How Does Trade Evolve in the Aftermath of Financial Crises?

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June 2014

Abstract

International trade collapsed in 2008-09, particularly in countries that experienced a financial crisis. Was this collapse unique or part of a broader historical pattern? Using an augmented gravity model and 179 episodes from 1970-2009, we find that financial crises are associated with sharp declines in imports of the crisis country—19 percent, on average, in the year following a crisis—and this decline is persistent, with imports recovering to their gravity-predicted levels only after 10 years. In contrast, exports of the crisis country fall modestly and then remain close to or even above the predicted level. The protracted drop in imports post-crisis is consistent with evidence of a sustained depreciation of the exchange rate and impaired credit conditions following crises.

JEL Classification Numbers: F10, G01

Keywords: trade, financial crisis

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[1] IMF; 700 19th St NW, Washington, DC 20431, USA; (202) 623-7000. The views expressed in this paper are those of the authors and do not necessarily represent those of the IMF or IMF policy. We are grateful to Olivier Blanchard, Don Davis, Petya Koeva Brooks, David Romer, Philippe Martin, Andrei Levchenko, and seminar participants at the World Bank, IMF, ITC, Hong Kong University of Science and Technology, Indira Gandhi Institute for Development Research, ICRIER, and the Delhi School of Economics for helpful comments. We thank Gavin Asdorian, Stephanie Denis, Lisa Kolovich, Andy Salazar and Yorbol Yakhshilikov for excellent research assistance.

I. INTRODUCTION

Financial crises have been a consistent feature of the economic landscape. As Reinhart and Rogoff (2008, 2009a) document in their history of such crises, the occurrence of both debt and banking crises over the past decades is merely a continuation of a pattern that extends back to at least the start of the 19th century. It comes as no surprise, then, that the effects of financial crises have been studied extensively. Cerra and Saxena (2008) and IMF (2009), for example, find that financial crises are associated with large and persistent declines in output; Kaminsky and Reinhart (1999) observe that problems in the banking sector are typically followed by a currency crisis; and Reinhart and Rogoff (2009b) note that financial crises lead to deep and prolonged asset market collapses, large declines in output and employment, and rising levels of government debt.

However, what happens to international trade after a country goes through a financial crisis has not been analyzed as extensively. The world witnessed a spectacular collapse of international trade in the aftermath of the Great Recession. While the collapse of trade that occurred in late 2008 and the beginning of 2009 was "sudden, severe, and synchronized," as depicted in Figure 1, its recovery was uneven across countries, with an important distinction being whether the country had a banking crisis. For countries that did not have a banking crisis, real imports were on average back to their pre-crisis peak by the beginning of 2010. In contrast for the 13 countries that underwent a systemic banking crisis, real imports were on average well below their pre-crisis levels (Figure 2).

Is this part of a broader historical pattern? Have financial crises in the past led to similar disruptions in a country's trade, and how long-lasting were these disruptions? Understanding the behavior of trade is crucial as it is an important channel through which crises can affect economic welfare and growth, and through which the effects of a crisis in one economy can spill over to its trading partners.

To answer these questions, we examine episodes of banking and debt crises over the past 40 years and analyze the behavior of trade flows following such crises. More specifically, we augment the gravity model of bilateral trade to examine whether, in the aftermath of a financial crisis, a country's exports and imports deviate from their "natural" level, i.e., the level of trade

that would have been predicted by standard determinants such as GDPs, bilateral distance, etc. We find that, even after controlling for income and other gravity controls, crises are associated with large and persistent declines in imports. On average, in the year following a crisis, imports of the crisis country are 19 percent lower than the level predicted by the gravity framework; imports recover slowly, taking roughly 10 years to return to normal. In contrast, exports of the crisis country are not as adversely affected. On average, exports are 4 percent below predicted in the year of the crisis and return close to or even above levels predicted by the gravity model in subsequent years. Importantly, we find evidence which suggests that the sharp and persistent import losses are associated with a sustained depreciation of the exchange rate and impaired credit conditions following financial crises.

Our main finding of long-lasting import losses is robust to the following: (i) alternative econometric methodologies, such as estimating a model with bilateral time-invariant characteristics (instead of country-pair fixed effects), accounting for omitted-variable and selection biases, and estimating a model with aggregate rather than bilateral trade; (ii) more flexible specifications, such as allowing the elasticity of trade to vary with respect to the various components of GDP (i.e., trend vs cyclical), with respect to crisis and non-crisis periods and allowing for time-varying multilateral resistance terms; (iii) introducing alternative controls such as domestic absorption; and (iv) excluding the most recent episode of financial crises.

Our empirical approach follows a growing body of literature that has used the gravity model to investigate the effects on trade of various types of "shocks" to an economy. Glick and Taylor (2010) and Martin, Mayer, and Thoenig (2008) use the gravity model to estimate the effects of war on bilateral trade and find very large and persistent trade losses between belligerents following war. Qureshi (2009) studies the impact of war on trade of neighboring countries. Similarly, Blomberg and Hess (2006) estimate the contemporaneous effect of different forms of violence (terrorism, revolutions, interethnic fighting, and external wars) on trade. The gravity framework has also been used extensively to quantify the trade impact of various policy regimes, such as exchange rate regimes, free trade agreements, and currency unions (e.g., Rose, 2000, Glick and Rose, 2002, Klein and Shambaugh, 2006, Baier and Bergstrand, 2007), exchange rate volatility (Thursby and Thursby, 1987), preferential trade agreements (e.g., Frankel, Stein and Wei, 1996), and democracy (Yu, 2010).

To date, only two other studies have used the gravity framework to analyze post-crisis trade dynamics. Ma and Cheng (2005) use a smaller sample of 52 countries over the period 1981-1998, and focus on short-term effects (up to two years) of banking crises. They find that during the latter half of their sample, banking crises had a negative impact on imports and a positive effect on exports in the year following the crisis, whereas both imports and exports decline two years after the crisis. In addition to the broader coverage of countries and years that we use, we analyze the evolution of trade over a longer time horizon following crises (up to 10 years), and we subject our results to a battery of robustness tests. Importantly, we also examine how the effects of crises vary across different product categories, and during global downturns, and we try to identify the channels through which a crisis impacts trade. Berman and Martin (2012) also use a bilateral gravity framework to investigate the effects of financial crises on trade. Their focus, however, is on the effect of financial crises on the exports of trading partners, and specifically on the vulnerability of Sub-Saharan African economies to financial crises in advanced economies. They find that a financial crisis in a trading partner has a moderate but long-lasting effect on exports, especially for African exporters.

Our study contributes to the large literature inspired by the "Great Trade Collapse."[2] This literature focuses on understanding the causes of the sudden, severe and synchronized collapse in trade that characterized the 2008-09 global financial crisis. The emerging consensus is that the great trade collapse was mostly a demand shock, with trade falling substantially more than output due to compositional effects (see e.g., Levchenko, Lewis, and Tesar, 2010, Eaton et al. 2011, Bems, Johnson, and Yi, 2010) and synchronicity because of the rise in vertical supply chains. Supply side factors, such as the disruption of trade credit (Chor and Manova 2012, Amiti and Weinstein, 2011, Iacovone and Zavacka, 2009) or a rise in protectionism (Evenett, 2010) were found to have some, but not a very large, role in the collapse in trade. Our study complements this literature by taking a step back and documenting whether the collapse of trade

[2] See among others, Baldwin (2009) and references therein, Alessandria, Kaboski and Midrigan (2010), Bems, Johnson and Yi (2010), Levchenko, Lewis and Tesar (2010), Eaton et al. (2011), and Chor and Manova (2012). There is also a rising literature that provides micro-evidence on trade adjustment following large depreciations in emerging economies (e.g., Gopinath and Neiman, 2011 and Alessandria, Kaboski, and Midrigan, 2011).

is also a feature of past financial crises.[3] Our paper also contributes to the extensive literature on the macroeconomic effects of crises. Most recently, Gourinchas and Obstfeld (2012) evaluate the behavior of various macroeconomic and financial variables around crisis events. Although the focus of their paper is on the predictors of crisis, one of their findings consistent with ours is a significant improvement in the current account in the aftermath of defaults and debt crises, especially for emerging market economies.

The rest of the paper is organized as follows. Section II presents the empirical methodology. Section III describes the data. Section IV presents the empirical results and their robustness. Section V provides a discussion of the likely mechanisms behind the main findings, while Section VI illustrates some additional patterns surrounding trade and crises. Section VII concludes.

II. METHODOLOGY

The effects of crises on international trade are estimated using a standard gravity model of international trade. The gravity model offers a well established framework with theoretical underpinnings to analyze the determinants of trade flows between countries.[4] It relates the level of bilateral trade flows to characteristics of the importing and exporting countries (most notably size and level of development) as well as to country-pair characteristics such as distance between the two countries and whether they share a common border, language, or currency. Variations of the gravity model have been used extensively in recent studies as benchmarks from which to assess the trade impact of various economic disturbances, policy regimes, and political events (see, for instance, Glick and Taylor, 2010, and references therein). We augment the conventional gravity model to include indicators of whether the importing or exporting country experiences a

[3] Freund (2009) also takes a historical perspective by examining the decline in world trade following four previous global downturns. In this paper we focus not on global trade dynamics, but on what happens to trade of individual economies that experience a banking or debt crisis.

[4] The framework can be derived formally from a general equilibrium model of production, consumption, and trade, as in Anderson and van Wincoop (2003). See also Baldwin and Taglioni (2006) for a survey of the use of gravity models in the literature, as well as the pitfalls one faces in estimating them.

financial crisis. Each observation in the regressions we run represents, for a particular year, an importer-exporter pair (a dyad).[5]

Our main estimating equation is specified as follows:

$$\ln M_{i,j,t} = \propto_{ij} + \pi_t + \sum_k \propto_k crisis_{i,t-k} + \sum_k \beta_k crisis_{j,t-k} + \gamma_1 \ln Y_{i,t} + \gamma_2 \ln Y_{j,t} + \delta_1 \ln y_{i,t} + \delta 2 \ln y_{j,t} + \mu X_{i,j,t} + \varepsilon_{i,j,t} \quad (1)$$

where $\ln M_{i,j,t}$ is the natural logarithm of imports of country i from exporter j at time t, $\ln Y_{i,t}$ is the natural logarithm of county i's real GDP (a proxy for market size), $\ln y_{i,t}$ is the natural logarithm of country i's real GDP per capita (a proxy for its level of development), and $crisis_{i,t-k}$ and $crisis_{j,t-k}$ are dummy variables indicating whether the crisis started in period $t-k$ in the importer and exporter respectively.

The π_t in eq. (1) represent time dummies, which capture factors that affect all countries' trade simultaneously, such as global downturns, global changes in commodity prices or uncertainty. $X_{i,j,t}$ captures other importer-exporter time-varying controls such as whether trading partners are part of a currency union or free trade agreement in time t.

The coefficients of interest are $\propto_k$ and β_k. $\propto_k$ captures the average effect of a crisis in country i on its imports from country j, k years after the beginning of a crisis in country i; β_k captures the average effect of a crisis in country j on country i's imports from country j—or equivalently, country j's exports to country i—k years after the crisis. In other words, $\propto_k$ measures the average effect of a crisis on a country's imports, and β_k measures the average effect of a crisis on a country's exports. Since the empirical specification controls for standard gravity determinants as well as year and importer*exporter fixed effects (see below), the estimated coefficients on crisis indicators capture whether k years after the crisis the imports or exports of a country are statistically different from what output, external demand/supply and other determinants of trade would predict.

[5] We follow the majority of the empirical literature on the gravity model by focusing only on the non-zero trade flows. However, our findings are not sensitive to the exclusion of zero flows.

Following Glick and Rose (2002), we include in eq. (1) a full set of importer-exporter pair dummies, $\propto_{ij}$. These dummies control for all possible time-invariant country-pair characteristics such as distance, common language, common border, etc. The inclusion of the import-exporter dummies implies that the effect of crises on imports is identified controlling for the average level of imports of country i from country j.

Importantly, the importer-exporter pair dummies also proxy for the time-invariant component of the unobserved multilateral trade resistance effects in Anderson and van Wincoop (2003). Anderson and van Wincoop (2003) argue that bilateral trade is determined not only by bilateral trade costs, but by broader multilateral trade costs as well. For example, Australia and New Zealand have large trade flows not only because they are close to each other, but because they are far from the rest of the world. Based on the micro foundations of the gravity model, the multilateral trade resistance reflects the countries' CES ideal price indices—these can constitute an important source of bias in the estimated coefficients for standard gravity models. The standard in the gravity literature is to use importer-time and exporter-time fixed effects in panel gravity setting, to capture multilateral resistance that is time varying (see e.g. Baldwin and Taglioni, 2006). We cannot do this in our framework, because importer-time and exporter-time effects would absorb the crisis dummies which are the regressors of interest here. Thus, while the bilateral time-invariant importer-exporter dummies completely eliminate the cross-sectional correlation between the estimated coefficients and unobserved multilateral resistance term, they do not address the time series component of the bias. In order to address the latter source of bias, we allow the importer-exporter pair dummies to vary across decades, and even across 5-year periods (see Section IV.B for details). This strategy can attenuate the time series component of the bias, to the extent that the variation in price indices over time occurs at lower than annual frequency for a large number of countries.

III. A First Look at the Data

Our sample consists of 153 advanced, emerging, and developing economies, covering the period 1970–2009. Bilateral import and export flows are obtained from the IMF's *Direction of Trade Statistics* (DOTS) database. These are reported in current U.S. dollars and are deflated

using the world import and export price deflators, respectively, from the *International Financial Statistics* (IFS) database, to get each country's real imports and exports.[6]

Crisis dates are taken from Laeven and Valencia (2008, 2010). They identify 129 episodes of systemic banking crises since 1970. The banking crisis definition combines quantitative indicators measuring banking sector distress, such as a sharp increase in nonperforming loans, large number of defaults, bank runs and a decline in the aggregate banking system capital, with subjective assessment of the situation. Laeven and Valencia (2008) also identify 60 episodes of sovereign debt crises—defined as episodes of sovereign debt default and/or restructuring—over the same time period. The majority of countries in our sample have been involved in a banking or debt crisis over the sample period. Of the 153 countries in our sample, about three-quarters (119) had a crisis at some point during the sample period. Banking crises are quite dispersed across regions. There are 13 episodes of banking crisis during 2007-08, which were concentrated in the advanced economies. Debt crises have been mostly concentrated in Latin America (34 percent) and Sub-Saharan Africa (41 percent), with two-thirds of them occurring during the 1980s. We do not focus on currency crises in the baseline analysis, as trade dynamics following such crises are fundamentally different—the most important characteristic of currency crises is, by definition, a large exchange rate depreciation, which greatly influences the post-crisis dynamics of both imports and exports.[7]

Other standard variables used to estimate the gravity model include real GDP, population, and various country-pair characteristics, such as distance and colonial ties. Real GDP and real GDP per capita in U.S. dollars are obtained from the IMF's *World Economic Outlook* (WEO) database. Country-pair variables including distance, a common land border, island and landlocked status, common legal origin, language, and colonial ties are from Glick and Taylor (2010), while indicators for whether countries belong to a currency union or a free-trade area are

[6] The results discussed below are robust to using the nominal dollar values of trade and GDP instead.

[7] Trade dynamics following currency crises (as defined by Laeven and Valencia, 2008) are qualitatively similar to trade dynamics following banking crises, but with a much deeper initial fall in imports followed by a faster recovery to gravity-predicted levels. In the analysis below, we also investigate the role of the exchange rate—both changes in its level and its volatility.

from Glick and Rose (2002), which we extend until 2009. Further details of all the data used in the empirical analysis are outlined in the appendix and summarized in Table A1.

Table 1 presents some summary statistics on the number of observations and frequency of crises. Our full sample contains 372,060 bilateral importer*exporter*year observations. Notice that instead of constructing trade flows by averaging exports and imports for each country pair, we use the unidirectional trade value and introduce both importer and exporter fixed effects and their interaction. Thus, each country-pair which trades in both directions is represented twice: once for the imports from j to i and once for the imports from i to j. This gives us 20,003 importer*exporter pairs involving 153 countries. The bulk (two-thirds) of these observations is in the later sample period from 1990-2009, reflecting the greater geographical diversification of trade flows as many developing countries embarked on the process of trade liberalization. Summary statistics of all the variables used in the empirical analysis are provided in Table A2. Crisis is not an infrequent occurrence in the data. Almost 7 percent of the observations in the sample involve a contemporaneous crisis in either the importing or exporting country.

Before proceeding to the gravity framework, we examine how imports and exports evolve following financial crises. Figure 3 presents a first look at the data: it plots the coefficients on the importer and exporter crisis indicators and their lags from a simple regression of bilateral trade flows on these indicators, importer*exporter and time dummies. On average, imports fall by about 11 percent in the crisis year. An additional drop of about 13 percent occurs the following year. Imports recover slowly in subsequent years, so that even 10 years after the crisis, they are about 5 percent below what would have been predicted in the absence of a crisis. The effect on exports is smaller and often statistically indistinguishable from zero. 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, and they recover quickly to their "normal" level within two years following the crisis.

In the next section, we analyze more formally whether this sharp and long lasting reduction in imports simply reflects the change in the country's fundamentals in the aftermath of a crisis (such as, for example, the decline in income), or a disruption in trade flows, away from their gravity predicted levels.

IV. GRAVITY FRAMEWORK RESULTS

A. Main Findings

The estimates from the augmented gravity model of trade, using our preferred specification, equation (1), are presented in Table 2. To account for potential autocorrelation and heteroskedasticity in the error term, standard errors are clustered at the importer*exporter level (see Bertrand, Duflo and Mullainathan, 2004). The impact of the usual gravity time-invariant country-pair controls, such as distance, is captured by the importer-exporter fixed effects. We include the contemporaneous and lagged crisis indicators in the importer and exporter countries. The number of lags was chosen by a top-down approach (Pedroni, 2004): we include lags of the crisis indicators until the estimated coefficients on crisis in the importing country become statistically insignificant. This occurs at the 10^{th} lag of the indicator for crisis in the importing country. For brevity, the coefficients on the year and importer*exporter fixed effects are not reported.

Not surprisingly, the gravity model fits the data well, explaining about 87 percent of the variation in bilateral trade flows. The estimated coefficients on most of the importer- and exporter-time varying control variables such as GDP, currency union and free trade agreements (FTA) are plausible and similar to what has been found in the literature (see for example, Rose (2000), and Glick and Taylor (2010)).[8]

The key variables of interest are the importer and exporter crisis dummies and their lags, which capture the effect a crisis has on a country's imports and exports during its onset and in

[8] In the baseline specification, we include only the current value of the dummy for FTA. However, as Baier and Bergstrand (2007) have shown, FTAs can have strong cumulative effects on trade (we thank an anonymous referee for pointing this out). In order to address this issue, we estimate an alternative specification where we include current as well as five lags of the FTA variable. The coefficients on the importer and exporter crisis variables remain very similar to the baseline.

the following 10 years, after controlling for the standard gravity determinants of trade (some of which are also affected by the crisis). These estimated coefficients and the 90 percent confidence interval around the estimated coefficients are also plotted in Figure 4. The estimated coefficients on contemporaneous and lagged *importer* crisis dummies are all negative and statistically significant at the one percent level (except the tenth lag, which is significant at the 5 percent level). The estimated effects are economically significant as well. On average, imports fall by 9 percent below the gravity-predicted level in the year of the crisis, and by an additional 10 percent in the following year. They recover slowly in subsequent years: 5 years after a crisis, imports are still 10 percent below normal. It takes more than 10 years for imports to get back to normal.[9]

In contrast to imports, the evolution of exports following a crisis is much more muted. The estimated coefficients on the crisis dummy and its lags in Figure 4 (and Table 2) are often statistically insignificant and much smaller in magnitude. While there is a small drop in exports in the year of the crisis, exports recover quickly, and are back to their predicted level in the year following the crisis. If anything, exports remain slightly above their gravity predicted levels following financial crises. One possible explanation for the muted effect on exports is that exports of a country are dependent on external demand, and as long as that is robust, we should not observe a deleterious effect of a crisis in a country on its own exports. In fact, while lower domestic demand directly reduces import volumes, it may also reduce residents' consumption of exportable goods, freeing up space for more exports. In addition, if the real exchange rate tends to depreciate following a financial crisis, this would tend to boost exports. We examine this possibility in the next section, when we explore candidate explanations for the behavior of postcrisis trade.

What share of the large decline in imports that a country experiences after a financial crisis is due to the change in the gravity-related determinants of trade, versus a disruption in trade flows vis-à-vis what the gravity model would predict? Comparing Figure 3 and Figure 4 can give us a sense of the relative importance of these two effects. Conditioning on the time-varying gravity controls reduces significantly the estimated deviation of imports from their

[9] More precisely, it takes 11 years, since the coefficient of the 11^{th} lag is statistically indistinguishable from zero. The exact effect on imports in year k can be calculated as $(1-e^{(-k)})\approx -k$, since k is small.

"natural" level. This suggests that part of the impact of crises on imports is channeled through the effect such crises have on standard gravity controls, most notably on the importers' income.[10] However, the bulk of the unconditional decline remains unexplained: in other words, crises have a disruptive effect on imports, above and beyond their impact on the country's income. For the remainder of this paper, we will focus on this disruption effect of crises on trade, which we define as the deviation of a country's imports and exports from what the gravity model would predict.

How does the size of the fall in imports following a financial crisis compare with the trade disruption effect of other "shocks" that countries experience? For comparison, we analyze the evolution of trade following recessions. We estimate equation (1) replacing the crisis variable with an indicator for a recession, where recessions are defined by the start year using the Braun and Larrain (2005) methodology. Unlike financial crises, recessions have little effect on imports and exports. The estimates (not shown) suggest that imports dip by about 3 percent in the first and second year after the onset of a recession, returning to their gravity predicted levels thereafter. The results provide evidence that our main findings are specific to financial crises and are not driven by omitted variables that characterize recessions in general.

The contemporaneous decline of imports following crises is also comparable to the effect of violence on bilateral trade flows estimated by Blomberg and Hess (2006). For example, they find that a terrorist incident is associated with a 5 percent decline in a country's trade, whereas revolutions and interethnic conflicts are associated with declines of 19 percent and 15 percent respectively.[11]

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[10] Several studies document substantial medium-term output losses following financial crises. Cerra and Saxena (2008) find that the negative effect of banking crises on output 10 years later is about 7½ percent. Using a slightly different methodology, Abiad et al. (2009) establish that seven years after a financial crisis, output has declined relative to trend by close to 10 percent on average.

[11] On the other hand, the average decline in imports following a crisis is much smaller than the destruction of trade between countries at war with each other as estimated by Glick and Taylor (2010). The contemporaneous effect of war on trade between belligerents is roughly nine times the effect of a financial crisis. However, trade with "neutrals" (i.e., trading partners who are not directly involved in the conflict), which might be a more suitable comparator, declines by about 12 percent on average at the onset of war, and these effects remain statistically significant up to seven years after the start of the conflict. Thus, the magnitude of the effect of a war on neutrals is similar to a financial crisis.

How does the loss in imports following a financial crisis compare with other impediments to trade, such as, for example, tariffs? We follow the methodology in Feenstra (2002) and Blomberg and Hess (2006) to estimate a "tariff equivalent." The tariff equivalent for the coefficient on the importer-crisis dummy in period k is given by $\left(e^{\frac{\widehat{\propto_k}}{1-\sigma}} - 1\right) * 100$, where σ is the elasticity of substitution between domestic and foreign goods and $\widehat{\propto_k}$ is the estimated effect of crisis on imports. As is common in the literature (e.g., Anderson and Van Wincoop, 2003), we calculate the tariff equivalent factors using values of σ equal to 5 or 10. The estimates are shown in Table 3. The tariff-equivalent costs of crisis in the importer country are between 1-2 percent in the year of the crisis and in the range of 2-5 percent in the year following the crisis. These costs are persistent and remain between 1-3 percent 5 years following the crisis. The contemporaneous tariff equivalent costs of terrorist incidents, revolutions and interethnic conflicts calculated by Blomberg and Hess (2006) are also in the range of 1-3 percent.

B. Robustness

This section examines the robustness of our main findings presented in Table 2. We begin by investigating the sensitivity of our results to alternative econometric methodologies. We then check their robustness to more flexible specifications than the baseline and to introducing alternative controls. Next, we explore if our results are sensitive to the inclusion of the most recent crisis episode. The robustness tests are summarized in Figure 5 and shown in Table A3.

Alternative econometric methodologies

Our baseline results rely on the most conservative and robust fixed effects "within" estimator, which includes a set of import*exporter fixed effects. Nevertheless, it is worth examining what the estimated effect of crises would be in the traditional gravity specification, which includes separate dummies for the exporter and importer and allows us to estimate the coefficients on the standard time-invariant country-pair characteristics such as distance, a common land border, either or both partners being an island or landlocked, common legal origin, common language, and colonial ties. The main findings are robust to this alternative specification presented in column 2 of Table A3: imports fall substantially and persistently following crises, while exports are hurt less and recover quickly. The estimated coefficients on

most other bilateral trade costs variables (not reported for brevity) are similar to what has been found in the literature. For example, greater physical distance reduces bilateral imports, whereas common land border, legal origin and colonial linkages enhance trade significantly.

Our findings are also robust to correcting for the potential biases, identified by Helpman, Melitz and Rubinstein (2008), that arise from sample selection (owing to zero trade flows), and omitted variables due to potential asymmetries in trade (i.e., one country imports from, but does not export to, the other country). We adopt Helpman, Melitz and Rubinstein's (henceforth HMR) two-step empirical methodology to address these potential biases. Following their methodology, we first estimate a probit regression including an index for common religion (which serves as the exclusion variable for the second step). Predicted components of this equation are then used in the second stage to estimate the gravity equation, which excludes the religion variable.[12] The estimated coefficients on the crisis dummies using this methodology, shown in column 3 of Table A3, are similar to results from a comparable specification in Column 2 which does not correct for the selection bias.

Finally, we look at an alternative approach similar to that used in Gourinchas and Obstfeld (2012). We analyze the evolution of *aggregate* imports and exports of a country following a financial crisis, which would also alleviate concerns that the results might be an artifact of the disaggregated nature of the bilateral data. We estimate a collapsed version of the gravity model where we aggregate imports or exports of a country across all its trading partners. The gravity framework, however, is preferable as a baseline specification as it allows the inclusion of a number of country-pair controls, most importantly importer-exporter fixed effects. The estimating equation for the collapsed gravity model is specified as follows:

$$\ln Tr_{it} = \propto_i + \pi_t + \sum \propto_k crisis_{i,t-k} + \gamma_1 \ln Y_{it} + \gamma_2 \ln PY_{it} + \delta_1 \ln y_{it} + \delta_2 \ln Py_{it} + \sum \delta_k pcrisis_{i,t-k} + \varepsilon_{it} \quad (2)$$

[12] When interpreting the findings of this robustness check, it is important to keep in mind that HMR methodology is more suitable for estimating the cross-sectional, rather than time-varying, determinants of trade, since their exclusion variables are time-invariant. Note also that we implement the HMR methodology in the specification with separate exporter and importer fixed effects (and not interaction), since the exclusion variable varies only across country-pairs but not over time.

Where Tr stands for imports or exports, PY and Py represent partners' trade-weighted GDP and per capita GDP respectively. We first estimate eq. (2) with imports as the dependent variable. The estimated coefficients on the crisis dummies are shown in column 4 of Table A3. The magnitude of the crisis coefficients declines to about half relative to the baseline, but continues to be statistically significant. Aggregate imports fall by 9 percent in the year following the crisis, and then recover slowly. Imports are 6 percent below predicted 5 years following the crisis, and recover to normal in 10 years. Notice that while equation (1) puts equal weight on all trading partners, the collapsed version puts more weight on larger trading partners, and is analogous to estimating (1) weighted by size of the partner. In order to explore further, we also estimate equation (1) allowing the coefficients on crisis dummies to vary by size of the partner (not shown). We find that imports from small trading partners are hit more following a crisis whereas imports from large trading partners seem to be more resilient to a crisis (large trading partners defined as top 20 in terms of imports). These findings are consistent with a smaller effect of crisis on imports in the aggregate specification compared to the bilateral one.

Finally we estimate eq. (2) with aggregate exports as the dependent variable with the coefficients on the exporter crisis dummies, shown in the bottom half of the same column 4 of Table A3. Aggregate exports do not deviate significantly from normal either in the short or medium term, similar to the baseline.

More flexible specifications and alternative controls

One concern is that we may not be adequately controlling for output, and the import losses we find in the baseline may still be explained by decline in output following crises. For example, in the baseline specification, we assume a constant elasticity of imports with respect to GDP. However, it is possible that 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 GDP. To test this, we allow the elasticity of imports to vary across the trend and cyclical components of output, where the trend and cycle were separated using a Hodrick-Prescott filter. The estimated coefficients on the crisis dummies (column 5, Table A3) are almost identical to the baseline specification.

In a similar vein, the sensitivity of imports to output may be particularly high in times of crisis. We thus allow the coefficient on GDP to vary during crisis and non-crisis periods. The estimated coefficients are shown in column 6 of Table A3. The total effect of a crisis on imports or exports in this case would include the interaction term between GDP and the crisis dummies. Evaluated at the average sample GDP for the crisis episodes, the total effect of a crisis on imports and exports is similar to the baseline specification (see Figure 5). Similarly, one might also worry that trade might behave unusually in the years leading up to the crisis if crises are preceded by credit booms or investment or consumption binges. Our findings on the post crisis evolution of imports are robust to controlling for the pre-crisis trends in trade. In fact, imports appear to be very close to their gravity predicted levels in the years leading up to the crisis.

In the baseline specification described in equation (1), the multilateral trade resistance term is captured by $\propto_{ij}$, the importer-exporter pair dummies. Given the evolving nature of international trade, it is reasonable to assume that multilateral trade costs have changed over time and the inclusion of a single import-exporter fixed effect to capture these costs over the entire 40 year period may be overly restrictive. We, thus, estimate an alternative specification where we allow the $\propto_{ij}$'s to vary by decade. This specification attenuates the bias that may be introduced by imposing a time-invariant multilateral resistance term. The estimated coefficients on the crisis dummies from this more general specification are shown in column 7 of Table A3. The results are qualitatively similar to the baseline specification. Moreover, results are identical if we allow $\propto_{ij}$'s to vary by 5-year periods rather than by decade. Furthermore, our findings are also robust to the inclusion of importer-specific and exporter-specific linear time trends (results not shown for brevity).

According to the theoretical underpinnings of the gravity equation, imports of country i from country j are a function of country i 's domestic absorption (which determines its import demand), and domestic output in country j (which proxies for export supply). While GDP in the exporting country may be a reasonable proxy for its supply, GDP in the importing country may not be a good proxy for the absorption, especially during crisis periods. To the extent that absorption declines more than GDP during crises, the estimated import losses controlling for GDP may be overstated. In order to address this concern, in estimating the gravity equation, we replace GDP in the importing country by domestic absorption using data on absorption (the sum

of consumption and investment expenditures) from the IFS. The main findings are robust to controlling directly for the importer's absorption as presented in column 8 of Table A3.

Sensitivity to the inclusion of the most recent crisis episode

Are our baseline results for the short-term behavior of trade driven by the most recent episodes of financial crises, whose effects on trade were particularly large? Or are our results a part of a broader historical pattern? In order to address this issue, we restrict the dataset to 2006, excluding the 13 most recent episodes of banking crises, which occurred primarily in advanced countries like the U.S., the United Kingdom, and Germany. The results are shown in column 9 of Table A3. The magnitude of the import losses in the short run is indeed smaller once we omit the recent episodes. For example, imports are 7 percent and 17 percent below predicted in the year of the crisis and the following year respectively, compared to 9 percent and 19 percent, respectively, in the baseline. Similarly, export losses in the year of the crisis are even more muted once we omit the recent episodes. Nonetheless, it is clear that our main findings are not driven by the recent wave of banking crises and the well-known trade collapse; rather they are part of a broader historical pattern.

To summarize, a number of robustness tests support the main finding that financial crises are associated with a persistent decline in imports. The estimated export dynamics following crises are more sensitive to the particular econometric specification, or sample used, yet we do not find evidence that exports are as adversely affected by crises.

V. CANDIDATE EXPLANATIONS

So far we have established that financial crises have a large disruption effect on a country's imports, while its exports remain close to or even rise above their gravity predicted levels. But why do imports remain depressed for such a prolonged period in the aftermath of a financial crisis? We have already established that the change in the determinants of trade flows within the gravity framework account for some, but not all of the relative decline of imports. Below we investigate various channels through which a financial crisis might precipitate a disruption of imports.

Several studies have documented that financial crises are often followed by a depreciation of the exchange rate (see Kaminsky and Reinhart, 1999 and Gourinchas and Obstfeld, 2012) and, indeed, the behavior of imports would be consistent with such a depreciation. We first examine whether, within our sample, crises have an effect on the real exchange rate. Using the approach of Cerra and Saxena (2008), we trace the evolution of the real effective exchange rate (REER) following crises by estimating the impulse responses of the REER within a regression of the growth in REER on a crisis indicator, its ten lags, country and year fixed effects. Specifically, the estimating equation is specified as follows:[13]

$$\Delta lnE_{i,t} = \propto_i + \pi_t + \sum_k \propto_k crisis_{i,t-k} + \varepsilon_{i,t} \quad (3)$$

The real effective exchange rate 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, although the variation around this average is quite large (Figure 6). This persistent depreciation in exchange rates following crises could be one potential explanation for the negative effect of financial crises on imports.

In addition to exchange rates, we analyze three other possible explanations for the effects of crises on imports: a rise in exchange rate volatility, a worsening of credit conditions, and a rise in protectionism as measured by tariffs or non-tariff measures. The impulse response functions for each of these candidate explanations, based on equation (3), are shown in Figure 6.

Exchange rate variability may increase during crisis periods, and increased variability has been shown to adversely affect trade (Thursby and Thursby (1987) and IMF (2004)). Following the literature, we measure exchange rate volatility as the annual standard deviation of monthly changes in the exchange rate. We find that crises are associated with substantial increases in the volatility of the real effective exchange rate in the first few years of the crisis—volatility increases by 30 percent in the first two years following a crisis, making it a potentially important explanation for the observed import losses in the short-run. But the increase in volatility we

[13] As in Cerra and Saxena (2008), we use the estimated coefficients on the crisis and its lags from a specification in which the dependent variable is the growth rate of the outcome of interest in order to construct the evolution of the level of the outcome of interest in the aftermath of a crisis.

observe is temporary and dissipates over the medium-term (Figure 6), and hence cannot be the explanation for the persistence of the import losses.

Another plausible story is that the loss in imports following crises reflects worsening of credit conditions. Banking crises in particular are associated with a tightening of credit conditions—Abiad, Dell'Ariccia, and Li (2011) 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. Difficulty in obtaining credit may have deleterious effects on imports, above and beyond any effects weak credit might have on aggregate demand. For example, Amiti and Weinstein (2011), Iacovone and Zavacka (2009), and Chor and Manova (2012) establish the importance of trade finance and credit in explaining export performance during crises. As shown in Figure 6, the ratio of private sector credit to GDP declines by more than 10 percent in the year following the crisis, and continues to decline over time. Although the magnitude of this decline looks quite large, it should be noted that many banking crises were preceded by excessive credit growth, and were then followed by prolonged periods of deleveraging.[14]

Finally, a rise in protectionism seems to be a natural candidate to explain the import losses following crises. In the aftermath of a crisis, interest groups that favor domestic production are likely to strengthen. 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). As shown in Figure 6, we see some evidence for an increase in protectionism. Average tariffs increase by more than one percent in the fourth year after the crisis, and this effect rises to up to 6 percent in the longer-run; the variation around the average is quite large, however. Similarly, we find some evidence for a small but temporary increase in the number of antidumping measures implemented following a crisis. On average, the number of antidumping measures increases by roughly 2 percent in the year following the crisis, which slowly decreases over time.

Can the disruption in imports be explained by the effect that financial crises have on the candidate explanations mentioned above? One simple way to test this is to augment the gravity

[14] See for example McKinsey (2010) and Tang and Upper (2010).

framework to include all potential candidates that could explain the observed trade dynamics following crises: namely, level of the real effective exchange rate, exchange rate volatility, credit to GDP ratio, tariffs, and non-tariff measures. The results from this augmented specification are presented in Table 4. The limited availability of data for all these variables restricts the sample size significantly to just over 50,000 observations. Column (2) shows that our core results on the effect of crises on imports hold in this restricted sample (the crisis effect on exports are mostly insignificant in this restricted sample). Column (3) adds all the variables discussed above and the ten lags of each to the regression in order to account for the persistent effect crises have on some of these macroeconomic variables. We present only our coefficients of interest: the estimated coefficients on the crisis dummies. Once the gravity framework is augmented to include all the channels through which crises might affect imports, the estimated deviations of imports from gravity predicted levels in the years following crises are no longer negative and statistically significant, except in the short-run (column 3). Even in the short-run, the magnitude of the estimated coefficients on the crisis dummies is reduced by close to half in the augmented specification.

While the above exercise suggests that the disruption effect of crises on imports can be largely explained away by augmenting the gravity framework with all likely candidates, it would be useful to disentangle whether certain explanations are more important than others. In columns (4)-(8) of Table 4, we add only one variable at a time (and its lags) in order to compare how the inclusion of these variables affects the estimated deviation of imports from gravity predicted levels. The level of the exchange rate and credit conditions are the two candidate explanations which appear to matter the most for the statistical as well as economic significance of import losses; adding either of them largely eliminates the significance of the coefficients on the crisis dummies. Exchange rate volatility and protectionism seem to be less important, particularly in the medium-term. These findings are broadly consistent with the evolution of the variables described above and summarized in Figure 6.

In sum, exchange rate dynamics, impaired credit, and increased protectionism jointly perform well in explaining the sharp and persistent import losses we established above. However, we would still need to allude to other explanations to account for the significant reduction in imports we observe in the year of the crisis and the year after, even after controlling

for all these candidate explanations. There are two plausible stories. First, although we do not find evidence for substantial increases in tariffs and antidumping measures to explain the short-run effect on imports, increased protectionism may manifest itself in "murky" forms (e.g., clauses in stimulus packages that restrict spending to domestic producers), which may be difficult to detect in the data.

Second, "composition effects"—large drops in demand for goods that constitute a larger share of trade than of output—can account for some of the unexplained trade dynamics in the short-run. Eaton et al. (2011) and Levchenko et al. (2010) find that composition effects can account for the bulk of the disproportionate decline in trade relative to output in the 2008-09 global downturn. We find some suggestive evidence which shows that composition effects could be important in earlier crises as well. 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. And the post-crisis 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 post-crisis decline in the rest of GDP over the same period. Unfortunately, the lack of comprehensive historical data on the composition of demand for various categories of goods precludes a detailed investigation of this particular explanation.

VI. Differences in Trade Dynamics Across Products, and During Global Downturns

Until now, the reported estimates represent averages of the effect of crises on trade across all products, and time periods in the sample. In this section, we analyze whether the effect of a crisis varies systematically across product categories, and during global downturns.

A. Do Postcrisis Trade Dynamics Vary Across Products?

It is well known that the extent of the trade collapse during the 2008-09 global downturn differed across different product categories. The largest collapse was in demand for "postponable" items such as capital and consumer durables (e.g., Bems, Johnson and Yi (2010)). Is this pattern also borne out in earlier crises? In order to explore the evolution of imports in different product categories, we estimate a product-level gravity regression. We consider four

product categories—consumer nondurables, capital and consumer durables, intermediate and primary goods.

We follow Harrigan (2003) in stacking the product categories together, and estimating a gravity specification with product fixed effects. In addition, we allow all the standard gravity controls to vary by product categories. The estimating equation is specified as follows:

$$\ln M_{p,i,j,t} = \propto_{ijp} + \pi_t * \gamma_p + \sum_k \propto_{k,p} crisis_{i,t-k} * \gamma_p + \sum_k \beta_{k,p} crisis_{j,t-k} * \gamma_p + \sum_p \lambda_{1,p} \ln \mathrm{Y_{it}} * \gamma_p + \sum_p \lambda_{2,p} \ln \mathrm{Y_{jt}} * \gamma_p + \sum_p \delta_{1,p} \ln \mathrm{y_{it}} * \gamma_p + \sum_p \delta_{2,p} \ln \mathrm{y_{jt}} * \gamma_p + \sum_p \mu_p X_{ijt} * \gamma_p + \varepsilon_{p.i,j,t} \quad (4)$$

Where p denotes the product category, and γ_p denotes the vector of product fixed effects and $\propto_{ijp}$ denotes the triple interaction of importer, exporter and product fixed effects.

The evolution of imports and exports in different product categories is summarized in Figure 7. As in the recent global downturn, capital and consumer durables experience the largest short-term drop, with an average drop of 23 percent in the year after a crisis. The recovery in imports for this product category is protracted, with durables imports remaining 16 percent below normal after 5 years. Intermediate products are also quite adversely affected, with imports in this category remaining 21 percent below predicted in the year after crisis, and recovering only slowly in the medium-term. Consumer non-durables also experience smaller but still significant drops in the short- (13 percent in the year following the crisis) and medium-term (8 percent below predicted after 5 years). One possible explanation could be that for past crises that typically occurred in lower-income countries with weak social safety nets, crises and the resulting (un-cushioned) rise in unemployment led to declines even in consumer non-durables.[15] These effects would remain even in the regressions which control for output, if the measured GDP decline failed to adequately capture the adverse impact on poorer households. Finally, imports of primary goods seem to be the least affected by a crisis.

[15] See, for example, Friedman and Levinsohn (2003) who document the impact of the 1997 Asian crisis on Indonesian households.

Exports of most product categories (except durables) decline in the year of the crisis, quickly recovering in at most 3 years after the crisis. Capital and consumer durables experience the sharpest decline in the year of the crisis (5 percent), but recover quickly. The decline in exports of primary goods though marginally smaller in magnitude on impact, is more persistent—recovering to normal 3 years after the crisis. Exports of all product categories increase in above gravity-predicted levels in the medium-term, most likely due to competitive effects of exchange rate depreciation associated with crises. Notably, primary goods also experience the smallest increase in exports above gravity-predicted levels in the medium-term. This could be explained by the fact that primary goods include commodities, which are often priced in foreign currency. For example, Cook and Devereux (2006) provide evidence on foreign currency pricing in the case of Asia. Hence, the exchange rate depreciation associated with the crisis does not boost exports to an extent similar to other product categories.

B. Are Postcrisis Trade Dynamics Different During Global Downturns?

In the baseline regression equation (1), we include year fixed effects to control for factors that affect all countries' trade simultaneously, such as global downturns or increases in global uncertainty or risk aversion. Hence, the effect of financial crises captured in the baseline specification is over and beyond whatever effect global downturns have on world trade. However, our empirical framework allows us to evaluate whether trade dynamics differ if a crisis coincides with a global downturn. Whether the coincidence of a crisis with a global downturn matters is ambiguous. Based on a standard trade model, where imports are only a function of domestic demand, we should not expect import losses to differ significantly when crises are accompanied by a global downturn. On the other hand, import losses could also be higher due to disruptions in the supply from trading partners or a sharp increase in uncertainty and home bias that may occur during global downturns. In the case of exports, a global downturn depresses external demand and therefore domestic crises which are accompanied by global downturns are likely to be associated with higher export losses.

We interact contemporaneous and lagged crisis dummies with indicators of whether the year of the episode coincided with a global downturn. Following Freund (2009), we define global downturns as years where world real GDP growth is (i) below 2 percent, (ii) more than

1.5 percentage points below the previous 5-year average, and (iii) at its minimum relative to the previous two years and the following two years. The following global downturns are identified by this procedure: 1975, 1982, 1991, 2001, and 2008. About a fifth of the crisis episodes in our sample occurred during global downturns.

The estimating equation is specified as follows:

$$\ln M_{i,j,t} = \propto_{ij} + \pi_t + \sum_k \propto_k crisis_{i,t-k} + \sum_k \propto_k{}' crisis_{i,t-k} * \mathrm{D_{t-k}} + \sum_k \beta_k crisis_{j,t-k} + \sum_k \beta_k{}' crisis_{j,t-k} * \mathrm{D_{t-k}} + \gamma_1 \ln \mathrm{Y_{it}} + \gamma_2 \ln \mathrm{Y_{jt}} + \delta_1 \ln \mathrm{y_{it}} + \delta_2 \ln \mathrm{y_{jt}} + \mu X_{ijt} + \varepsilon_{i,j,t} \quad (5)$$

Where $\mathrm{D_{t-k}}$=1 if a global downturn occurred in year $t-k$.

The effect of a crisis on a country's imports k years following the crisis is captured by the coefficient $\propto_k$ if the year of the crisis does not coincide with a global downturn, and is equal to $\propto_k + \propto_k{}'$ if the crisis is accompanied by a global downturn. The coefficients on the crisis dummies and the 90 percent confidence intervals are summarized in Figure 8. Countries that experience a crisis during a global downturn have deeper import and export losses, even after conditioning on all the standard gravity controls. More specifically, the imports of a crisis country fall 28 percent below predicted in the year following the crisis, almost 10 percentage points higher than a crisis episode which is not accompanied by a downturn. Just as important, the decline is much more persistent if the crisis is accompanied by a global downturn; imports remain almost 10 percent below normal even ten years after a crisis. Exports also fall more, and take longer to recover for crises accompanied by global downturns; however, the evolution of exports continue to be less dramatic compared to imports. These findings suggest that the 2007-08 financial crises may result in deeper trade losses than historical episodes which did not coincide with a global downturn. Importantly, the persistent export losses we observe support our conjecture for a demand side explanation. Domestic crises have a muted effect on a country's own exports, unless they are accompanied by a global downturn which depresses external demand. The larger import losses when crises are accompanied by a global downturn are more

consistent with explanations based on non-standard trade models such as disruptions in the supply from trading partners during global downturns.[16]

VII. CONCLUSIONS

Using bilateral trade data for a large set of countries over the period 1970-2009, this paper provides evidence that financial crises are associated with large and persistent losses in imports. This is over and above any import compression due to lower output and changes in other standard determinants of trade flows as a result of a crisis. In contrast, exports are not as adversely affected and their behavior can be better explained by standard gravity determinants. Exports of the crisis country fall modestly in the year of the crisis, but then remain close to or even above the predicted level in both the short and medium-term. We also find that imports of consumer and capital durables are hit the most; and episodes coinciding with global downturns and those concurrent with a crisis in the partner countries, have more adverse effects.

Why do crises have such a persistent disruption effect on imports? We evaluate three potential candidate explanations: exchange rate dynamics, impaired credit conditions and increased protectionism. These three candidates jointly perform a good job in explaining the long-lasting effect on imports. Specifically, a depreciation of the exchange rate and worsening credit conditions play a predominant role in explaining the import losses. Exchange rate volatility, increased tariffs and anti-dumping measures, play a smaller role. These mechanisms, however, cannot fully explain the sharp drop in imports in the very short-run – in the year of the crisis, and the year after. Our conjecture is that a rise in more hidden forms of protectionism, which are difficult to quantify (e.g. "behind the border" measures —such as technical barriers to trade, procurement, and regulatory measures discussed in Gregory et al. (2010)), or "composition effects" that played a role in the most recent crisis, could explain short-run trade dynamics following past financial crises.

[16] We also examine whether the effect of a financial crisis in a country is more severe when it is concurrent with a crisis in only one trading partner (as opposed to global downturns). Indeed, the decline in trade between two countries that have both had a crisis is disproportionately more severe, as well as more persistent. Finally we also examine whether import losses are greater for ."severe" crises, where a severe crisis is defined as an episode in which the size of the output loss in the first two years of the crisis is above the median. We found that import losses occur regardless of whether a financial crisis is severe or moderate, but the initial import loss is larger for severe crises.

REFERENCES

Abiad, Abdul, Ravi Balakrishnan, Petya Koeva Brooks, Daniel Leigh and Irina Tytell, 2009, "What's the Damage? Medium-term Output Dynamics After Banking Crises," IMF Working Paper 09/245 (Washington: International Monetary Fund).

Abiad, Abdul, Giovanni Dell'Ariccia, and Bin Li, 2011, "Creditless Recoveries," IMF Working Paper 11/58 (Washington: International Monetary Fund).

Alessandria, George, Joseph P. Kaboski, and Virgiliu Midrigan, 2010, "The Great Trade Collapse of 2008–09: An Inventory Adjustment?" *IMF Economic Review*, Vol. 58, pp. 254-94.

———, 2011, "Inventories, Lumpy Trade and Large Devaluations." *American Economic Review*, Vol. 101, No. 3, pp. 303-07.

Altomonte, Carlo, and Gianmarco I.P. Ottaviano, 2009, "Resilient to the Crisis? Global Supply Chains and Trade Flows," in *The Great Trade Collapse: Causes, Consequences and Prospects*, ed. by Richard Baldwin. Available at www.voxeu.org/index.php?q=node/4289.

Amiti, Mary, and David E. Weinstein, 2011, "Exports and Financial Shocks," *Quarterly Journal of Economics*, Vol. 126, No. 4, pp. 1841-1877.

Anderson, James, and Eric Van Wincoop, 2003, "Gravity with Gravitas: A Solution to the Border Puzzle," *American Economic Review*, Vol. 93, No. 1, pp. 170–92.

Baier, Scott and Jeffrey Bergstrand, 2007, "Do Free Trade Agreements Actually Increase Members' International Trade"? *Journal of International Economics*, Vol. 71, pp. 72-95.

Baldwin, Richard, ed., 2009, *The Great Trade Collapse: Causes, Consequences and Prospects*. Available at www.voxeu.org/index.php?q=node/4297.

———, and Daria Taglioni, 2006, "Gravity for Dummies and Dummies for Gravity Equations," NBER Working Paper No. 12516 (Cambridge, Massachusetts: National Bureau of Economic Research).

Bems, Rudolphs, Robert C. Johnson and Kei-Mu Yi, 2010, "Demand Spillovers and the Collapse of Trade in the Global Recession," *IMF Economic Review*, Vol. 58, No. 2, pp. 295-326.

Berman, Nicolas, and Philippe Martin, 2012, "The Vulnerability of Sub-Saharan Africa to the Financial Crisis: The Case of Trade," *IMF Economic Review*, Vol. 60, No. 3, pp. 329-64.

Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan, 2004, "How Much Should We Trust Differences-in-Differences Estimates?," *Quarterly Journal of Economics*, Vol. 119(1), pp. 249-75.

Blomberg, S. Brock and Gregory D. Hess, 2006, "How Much Does Violence Tax Trade?" *Review of Economics and Statistics*, Vol. 88, No. 4, pp. 599-612.

Bown, Chad P. (2010) "Global Antidumping Database," available at http://econ.worldbank.org/ttbd/gad/.

Braun, Matías and Borja Larrain, 2005, "Finance and the Business Cycle: International, Inter-Industry Evidence," *Journal of Finance*, Vol. 60, No. 3, pp. 1097-1128.

Caprio, Gerard, Daniela Klingebiel, Luc Laeven and Guillermo Noguera, 2005, "Appendix: Banking Crisis Database." In Patrick Honohan and Luc Laeven (eds.). *Systemic Financial Crises: Containment and Resolution* (Cambridge, U.K.: Cambridge University Press).

Cerra, Valerie, and Sweta Saxena, 2008, "Growth Dynamics: The Myth of Economic Recovery," *American Economic Review*, Vol. 98, No. 1, pp. 439–57.

Chor, Davin, and Kalina Manova, 2012, "Off the Cliff and Back? Credit Conditions and International Trade during the Global Financial Crisis", *Journal of International Economics*, Vol. 87, pp. 117-133.

Cook, David and Michael Devereux, 2006, "External Currency Pricing and the East Asian Crisis," *Journal of International Economics,* Vol. 69, No. 1, pp 37-63.

Eaton, Jonathan, Sam Kortum, Brent Neiman, and John Romalis, 2011, "Trade and the Global Recession" NBER Working Paper No. 16666 (Cambridge, Massachusetts: National Bureau of Economic Research).

Evenett, Simon J., 2009, "What Can Be Learned from Crisis-Era Protectionism? An Initial Assessment," CEPR Discussion Paper No. 7494 (London: Centre for Economic Policy Research)

Feenstra, Robert, 2002, *Advanced International Trade: Theory and Evidence* (Princeton University Press).

———, Robert Lipsey, Haiyan Deng, Alyson Ma, and Hengyong Mo, 2005, "World Trade Flows: 1962–2000," NBER Working Paper No. 11040 (Cambridge, Massachusetts: National Bureau of Economic Research).

Frankel, Jeffrey, Ernesto Stein, and Shang-Jin Wei, 1996, "Regional Trading Arrangements: Natural or Supernatural?" *American Economic Review*, Vol. 86, No. 2, pp. 52–56.

Freund, Caroline, 2009, "The Trade Response to Global Downturns: Historical Evidence," Policy Research Working Paper No. 5015 (Washington: World Bank).

Glick, Reuven, and Andrew K. Rose, 2002, "Does a Currency Union Affect Trade? The Time Series Evidence," *European Economic Review,* Vol. 46, No. 6, pp. 1125–51.

Glick, Reuven, and Alan M. Taylor, 2010, "Collateral Damage: Trade Disruption and the Economic Impact of War," *Review of Economics and Statistics*, Vol. 92, No. 1, pp. 102–27.

Gopinath, Gita and Brent Neiman, 2011, "Trade Adjustment and Productivity in Large Crises," NBER Working Paper No. 16958 (Cambridge, Massachusetts: National Bureau of Economic Research).

Gourinchas, Pierre-Olivier and Maurice Obstfeld, 2012, "Stories of the Twentieth Century for the Twenty-First," *American Economic Journal: Macroeconomics*, Vol. 4, No. 1, pp 226-65.

Gregory, Rob, Christian Henn, Brad McDonald and Mika Saito, 2010, "Trade and the Crisis: Protect or Recover," IMF Staff Position Note 10/07 (Washington: International Monetary Fund).

Giuliano, Paola, Prachi Mishra, and Antonio Spilimbergo, 2013, "Democracy and Reforms" *American Economic Journal: Macroeconomics*, Vol. 5, No. 4, pp.-204.

Harrigan, James, 1996, "Openness to Trade in Manufactures in the OECD," *Journal of International Economics*, Vol. 40, No. 1/2, pp. 23-39.

———, 2003 "Specialization and the Volume of Trade: Do the Data Obey the Laws?" chapter in *The Handbook of International Trade*, Basil Blackwell, edited by James Harrigan and Kwan Choi. Also available as NBER Working Paper No. 8675 and *Federal Reserve Bank of New York Staff Report* No. 140.

Helpman, Elhanan, Marc Melitz and Yona Rubinstein, 2008, "Estimating Trade Flows: Trading Partners and Trading Volumes," *Quarterly Journal of Economics*, Vol. 123, No. 2, pp. 441-87.

Iacovone, Leonardo and Veronika Zavacka, 2009, "Banking Crises and Exports: Lessons from the Past," Policy Research Working Paper 5016 (Washington, DC: World Bank).

International Monetary Fund (IMF), 2004, "A New Look at Exchange Rate Volatility and Trade Flows," IMF Occasional Paper No. 235 (Washington: International Monetary Fund).

———, 2009, "What's the Damage? Medium-term Output Dynamics after Financial Crises," *World Economic Outlook*, Chapter 4, October.

Kaminsky, Graciela, L., and Carmen M. Reinhart, 1999, "The Twin Crises: The Causes of Banking and Balance of Payments Problems," *American Economic Review,* Vol. 89, No. 3, pp. 473–500.

Klein, Michael W. and Jay C. Shambaugh, 2006, "Fixed Exchange Rates and Trade," *Journal of International Economics*, Vol. 70, pp. 359–83.

Laeven, Luc, and Fabian Valencia, 2008, "Systemic Banking Crises: A New Database," IMF Working Paper 08/224 (Washington: International Monetary Fund).

———, 2010, "Resolution of Banking Crises: The Good, the Bad, and the Ugly," IMF Working Paper 10/146 (Washington: International Monetary Fund).

Levchenko, Andrei, Logan Lewis, and Linda Tesar, 2010, "The Collapse of International Trade during the 2008-2009 Crisis: In Search of the Smoking Gun," *IMF Economic Review*, forthcoming.

Ma, Zihui and Leonard Cheng, 2005, "The Effects of Financial Crises on International Trade," NBER Conference Volume, International Trade in East Asia Seminar on Economics, Vol. 14 (Cambridge, Massachusetts: National Bureau of Economic Research).

Martin, Philippe, Thierry Mayer, and Mathias Thoenig, 2008, "Make Trade, Not War?" *Review of Economic Studies*, Vol. 75, No. 3, pp. 865–900.

McKinsey Global Institute, 2010, *Debt and Deleveraging: The Global Credit Bubble and its Economic Consequences*. January 2010.

O'Rourke, Kevin, 2009, "Government Policies and the Collapse in Trade during the Great Depression," in *The Great Trade Collapse: Causes, Consequences and Prospects*, ed. by Richard Baldwin. Available at www.voxeu.org/index.php?q=node/4267.

Pedroni, Peter, 2004, "Panel Cointegration; Asymptotic and Finite Sample Properties of Pooled Time Series Tests with an Application to the PPP Hypothesis," *Econometric Theory*, Vol. 20, pp. 597-625.

Pula, Gabor, and Tuomas Peltonen, 2009, "Has Emerging Asia Decoupled? An Analysis of Production and Trade Linkages Using the Asian International Input-Output Table," ECB Working Paper No. 993 (Frankfurt: European Central Bank).

Qureshi, Mahvash Saeed, 2009, "Trade and Thy Neighbor's War," IMF Working Paper 09/283 (Washington: International Monetary Fund).

Reinhart, Carmen, and Kenneth Rogoff, 2008, "Banking Crises: An Equal Opportunity Menace", NBER Working Paper No. 14587 (Cambridge, Massachusetts: National Bureau of Economic Research).

———, 2009a, *This Time is Different: Eight Centuries of Financial Folly*, Princeton University Press.

———, 2009b, "The Aftermath of Financial Crises," *American Economic Review*, Vol. 99, No. 2: 466-472.

Rose, Andrew, 2000, "One Money, One Market: Estimating the Effect of Common Currencies on Trade," *Economic Policy*, Vol. 15, No. 30, pp.7–46.

Tang, Gary, and Christian Upper, 2010, "Debt Reduction After Crises", BIS Quarterly Review, September.

Thursby, Marie, and Jerry Thursby, 1987, "Bilateral Trade Flows, the Linder Hypothesis, and Exchange Risk," *Review of Economics and Statistics*, Vol. 69, No. 3, pp.488–95.

Yu, Miaojie, 2010, "Trade, Democracy and the Gravity Equation," *Journal of Development Economics*, Vol. 91, pp.289–300.

Appendix

How Does Trade Evolve in the Aftermath of Financial Crises?

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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 A1.

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 et al. (2005), Laeven and Valencia (2008), and Reinhart and Rogoff (2009a). 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 to private lending and the year of debt rescheduling. Using this approach, they identify 60 episodes of sovereign debt defaults and restructurings since 1970.

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, respectively, from the IFS database, to get 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 based on 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 et al, 2005). The data base is first extended using the UN

Comtrade database. The Standard International Trade Classification, Revision 2 (SITC Rev. 2) codes 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 Non Durables, Intermediate Goods and Primary Goods, following Pula and Peltonen (2009).

The measure of trade liberalization is from the IMF Structural Reforms Database and is described in Giuliano, Mishra and Spilimbergo (2013).

Table 1. Sample Characteristics

	1970-2009	1970-1989	1990-2009
Total			
Number of importer-exporter-year observations	372,060	81,112	290,948
Number of importer-exporter pairs	20,003	10,663	19,780
Number of countries	153	120	153
Crisis, contemporaneous			
Number of importer-exporter-year observations	24,856	8,343	16,513
Number of importer-exporter pairs	13,397	5,666	11,873
Number of countries	110	55	82
Crisis, contemporaneous and lagged			
Number of importer-exporter-year observations	215,924	44,549	171,375
Number of importer-exporter pairs	18,364	7,673	18,021
Number of countries	118	62	115

Note: "Total" refers to the importer-exporter-year observations with data on trade and the necessary correlates. "Crisis, contemporaneous" refers to importer-exporter-year observations in which either the exporter or the importer has a crisis. "Crisis, contemporaneous and lagged" referes to importer-exporter-year observations in which either the importer or the exporter has a crisis in the current or the preceding 10 years.

Table 2. Imports and Exports Following Crises: Pooled Panel Gravity Estimates, 1970-2009

Dependent variable: log (imports) at (importer, exporter, year) level in year t

	Importer	Exporter
Crisis t	-0.089 ***	-0.039 ***
	[0.015]	[0.015]
Crisis t-1	-0.191 ***	0.019
	[0.016]	[0.015]
Crisis t-2	-0.140 ***	0.037 **
	[0.016]	[0.016]
Crisis t-3	-0.113 ***	0.01
	[0.016]	[0.016]
Crisis t-4	-0.119 ***	0.011
	[0.016]	[0.017]
Crisis t-5	-0.105 ***	0.041 **
	[0.016]	[0.016]
Crisis t-6	-0.095 ***	0.038 **
	[0.016]	[0.016]
Crisis t-7	-0.081 ***	0.042 ***
	[0.015]	[0.015]
Crisis t-8	-0.083 ***	0.035 **
	[0.015]	[0.015]
Crisis t-9	-0.055 ***	0.041 ***
	[0.015]	[0.015]
Crisis t-10	-0.032 **	0.018
	[0.014]	[0.015]
Log Importer GDP	1.045 ***	
	[0.071]	
Log Exporter GDP	0.507 ***	
	[0.082]	
Log Importer GDP Per Capita	-0.141 **	
	[0.068]	
Log Exporter GDP Per Capita	0.756 ***	
	[0.076]	
Currency Union	0.004	
	[0.054]	
Free Trade Agreement	0.426 ***	
	[0.042]	
R-suqared	0.87	
Number of Observations	372,060	
Number of Importer-Exporter Pairs	20,003	
Importer-Exporter Dummies	Yes	

Note: This table shows the estimates from regression Equation (1) in the text. All reported coefficients are from the same regression. The regression includes year and importer-exporter dummies. Robust standard errors clustered at the importer-exporter pair level in parentheses. Significance at the 1, 5, and 10 percent indicated by ***, **, and *, respectively.

Table 3. Tariff Equivalent Trade Costs

	(1) Sigma=5	(2) Sigma=10
	Importer	Importer
Crisis t	2.2	1.0
Crisis t-1	4.9	2.1
Crisis t-2	3.6	1.6
Crisis t-3	2.9	1.3
Crisis t-4	3.0	1.3
Crisis t-5	2.7	1.2
Crisis t-6	2.4	1.1
Crisis t-7	2.0	0.9
Crisis t-8	2.1	0.9
Crisis t-9	1.4	0.6
Crisis t-10	0.8	0.4

Note: The tariff-equivalent trade costs shown in this table are calculated using the coefficients in Table 2. Each number represents a tariff-equivalent percentage; i.e. the percent by which tariffs have to be raised to reduce imports by the same amount as occurrence of a crisis. The first column is based on a CES elasticity of 5, while the last column is based on a CES elasticity of 10. See text for details of the calculations.

Table 4. Imports and Exports Following Crises: Candidate Explanations

	Baseline	Baseline - restricted sample (no explanations)	Baseline - restricted sample (all explanations)	Exchange rate	Exchange rate volatility	Credit/GDP	Tariffs	Non-tariff measures
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Importer: Crisis t	-0.089 ***	-0.132 ***	-0.071 ***	-0.112 ***	-0.126 ***	-0.121 ***	-0.112 ***	-0.133 ***
	[0.015]	[0.025]	[0.027]	[0.025]	[0.027]	[0.026]	[0.025]	[0.025]
Importer: Crisis t-1	-0.191 ***	-0.245 ***	-0.109 ***	-0.16 ***	-0.247 ***	-0.211 ***	-0.239 ***	-0.24 ***
	[0.016]	[0.028]	[0.031]	[0.029]	[0.030]	[0.029]	[0.028]	[0.028]
Importer: Crisis t-2	-0.14 ***	-0.114 ***	0.012	-0.043	-0.117 ***	-0.042	-0.122 ***	-0.113 ***
	[0.016]	[0.027]	[0.032]	[0.029]	[0.030]	[0.028]	[0.027]	[0.027]
Importer: Crisis t-3	-0.113 ***	-0.077 ***	0.036	-0.019	-0.089 ***	-0.005	-0.084 ***	-0.078 ***
	[0.016]	[0.026]	[0.031]	[0.027]	[0.029]	[0.027]	[0.026]	[0.026]
Importer: Crisis t-4	-0.119 ***	-0.055 **	0.064 **	0.022	-0.071 **	0.011	-0.064 **	-0.055 **
	[0.016]	[0.027]	[0.031]	[0.028]	[0.029]	[0.028]	[0.027]	[0.027]
Importer: Crisis t-5	-0.105 ***	-0.082 ***	0.033	-0.013	-0.095 ***	-0.028	-0.081 ***	-0.077 ***
	[0.016]	[0.025]	[0.029]	[0.026]	[0.027]	[0.027]	[0.025]	[0.026]
Importer: Crisis t-6	-0.095 ***	-0.07 ***	0.045	0.001	-0.079 ***	-0.018	-0.06 **	-0.069 ***
	[0.016]	[0.024]	[0.028]	[0.024]	[0.026]	[0.025]	[0.024]	[0.024]
Importer: Crisis t-7	-0.081 ***	-0.078 ***	0.02	-0.007	-0.084 ***	-0.037	-0.074 ***	-0.083 ***
	[0.015]	[0.023]	[0.027]	[0.023]	[0.025]	[0.024]	[0.023]	[0.023]
Importer: Crisis t-8	-0.083 ***	-0.102 ***	-0.009	-0.042 *	-0.088 ***	-0.064 ***	-0.095 ***	-0.108 ***
	[0.015]	[0.023]	[0.026]	[0.023]	[0.025]	[0.023]	[0.023]	[0.023]
Importer: Crisis t-9	-0.055 ***	-0.102 ***	-0.012	-0.039 *	-0.1 ***	-0.066 ***	-0.093 ***	-0.107 ***
	[0.015]	[0.022]	[0.024]	[0.022]	[0.024]	[0.022]	[0.022]	[0.022]
Importer: Crisis t-10	-0.032 **	-0.056 ***	-0.003	-0.001	-0.058 ***	-0.037 *	-0.05 **	-0.06 ***
	[0.014]	[0.020]	[0.020]	[0.020]	[0.021]	[0.020]	[0.020]	[0.020]
Exporter: Crisis t	-0.039 ***	0.003	-0.012	-0.006	-0.037	-0.004	0.002	0.004
	[0.015]	[0.028]	[0.029]	[0.028]	[0.030]	[0.028]	[0.028]	[0.028]
Exporter: Crisis t-1	0.019	0.087 **	0.057	0.063 *	0.008	0.077 **	0.085 **	0.087 **
	[0.015]	[0.034]	[0.037]	[0.034]	[0.036]	[0.034]	[0.034]	[0.034]
Exporter: Crisis t-2	0.037 **	0.11 ***	0.077 **	0.092 ***	0.033	0.101 ***	0.108 ***	0.11 ***
	[0.016]	[0.033]	[0.037]	[0.033]	[0.035]	[0.034]	[0.033]	[0.033]
Exporter: Crisis t-3	0.01	0.028	-0.009	0.024	-0.043	0.009	0.028	0.029
	[0.016]	[0.035]	[0.038]	[0.035]	[0.038]	[0.036]	[0.035]	[0.035]
Exporter: Crisis t-4	0.011	0.066 **	0.033	0.064 *	0.007	0.047	0.065 **	0.066 **
	[0.017]	[0.033]	[0.037]	[0.033]	[0.036]	[0.034]	[0.033]	[0.033]
Exporter: Crisis t-5	0.041 **	0.017	-0.004	0.012	-0.031	0.006	0.016	0.018
	[0.016]	[0.032]	[0.036]	[0.032]	[0.035]	[0.033]	[0.032]	[0.032]
Exporter: Crisis t-6	0.038 **	0.006	0.008	0.004	-0.023	-0.001	0.005	0.006
	[0.016]	[0.030]	[0.034]	[0.031]	[0.033]	[0.032]	[0.030]	[0.030]
Exporter: Crisis t-7	0.042 ***	0.021	0.021	0.018	-0.003	0.01	0.02	0.02
	[0.015]	[0.029]	[0.031]	[0.029]	[0.030]	[0.030]	[0.029]	[0.029]
Exporter: Crisis t-8	0.035 **	0.038	0.036	0.031	0.021	0.027	0.037	0.038
	[0.015]	[0.027]	[0.030]	[0.027]	[0.029]	[0.029]	[0.027]	[0.027]
Exporter: Crisis t-9	0.041 ***	0.026	0.022	0.022	0.002	0.021	0.026	0.027
	[0.015]	[0.027]	[0.029]	[0.027]	[0.029]	[0.028]	[0.027]	[0.027]
Exporter: Crisis t-10	0.018	0.014	0.012	0.012	0.009	0.011	0.015	0.015
	[0.015]	[0.024]	[0.025]	[0.024]	[0.026]	[0.024]	[0.024]	[0.024]
R-suqared	0.87	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Number of Observations	372,060	50,880	50,880	50,880	50,880	50,880	50,880	50,880
Number of Importer-Exporter Pairs	20,003	4,496	4,496	4,496	4,496	4,496	4,496	4,496

Note: All regressions include year and import-exporter pair dummies. Robust standard errors clustered at the importer-exporter pair level in parentheses in all regressions. Significance at the 1, 5, and 10 percent indicated by ***, **, and *, respectively. The dependent variable in (1)-(10) is log(imports) at (importer, exporter, year) level. (1) is the baseline specification corresponding to Table 2, (2) is the baseline specification retricted to the sample where data on all mechansims is available. Columns (3)-(7) adds one mechanism at a time and its ten lags to the restricted sample baseline in column (2). (3) adds to the baseline real effective exchange rate in the exporter and importer, and its ten lags. (4) adds to the baseline the volatility of real effective exchange rate in exporter and importer, and its ten lags. Volatility is measured as the annual standard deviation of monthly changes in exchange rate. (5) adds to the baseline average tariffs in the importer, and ten lags. (6) adds to the baseline number of anti-dumping measures in the importer, and its ten lags. (7) adds credit/GDP in the exporter and importer, and ten lags.

Table A1. Data Sources

Annual Data

Variable	Source
Real Exports and Imports	Direction of Trade Statistics (DOTS) Database
Real GDP in U.S. Dollars	IMF World Economic Outlook (WEO) Database
Real GDP per Capita in U.S. Dollars	IMF World Economic Outlook (WEO) Database
World Import/Export Price Deflator	International Financial Statistics (IFS) Database
Bilateral exchange rate	IMF World Economic Outlook (WEO) Database
Real Effective Exchange Rate	IMF World Economic Outlook (WEO) Database
Product-Level Imports and Exports	Feenstra and others (2005), COMTRADE, Pula and Peltonen (2009)
Trade Liberalization	Guiliano, Mishra, and Spilimbergo (2013)
Debt Crisis Indicators	Laeven and Valencia (2008)
Banking Crisis Indicators	Laeven and Valencia (2010)

High-Frequency Data

Variable	Source
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

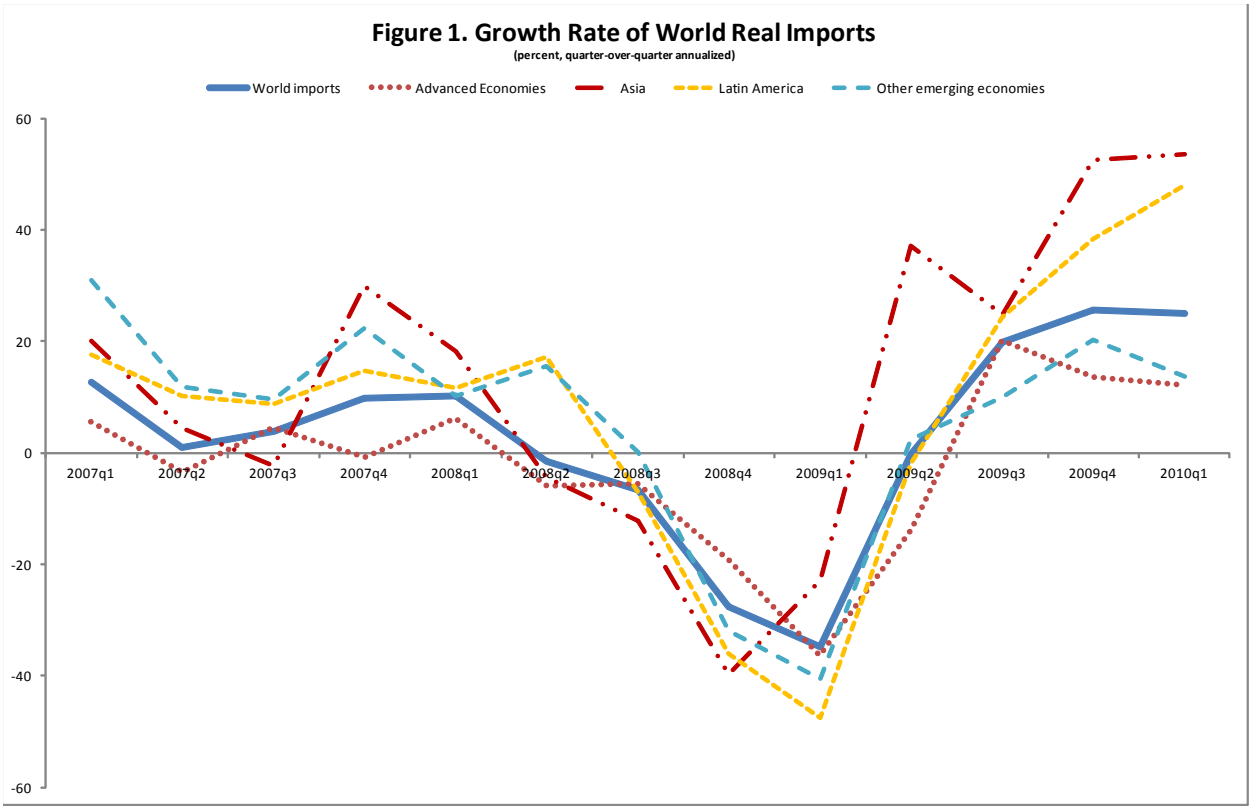
Table A2. Summary Statistics of Main Variables

Variable	Nobs	Mean	StDev	Min	Max
Crisis in Importer	372060	0.034	0.182	0	1
Crisis in Exporter	372060	0.034	0.182	0	1
Log Trade	372060	1.009	3.736	-32.898	12.255
Log Importer GDP	372060	3.450	2.160	-2.800	9.376
Log Exporter GDP	372060	3.564	2.112	-2.800	9.376
Log Importer GDP Per Capita	372060	-12.871	1.642	-16.315	-9.776
Log Exporter GDP Per Capita	372060	-12.819	1.636	-16.315	-9.776
Log Distance	291764	4.071	0.826	0.297	5.661
1 if Common Border	291764	0.029	0.168	0	1
1 if Island	372060	0.010	0.101	0	1
1 if Landlock	372060	0.011	0.102	0	1
1 if Common Legal System	291764	0.359	0.480	0	1
1 if Common Language	291764	0.303	0.460	0	1
1 if Colonial Times	291764	0.018	0.134	0	1
1 if Currency Union	372060	0.014	0.116	0	1
1 if Free Trade Area	372060	0.048	0.214	0	1

Table A3. Imports and Exports Following Crises: Robustness

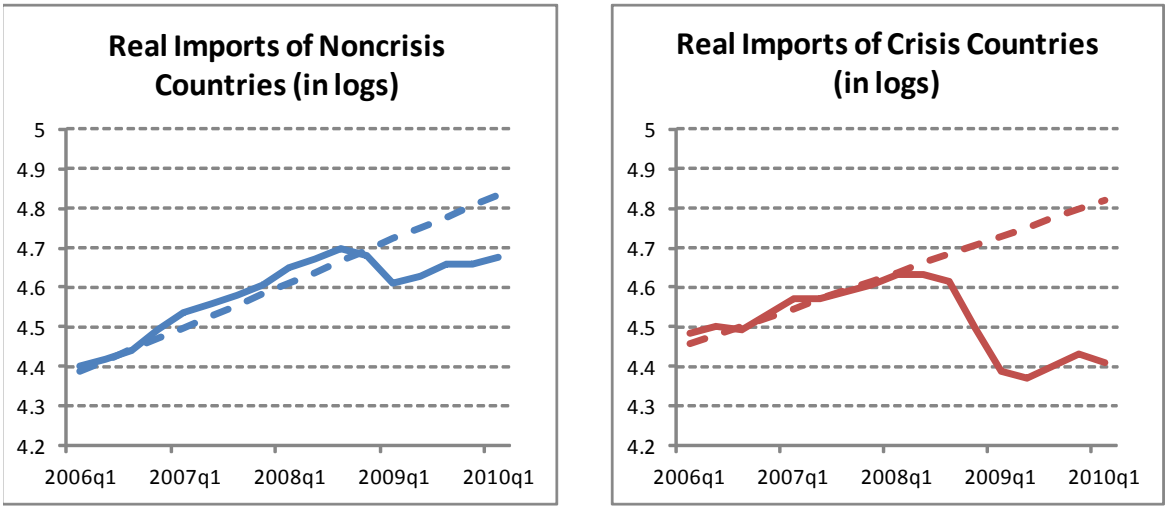
	Baseline	Country-Pair Controls	HMR	Aggregate	Cyclical/ Trend	Elasticity Crisis	Vary multilateral resistance	Domestic absorption	No 2007-2009 crises
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Importer: Crisis t	-0.089 ***	-0.058 ***	-0.047 ***	-0.04	-0.089 ***	-0.085 ***	-0.045 ***	-0.125 ***	-0.068 ***
	[0.015]	[0.017]	[0.017]	[0.028]	[0.015]	[0.015]	[0.014]	[0.016]	[0.016]
Importer: Crisis t-1	-0.191 ***	-0.146 ***	-0.136 ***	-0.086 **	-0.19 ***	-0.188 ***	-0.154 ***	-0.224 ***	-0.169 ***
	[0.016]	[0.018]	[0.018]	[0.033]	[0.016]	[0.016]	[0.015]	[0.016]	[0.017]
Importer: Crisis t-2	-0.14 ***	-0.119 ***	-0.109 ***	-0.081 **	-0.14 ***	-0.141 ***	-0.124 ***	-0.175 ***	-0.127 ***
	[0.016]	[0.019]	[0.019]	[0.035]	[0.016]	[0.016]	[0.017]	[0.017]	[0.017]
Importer: Crisis t-3	-0.113 ***	-0.099 ***	-0.093 ***	-0.054 *	-0.114 ***	-0.114 ***	-0.100 ***	-0.15 ***	-0.104 ***
	[0.016]	[0.019]	[0.019]	[0.030]	[0.016]	[0.016]	[0.018]	[0.017]	[0.016]
Importer: Crisis t-4	-0.119 ***	-0.102 ***	-0.102 ***	-0.055 **	-0.119 ***	-0.117 ***	-0.104 ***	-0.16 ***	-0.114 ***
	[0.016]	[0.019]	[0.019]	[0.028]	[0.016]	[0.016]	[0.018]	[0.017]	[0.017]
Importer: Crisis t-5	-0.105 ***	-0.088 ***	-0.09 ***	-0.058 **	-0.105 ***	-0.105 ***	-0.100 ***	-0.158 ***	-0.107 ***
	[0.016]	[0.019]	[0.018]	[0.029]	[0.016]	[0.016]	[0.017]	[0.017]	[0.016]
Importer: Crisis t-6	-0.095 ***	-0.096 ***	-0.101 ***	-0.063 **	-0.095 ***	-0.094 ***	-0.089 ***	-0.135 ***	-0.093 ***
	[0.016]	[0.018]	[0.018]	[0.029]	[0.016]	[0.016]	[0.017]	[0.017]	[0.016]
Importer: Crisis t-7	-0.081 ***	-0.079 ***	-0.084 ***	-0.063 **	-0.081 ***	-0.077 ***	-0.074 ***	-0.119 ***	-0.087 ***
	[0.015]	[0.018]	[0.018]	[0.027]	[0.015]	[0.015]	[0.017]	[0.016]	[0.016]
Importer: Crisis t-8	-0.083 ***	-0.075 ***	-0.083 ***	-0.064 **	-0.083 ***	-0.083 ***	-0.098 ***	-0.124 ***	-0.084 ***
	[0.015]	[0.018]	[0.018]	[0.025]	[0.015]	[0.015]	[0.016]	[0.016]	[0.016]
Importer: Crisis t-9	-0.055 ***	-0.054 ***	-0.058 ***	-0.049 **	-0.056 ***	-0.054 ***	-0.075 ***	-0.1 ***	-0.071 ***
	[0.015]	[0.017]	[0.017]	[0.024]	[0.015]	[0.015]	[0.015]	[0.015]	[0.016]
Importer: Crisis t-10	-0.032 **	-0.036 **	-0.043 ***	-0.021	-0.032 **	-0.028 **	-0.042 ***	-0.063 ***	-0.047 ***
	[0.014]	[0.017]	[0.017]	[0.022]	[0.014]	[0.014]	[0.014]	[0.015]	[0.015]
Exporter: Crisis t	-0.039 ***	0.009	0.018	0.018	-0.044 ***	-0.038 ***	0.069 ***	-0.037 **	-0.001
	[0.015]	[0.017]	[0.017]	[0.033]	[0.015]	[0.015]	[0.015]	[0.015]	[0.017]
Exporter: Crisis t-1	0.019	0.07 ***	0.078 ***	0.051 *	-0.001	0.021	0.120 ***	0.015	0.058 ***
	[0.015]	[0.018]	[0.018]	[0.031]	[0.016]	[0.015]	[0.017]	[0.016]	[0.017]
Exporter: Crisis t-2	0.037 **	0.078 ***	0.081 ***	0.046	0.026	0.037 **	0.118 ***	0.036 **	0.066 ***
	[0.016]	[0.019]	[0.019]	[0.035]	[0.016]	[0.016]	[0.019]	[0.017]	[0.017]
Exporter: Crisis t-3	0.01	0.048 **	0.052 ***	0.028	0.01	0.007	0.086 ***	0.01	0.031 *
	[0.016]	[0.019]	[0.019]	[0.037]	[0.016]	[0.016]	[0.020]	[0.017]	[0.017]
Exporter: Crisis t-4	0.011	0.049 **	0.048 **	0.027	0.015	0.011	0.102 ***	0.008	0.027
	[0.017]	[0.019]	[0.019]	[0.038]	[0.017]	[0.016]	[0.020]	[0.017]	[0.017]
Exporter: Crisis t-5	0.041 **	0.066 ***	0.064 ***	0.03	0.045 ***	0.037 **	0.126 ***	0.035 **	0.05 ***
	[0.016]	[0.019]	[0.019]	[0.037]	[0.016]	[0.016]	[0.020]	[0.017]	[0.017]
Exporter: Crisis t-6	0.038 **	0.076 ***	0.073 ***	0.014	0.042 ***	0.034 **	0.125 ***	0.035 **	0.041 **
	[0.016]	[0.018]	[0.018]	[0.033]	[0.016]	[0.015]	[0.020]	[0.016]	[0.016]
Exporter: Crisis t-7	0.042 ***	0.065 ***	0.066 ***	0.01	0.04 ***	0.041 ***	0.128 ***	0.036 **	0.033 **
	[0.015]	[0.018]	[0.018]	[0.031]	[0.015]	[0.015]	[0.020]	[0.016]	[0.016]
Exporter: Crisis t-8	0.035 **	0.056 ***	0.056 ***	-0.001	0.032 **	0.034 **	0.108 ***	0.033 **	0.023
	[0.015]	[0.018]	[0.018]	[0.030]	[0.015]	[0.015]	[0.019]	[0.016]	[0.016]
Exporter: Crisis t-9	0.041 ***	0.057 ***	0.061 ***	-0.019	0.035 **	0.043 ***	0.096 ***	0.038 **	0.018
	[0.015]	[0.017]	[0.017]	[0.032]	[0.015]	[0.014]	[0.017]	[0.015]	[0.016]
Exporter: Crisis t-10	0.018	0.02	0.026	-0.006	0.014	0.020	0.062 ***	0.018	-0.011
	[0.015]	[0.017]	[0.017]	[0.032]	[0.015]	[0.014]	[0.016]	[0.015]	[0.016]
R-suqared	0.87	0.74	0.74	0.98	0.87	0.87	0.88	0.87	0.87
Number of Observations	372,060	291,764	298,067	4,156	372,060	291,764	372,060	340,302	322,970
Number of Importer-Exporter Pairs	20003	13632	13918		20003	13632	20003	18457	19961

Note: All regressions except (2), (3) and (4) include year and import-exporter pair dummies. Robust standard errors clustered at the importer-exporter pair level in parentheses in all regressions except (4). Significance at the 1, 5, and 10 percent indicated by ***, **, and *, respectively. The dependent variable in all regressions except (4) is log(imports) at (importer, exporter, year) level. (1) is the baseline specification corresponding to Table A4. (2) and (3) include importer, exporter and year dummies, they do not include importer*exporter dummies; instead they include bilateral country-pair varying standard gravity controls. (3) uses the two-step methodology in Helpman-Melitz-Rubinstein (2008). (4) estimates a collapsed-gravity model, where imports and exports are aggregated across all trading parters and used as dependent variables. The coefficients on importer-crisis and exporter-crisis represent the cofficients from a regression of log(imports) and log(exports) respectively on crisis dummies and other controls. In (4), robust standard errors clustered at the country level in parentheses. (5) allows the elasticity of imports to GDP to vary between cyclical and trend components of GDP, (6) allows it to vary between crisis and non-crisis years. (7) allows the importer*exporter dummy to vary by decade to allow for time-varying multilateral resistance. (8) includes domestic absorption in importer country, rather than GDP. (9) includes only "pure" financial crisis episodes, i.e. excludes episodes accompanied by large depreciations in the definition of crisis. (10) includes data only until 2006.



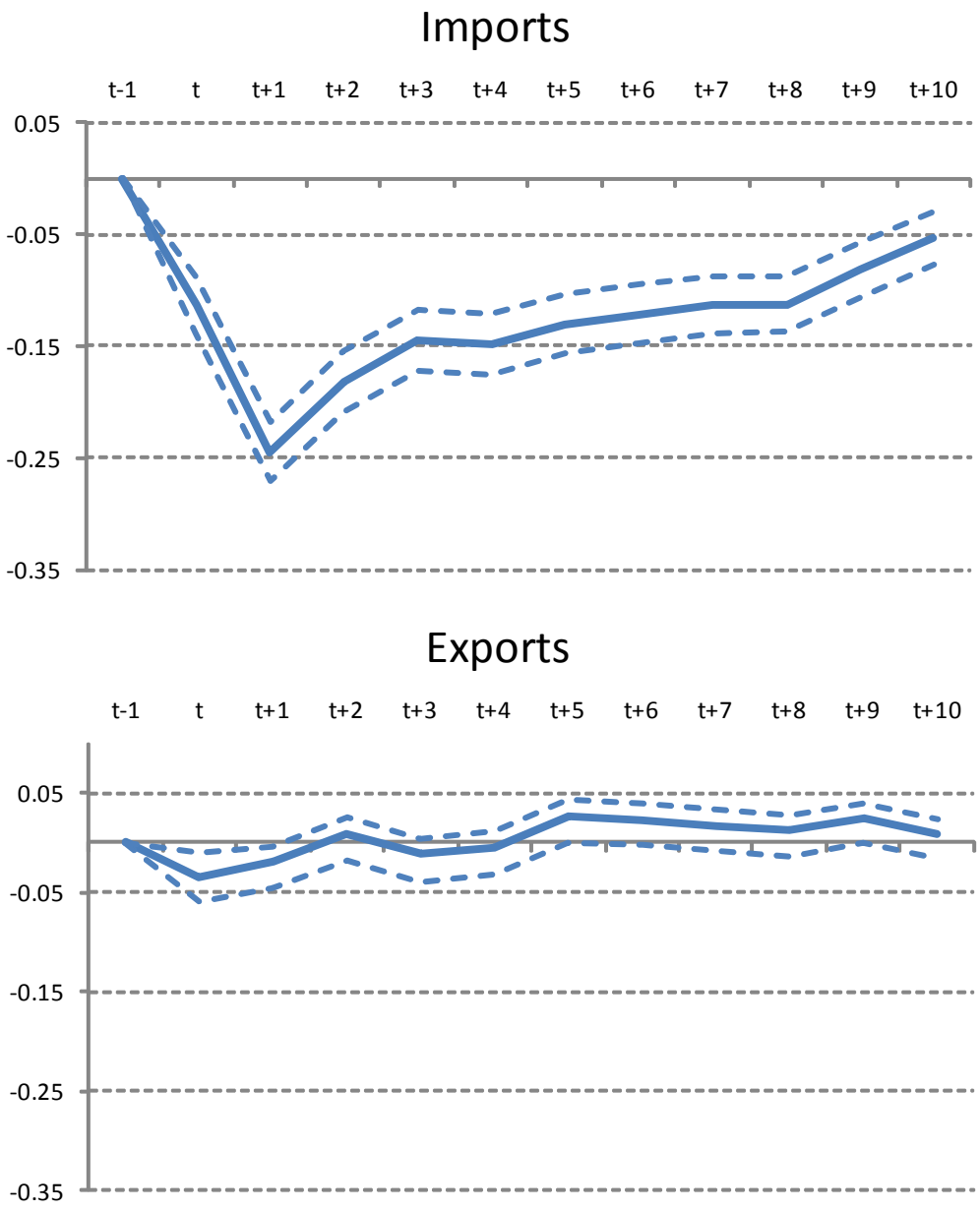
Source. CPB Netherlands Bureau of Economic Analysis.

Figure 2. Evolution of Imports in Banking Crisis and Non-Banking Crisis Countries



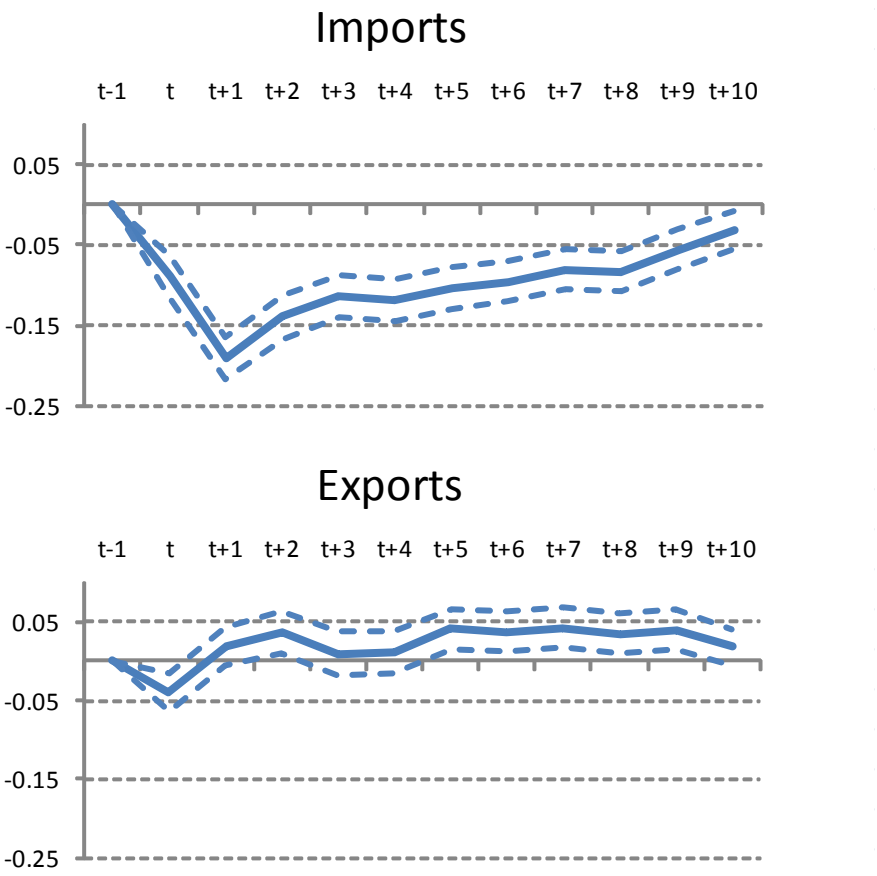
Note: Dashed line shows precrisis trend, based on 2001-2007 period. Crises are banking crises as defined by Laeven and Valencia (2010). Source. IMF Direction of Trade Statistics.

Figure 3. Evolution of Imports and Exports Following Crises: A First Look



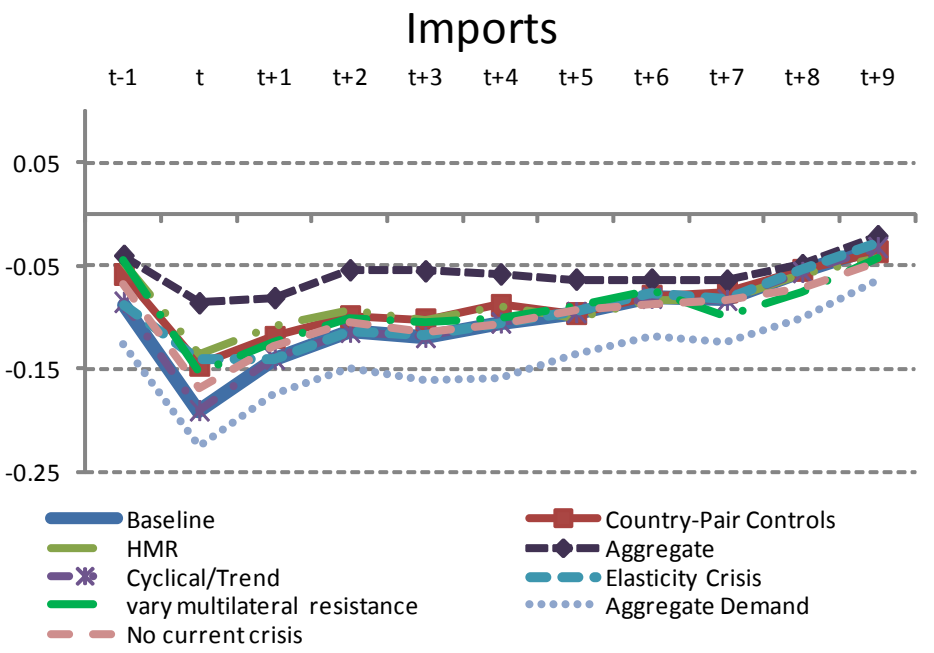
Notes. This figure shows the estimated coefficients from a regression of bilateral imports (in logs) on indicators of crisis in the exporter and importer, and ten lags of this indicator; the regression also includes exporter-importer pair dummies and year dummies. "t" , "t+1", "t+2" etc. represents the evolution of trade in "t", "t+1", "t+2" etc. following a crisis in year "t". The dotted lines show the 90% confidence interval around the estimated coefficients.

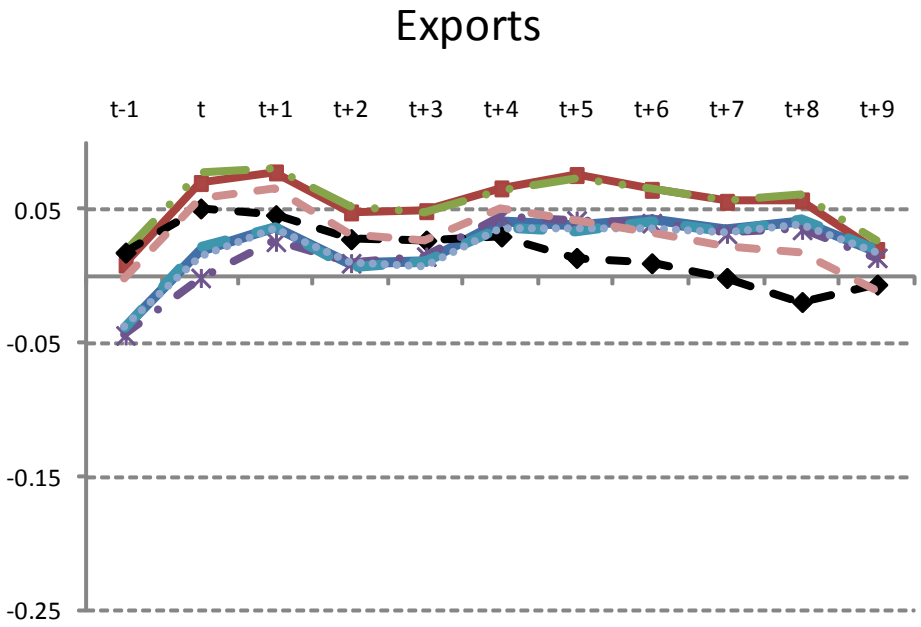
Figure 4. Evolution of Imports and Exports Following Crises: Gravity Model



Notes. This figure shows the estimated coefficients from the fully specified gravity model in equation (1) and Table 2. "t" , "t+1", "t+2" etc. represents the evolution of trade in "t", "t+1", "t+2" etc. following a crisis in year "t". The dotted lines show the 90% confidence interval around the estimated coefficients.

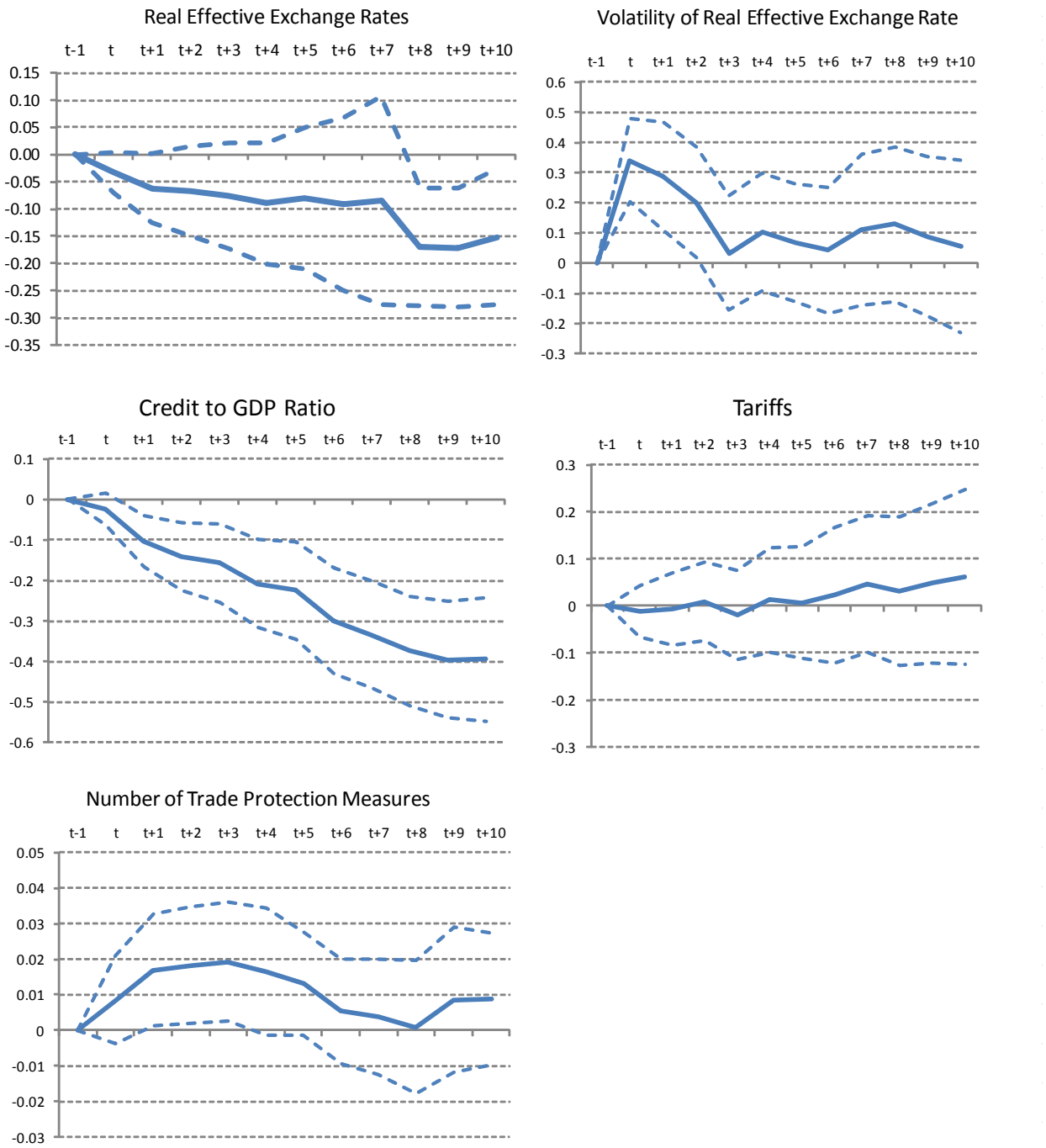
Figure 5. Evolution of Imports and Exports Following Crises: Robustness





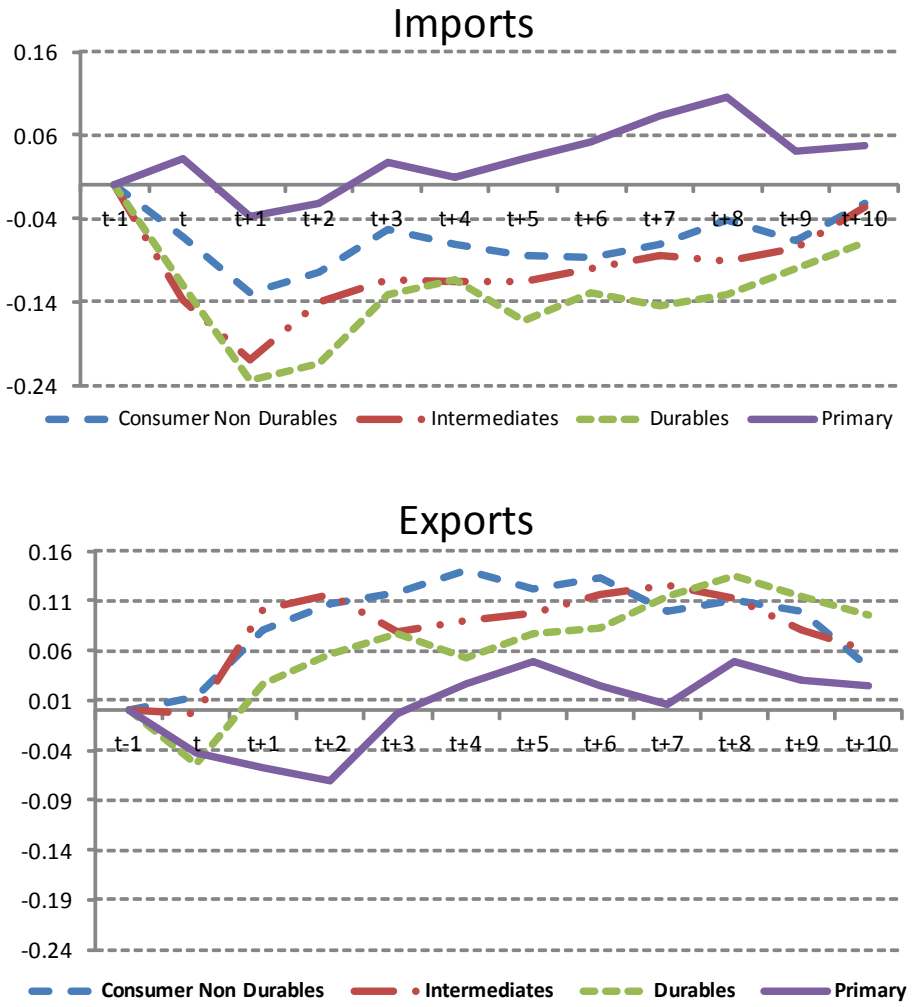
Notes. This figure shows the coefficient estimates of crisis dummies from various robustness tests conducted in Table A3. "t" , "t+1", "t+2" etc. represents the evolution of trade in "t", "t+1", "t+2" etc. following a crisis in year "t".

Figure 6. Why a Persistent Drop in Imports Following Crises?



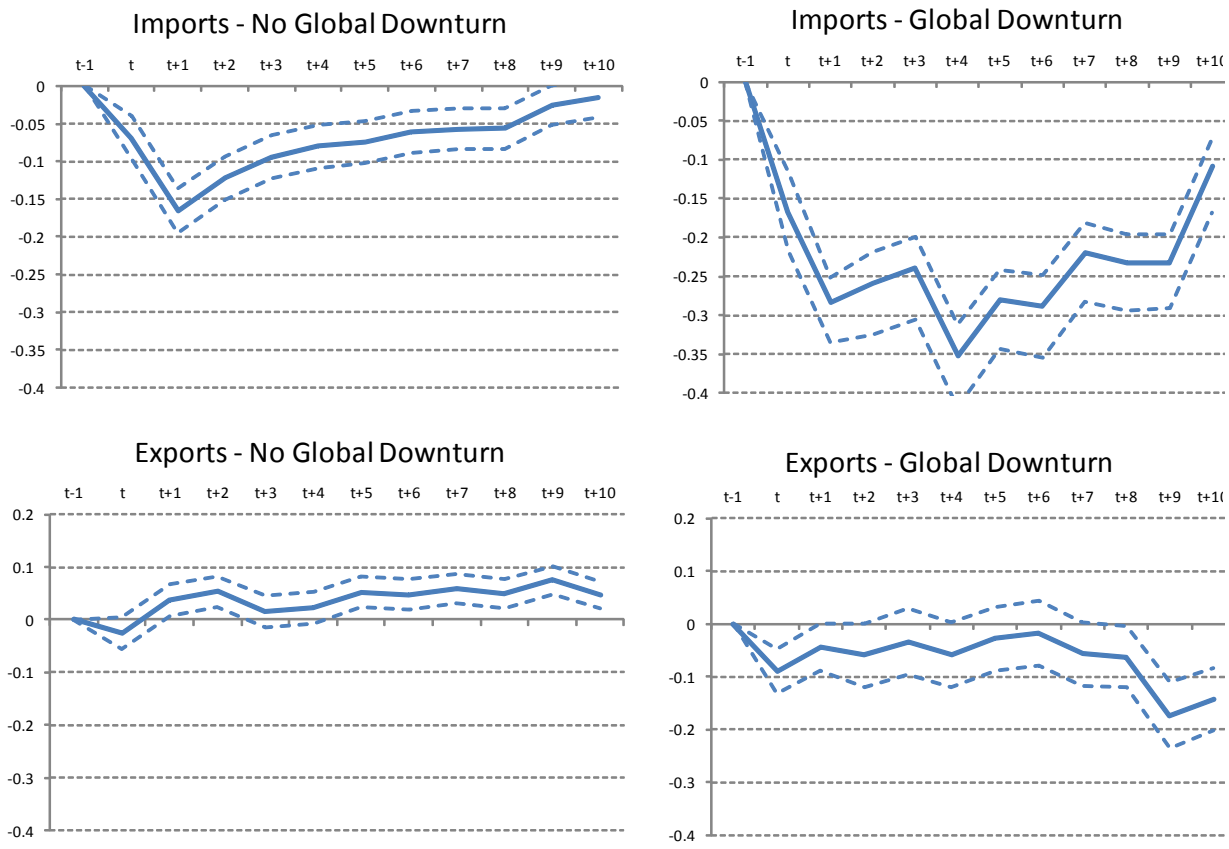
Notes. Each chart plots the impulse response function of the variable stated on top of the chart to financial crises, estimated using equation (3). "t" , "t+1", "t+2" etc. represents the evolution of the channel in "t", "t+1", "t+2" etc. following a crisis in year "t". The dotted lines show the 90% confidence interval around the estimated coefficients.

Figure 7. Evolution of Imports and Exports for Different Product Categories



Notes. This figure shows the coefficient estimates of crisis dummies from the fully specified product-level gravity model in equation (4). "t" , "t+1", "t+2" etc. represents the evolution of trade in "t", "t+1", "t+2" etc. following a crisis in year "t". The classification into product groups follows Pula and Peltonen (2009).

Figure 8. Evolution of Imports and Explorts Following Crises During Global Downturns



Notes. This figure shows the coefficient estimates of crisis dummies from the fully specified gravity model in equation (5), allowing the coefficients on crisis dummies to vary in years of global downturn. The years of global downturn are 1975, 1982, 1991, 2001 and 2008. "t" , "t+1", "t+2" etc. represents the evolution of trade in "t", "t+1", "t+2" etc. following a crisis in year "t". The dotted lines show the 90% confidence interval around the estimated coefficients.