Baseline Plus Autoregressive Terms	Bilateral Gravity in Changes	Bilateral Gravity in Changes, Top 20 Partners	Baseline, Pure Bank and Debt Crises
Crisis year, *t*	–0.080	–0.082	–0.078	–0.076	–0.080	–0.064
t + 1	–0.158	–0.159	–0.167	–0.191	–0.156	–0.152
t + 2	–0.171	–0.174	–0.181	–0.166	–0.162	–0.174
t + 3	–0.153	–0.156	–0.161	–0.153	–0.135	–0.159
t + 4	–0.169	–0.160	–0.173	–0.172	–0.159	–0.176
t + 5	–0.190	–0.183	–0.191	–0.183	–0.184	–0.202

Source: IMF staff calculations.

- *Robustness Test 2*: *Uniform elasticity of imports to output*—We report the results from a specification that would most closely mirror a collapsed gravity specification in changes. Namely, as is standard in the literature, we impose the same elasticity of imports to output across economies and over time.
- *Robustness Test 3: Bilateral gravity (all controls) in changes*—Rather than focusing on the economy's aggregate imports, we estimate a unidirectional (bilateral) gravity model in changes. The specification is as in equation (4.4) but contains the standard gravity controls: the growth in the economy's and partners' output as well as a set of dummies for crises occurring in both home and partner economies, indicators for whether the country pair is in a currency union or free trade agreement, and time and importer-exporter pair dummies. The elasticity with respect to an economy's output is allowed to vary across regions and between the pre- and post-1990 periods.
- *Robustness Test 4: Allowing the elasticity of imports to vary across cyclical versus trend components of output*—Imports may be more responsive to cyclical than to trend movements in output; if so, the baseline approach would overestimate the fall in imports controlling for output. To test this, we allow the elasticity of imports to vary across the trend and cyclical components

Table 4.7. Estimated Elasticity of Imports to Output: Panel Regression with Country and Time Dummies

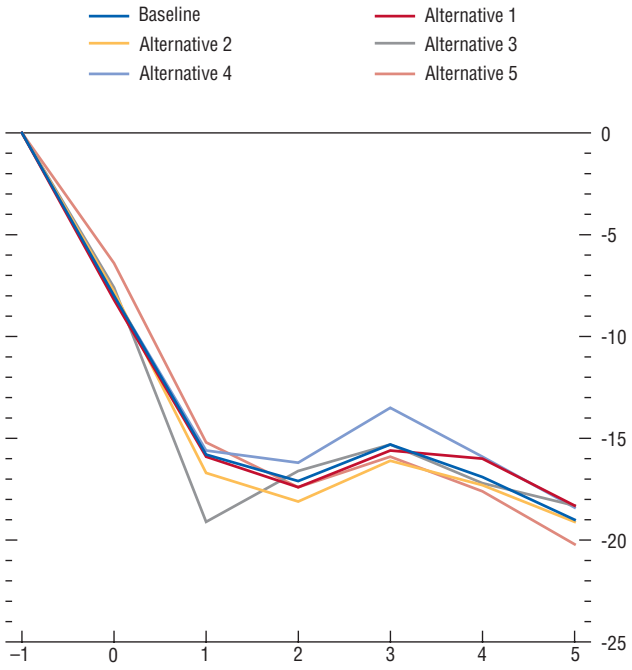
	Pre-1990	Post-1990
Advanced	1.99	1.94
Developing Asia	0.89	2.76
Africa	0.99	1.50
CIS,[1] Georgia, Mongolia	. . .	4.57
Central and Eastern Europe	1.46	1.38
Middle East	0.79	1.89
Maghreb	0.83	1.09
South America	2.26	2.88
Central America	2.03	1.58
Caribbean	1.87	1.77

Source: IMF staff calculations.

[1]Commonwealth of Independent States.

Figure 4.14. Import Losses, Not Controlling for Output: Alternative Methodologies

(Percent deviation from normal; years on x-axis; crisis begins at t = 0)



Source: IMF staff calculations.

of output, where the trend and cycle were separated using a Hodrick-Prescott filter. As in the baseline, the import elasticity with respect to both the cyclical and trend components of output are allowed to vary across WEO regions and between the pre- and post-1990 periods.

- *Robustness Test 5: Controlling for changes in the REER and relative prices*—Import dynamics may differ after crises due to changes in the REER and relative price levels. Equation (4.5) is augmented to control for changes in REER and the domestic price level, proxied by the change in the GDP deflator.
- *Robustness Test 6: Controlling for changes in domestic aggregate demand*—An economy's GDP may not be a good proxy for absorption in the importing economy, and to the extent that absorption declines more than GDP during crises, the estimated import losses after controlling for output may be overstated. We replace growth in output by growth in domestic absorption (consumption plus investment) on the right-hand side of equation (4.5).
- *Robustness Test 7: Allowing the elasticity of imports to output to differ across economies*—We further increase the flexibility of our specification by estimating separately the elasticity of imports to output for each of the 154 economies in the sample.
- *Robustness Test 8: Allowing the elasticity of imports to output to vary across crisis versus noncrisis periods*—Similar to Robustness Test 4, the sensitivity of imports to output may be particularly high in times of crisis. We thus allow the coefficient on output to vary during crisis and noncrisis periods.

The results of these robustness tests are presented in Table 4.8 and Figure 4.15. The finding that imports remain below their normal levels following a crisis, even after controlling for output, is confirmed across all these robustness checks. While the standard errors increase substantially once we allow the estimated elasticity of imports to output to vary across economies, the point estimates remain very similar to the baseline specification.

Decomposition of Unconditional Import Losses

We use a three-step approach to evaluate the importance of different mechanisms in explaining the unconditional import losses, as detailed below. It is important to keep in mind that this is simply an accounting exercise that attempts to decompose the unconditional import losses based on observed correlations. The true contributions of the various mechanisms might differ from these estimated correlations.

Step 1: We document whether crises are followed by persistent changes in tariffs, credit, the REER, and exchange rate volatility by estimating equation (4.1) with the mechanisms of interest as the dependent variable.

Table 4.8. Conditional Import Losses: Robustness of Estimated Impulse Response Functions

Time	Baseline	Baseline and Lagged Growth of Output	Same Elasticity across Regions and Time	Full Gravity in Changes	Elasticity: Cyclical vs. Trend	Control for Changes in REER and PPP[1]	Control for Changes in Consumption and Investment	Elasticity: Varies by Economy	Elasticity: Differs during Crisis Years
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Crisis year, *t*	–0.040***	–0.037**	–0.058***	–0.022*	–0.043***	–0.052***	–0.042***	–0.031*	–0.052***
t + 1	–0.073***	–0.074***	–0.116***	–0.093***	–0.076***	–0.090***	–0.079***	–0.058**	–0.114***
t + 2	–0.077***	–0.086***	–0.129***	–0.053***	–0.086***	–0.092***	–0.093***	–0.054*	–0.122***
t + 3	–0.063*	–0.071**	–0.114***	–0.048**	–0.077**	–0.074***	–0.076***	–0.041	–0.099***
t + 4	–0.077**	–0.081***	–0.133***	–0.074***	–0.090***	–0.091***	–0.087***	–0.057*	–0.101***
t + 5	–0.089**	–0.092***	–0.152***	–0.068***	–0.099***	–0.105***	–0.095***	–0.071*	–0.115***

Source: IMF staff calculations.

Note: All columns include economy- and year-fixed effects. Columns (1), (2), and (4) – (7) allow the elasticity of imports to output (or its cyclical and trend component and consumption and investment) to vary by WEO regions and after 1990. In column (8), the elasticity of imports to output is allowed to vary by economy.

[1]REER = real effective exchange rate; PPP = purchasing power parity.

Step 2: We estimate the elasticity of imports with respect to the various mechanisms in the following regression framework:

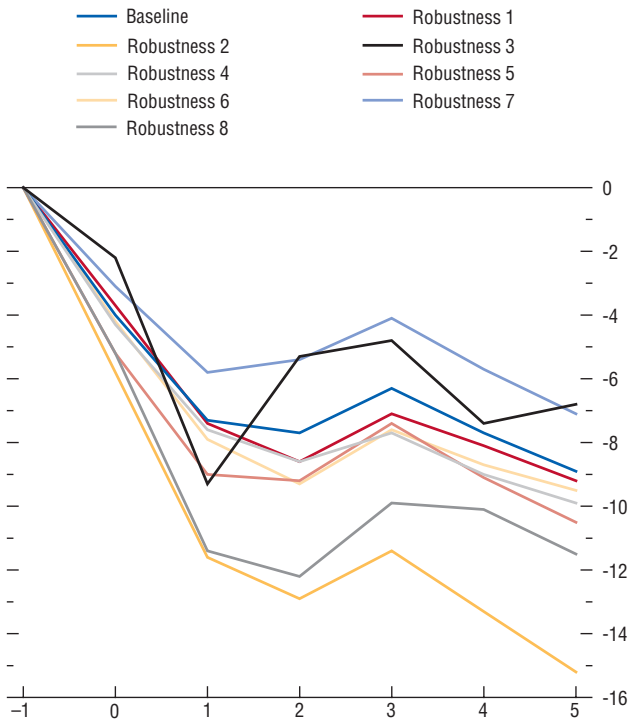
$$\begin{aligned}\ln M_{it} = {} & \alpha_i + \pi_t \\ & + (\beta_{GDP,r} + \beta_{GDP,r} \times D_{t\geq 1990}) \ln GDP_{it} \\ & + \beta_{Tariff} \ln Tariff_{it} + \beta_{cr} \ln Credit_{it} \\ & + \beta_{REER} \ln REER_{it} + \beta_{vol} \ln Volatility_{it} \\ & + \sum \alpha_k crisis_{i,t-k} + \beta_3 \ln PGDP_{it} \\ & + \sum \delta_k pcrisis_{i,t-k} + \varepsilon_{it} \qquad (4.6)\end{aligned}$$

Step 3: We combine the estimates from steps 1 and 2 to quantify the contribution of various mechanisms. In particular, the estimated change in the mechanism following a crisis in step 1 is multiplied by the estimated elasticity of imports with respect to that mechanism in step 2. The contribution of each mechanism is then expressed as a fraction of the unconditional import losses. The contribution of output is computed as the difference between the unconditional import losses from equation (4.1) and import losses conditional on output from equation (4.5).

Composition Effects during Earlier Crises: A Back-of-the-Envelope Calculation

If GDP and imports had the same composition of goods and services, and if, within each sector, imports changed proportionally to domestic final demand, imports would be expected to fall by as much as GDP after a crisis. However, if there are differences in the composition of imports and GDP, *and* if goods and services that constitute a larger share of trade than of GDP experience a relatively larger decline in demand following a crisis, imports will fall more than GDP even in the absence of changes in other factors (such as credit, exchange rates, or degree of protectionism) described in the chapter. For example, part of the outsize decline in imports relative to GDP in the recent crisis has been attributed to the resilience in the demand for services relative to manufactured goods. Since demand for manufactured goods experienced a relatively larger decline and since manufactured

Figure 4.15. Import Losses, Controlling for Output: Robustness
(Percent deviation from normal; years on x-axis; crisis begins at t = 0)

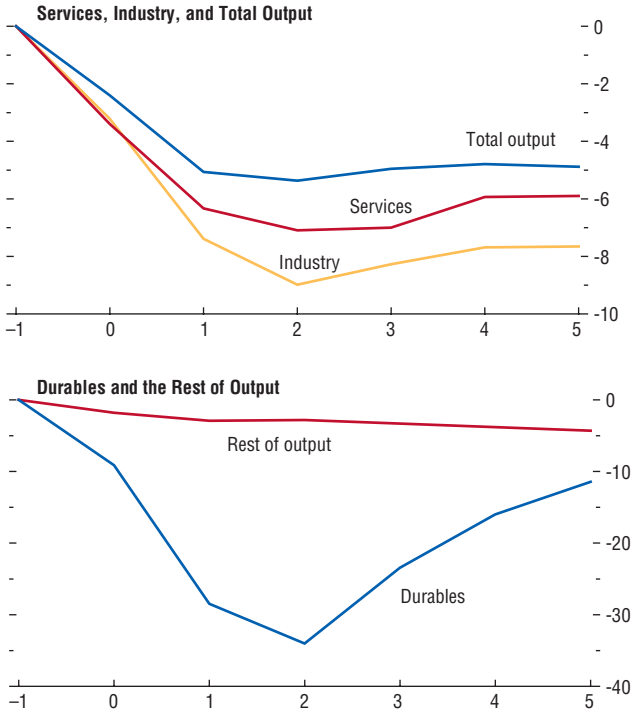


Source: IMF staff calculations.

Figure 4.16. The Postcrisis Evolution of Various Components of GDP

(Percent deviation from normal; years on x-axis; crisis begins at t = 0)

Crises are followed by roughly equal declines in services and industry. The postcrisis decline in investment in machinery and equipment, on the other hand, is much deeper than for the rest of output.



Source: IMF staff calculations.

Note: Lines indicate the impulse response function – the effect of a crisis on imports relative to what would be predicted in the absence of a crisis. Predictions are based on contemporaneous and lagged crises, and country and time dummies.

goods comprise a larger share of trade than of GDP, overall imports declined more than GDP (Borchert and Mattoo, 2009).

We first investigate whether historically there is a difference in the behavior of manufactured goods and services following crises. Since detailed data on the demand side are not available, we use sectoral value-added data to document whether there are differences in the behavior of services versus industry after crises. Somewhat surprisingly, this does not appear to be the case. The estimated drop in services is very similar to the decline in industry value added after crises (Figure 4.16, top panel).[27] Given this similarity in the dynamics of services and industry, the different shares of services in output and trade do not appear to be a likely explanation.

However, within the "manufactured goods" category, there are compositional differences between output and trade. Across a sample of 48 economies for which disaggregated data on gross fixed investment are available, (capital) durables, measured by tradable investment goods—namely, machinery and equipment—account for only 8 percent of GDP. For the same set of economies, the average share of (capital) durables in imports is 18 percent.[28] Although the data coverage is rather scant—only 26 of the identified crises can be included in the analysis— we provide some back-of-the-envelope calculations to estimate the contribution of these composition effects in explaining import losses following crises.

We begin with the following two identities:

$$GDP_{gth} = sh_{dur_{GDP}} \times DUR_{GDP_{gth}} + (1 - sh_{dur_{GDP}}) \times OTHER_{GDP_{gth}} \quad (4.7)$$

$$IMP_{gth} = sh_{dur_{IMP}} \times DUR_{IMP_{gth}} + (1 - sh_{dur_{IMP}}) \times OTHER_{IMP_{gth}}, \quad (4.8)$$

[27]The overall output loss is slightly lower than the loss of services and industry due to the resilience of agricultural production to crises.

[28]The definition of "durables" in the trade and output data is not identical because these series come from different, not always comparable, data sources. However, it is unlikely that differences in definitions account for the differences in the shares of these goods in imports and output.

where GDP_{gth} and IMP_{gth} are the growth rates in GDP and imports, respectively; $sh_{dur_{GDP}}$ and $sh_{dur_{IMP}}$ are the share of (capital) durables in GDP and imports, respectively; $DUR_{GDP_{gth}}$ and $DUR_{IMP_{gth}}$ are the growth rate in the (capital) durable component of GDP and imports, respectively; and $OTHER_{GDP_{gth}}$ and $OTHER_{IMP_{gth}}$ are the growth rate in other components of GDP and imports, respectively.

Assuming the elasticity of imports of different products to GDP is 1, equation (4.8) can be rewritten as

$$IMP_{gth} = sh_{dur_{IMP}} \times DUR_{GDP_{gth}} + (1 - sh_{dur_{IMP}}) \times OTHER_{GDP_{gth}}. \quad (4.9)$$

Subtracting (4.7) from (4.9) implies

$$IMP_{gth} - GDP_{gth} = (sh_{dur_{IMP}} - sh_{dur_{GDP}}) \times (DUR_{GDP_{gth}} - OTHER_{GDP_{gth}}). \quad (4.10)$$

Based on equation (4.10), we define the composition effect as the extent to which the difference between the growth rates of GDP and imports is explained by different compositions of GDP and imports. It is a product of two factors: (1) differences in the share of durables in imports and GDP and (2) differences in the growth of durables and other components following a crisis. If either of these differences is zero, composition cannot be an explanation for observing import losses controlling for output.

Table 4.9 and Figure 4.16 present the findings from this exercise. The impulse response functions of investment in machinery and equipment and the rest of GDP are shown in Figure 4.16 (bottom panel).[29] The postcrisis decline in investment, and in particular in machinery and equipment, is much larger than the postcrisis decline in the rest of GDP over the same period. As presented in column (6) of Table 4.9, for this selected sample of crises, the composition effect can explain 5 to 13 percent of the unconditional import loss. It is important to keep in mind that these composition effects are calculated only from the different shares and postcrisis behavior of machinery and equipment relative to the rest of output; other composition effects—most notably, from consumer durables—may also be present. In addition, composition effects may already be reflected in the higher elasticity of imports to output that is allowed for in our baseline specification. Thus, these estimates of the size of the composition effect could be thought of as a lower bound.

[29]Given the share of durables in GDP, as well as the decline in overall GDP, we can also calculate how much demand for other components of GDP falls after crises.

Table 4.9. Import Losses and Composition Effects

	Implied Response Function					
	GDP	Investment in Durables	Other	Actual Import Loss	Estimated Composition Effect	Share of Import Loss Explained by Composition Effects
Time	(1)	(2)	(3)	(4)	(5)	(6)
Crisis year, *t*	–0.024	–0.091	–0.018	–0.088	–0.007	8.0
t + 1	–0.051	–0.285	–0.029	–0.267	–0.025	9.2
t + 2	–0.054	–0.340	–0.028	–0.250	–0.030	12.1
t + 3	–0.050	–0.234	–0.033	–0.155	–0.019	12.6
t + 4	–0.048	–0.160	–0.038	–0.153	–0.012	7.7
t + 5	–0.049	–0.114	–0.043	–0.144	–0.007	4.8

Source: IMF staff calculations.

Note: All estimates in columns (1), (2), and (4) are significant at the 1 percent level. Standard errors (not reported) are clustered by economy and corrected for heteroscedasticity. The actual import loss is estimated for the subsample of economies and crises for which disaggregated investment data are available. The share of import loss explained by composition effects in column (6) is calculated as the estimated composition effect in column (5) divided by the actual import loss multiplied by 100.

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