

The Financial Crisis, Trade Finance and the Collapse of World Trade

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The financial crisis that began in August 2007 and intensified in the fall of 2008 pushed the global economy into its most severe recession since World War II. As 2009 drew to a close, there were signs that economic activity in many countries was rebounding, but the fragile state of many countries' financial systems and concerns about how governments and central banks will manage the exit strategies from the extraordinary measures taken to mitigate the worst effects of the crisis leave many open questions about the ultimate course of the recovery. World trade collapsed in 2008–09 at a pace not seen since the Great Depression, raising concerns that the financial crisis would lead to deglobalization—a reversal of the globalization that has characterized the past three decades. As global economic activity has rebounded, trade flows have picked up as well, allaying some of these fears. But the scale and the speed of the collapse of global trade warrants investigation and poses a challenge for some standard models of international economics.

In this essay I will discuss the impact that the crisis had on world trade. I will then review two explanations for the severity of the collapse. One line of argument holds that given the normal behavior of trade flows over the course of the business cycle and given the severity of this most recent cyclical downturn, a major contraction of world trade should have been expected. A second line of argument, which is not incompatible with the first,

holds that the financial crisis had an independent effect on trade flows, over and above the effect it had on global economic activity, by limiting or severing access to trade finance. We will see that the decline in trade was excessive, even given the severity of the recession. And there is evidence that reduced access to trade finance is an important part of the overall explanation.

What Has Happened to Global Trade?

Despite the recent increase in the importance of international trade in services—long considered the quintessential nontradable—the bulk of international trade still consists of trade in goods and commodities. Each month the CPB Netherlands Bureau for Economic Policy Analysis produces a report on global trade in goods, along with a breakdown for the major groupings. Chart 1 shows the time series of global exports of goods since January 1991, when the series began. Following steady growth over most of the past decade, global exports peaked in the first half of 2008 (specifically, in April 2008) and then posted a precipitous 20 percent decline through the early months of 2009. (The trough month was January 2009, but exports hovered at close to their January level through May 2009.)¹ As economic activity in many parts of the world started to recover in the latter half of 2009, trade volumes picked up, and at the time of writing, the volume of trade had increased 15.5 percent from May through December 2009.

What was extraordinary about this trade collapse was its scale and breadth. The 20 percent decline from peak to trough in the series in Chart 1 is the biggest in the history of that specific measure. Global trade declined during the 2001 recession, but only by 7 percent. Other measures of global trade with a longer time series show that the decline was the largest since World War II, indeed the largest since the Great Depression.²

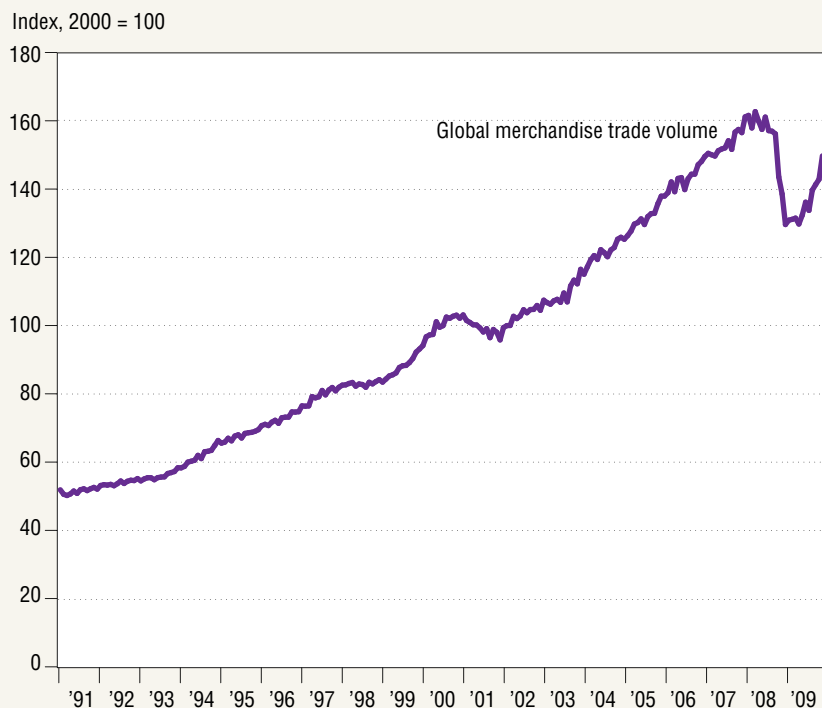
Furthermore, the trade collapse was widespread. As Table 1 shows, the collapse was not confined to the advanced economies that were at the epicenter of the financial crisis, but encompassed the emerging economies as well. Exports of the advanced economies—defined here as the Organization for Economic Cooperation and Development (OECD) excluding Turkey, South Korea and Mexico—peaked in April 2008 and then declined 23.3 percent through January 2009.

Japan's exports peaked earlier and saw by far the largest decline, while U.S. exports peaked a bit later. Exports of the emerging economies also peaked in April 2008, with central and eastern Europe and Latin America peaking in January 2008, whereas Asian exports did not peak until July. By early 2009, exports had turned around in most regions of the world, with Latin America being the last to experience recovery. Just as Japan experienced the most severe downturn, so too has it experienced the sharpest rebound. But the advanced economies as a whole seem to be lagging, held back in particular by the weak recovery of euro-area exports.

Why Did Trade Collapse?

Many explanations have been proposed for the scale of the collapse in trade. One immediate concern was that countries were raising tariff and nontariff barriers to trade flows to protect domes-

Chart 1
Global Trade Posts Historic Drop



SOURCE: CPB Netherlands Bureau for Economic Policy Analysis *World Trade Database*.

Table 1
Financial Crisis Takes Widespread Toll on World Exports

	Peak month	Trough month	Peak to trough (percent change)	Trough to December 2009 (percent change)
Advanced economies	April 2008	January 2009	-23.3	12.6
U.S.	July 2008	April 2009	-24.7	20.2
Euro area	April 2008	February 2009	-23.1	8.4
Japan	January 2008	March 2009	-41.4	40.3
Emerging economies	April 2008	January 2009	-21.5	22.0
Asia	July 2008	January 2009	-24.7	29.5
Latin America	January 2008	August 2009	-21.1	20.9
Central and eastern Europe	January 2008	May 2009	-30.8	12.9
Africa and Middle East	April 2008	April 2009	-12.8	8.5

SOURCE: CPB Netherlands Bureau for Economic Policy Analysis *World Trade Monitor*, December 2009.

There is very little evidence to date that this protectionist rhetoric translated into more restrictive trade policy.

tic industries from the worst of the downturn. While there was a very real increase in protectionist rhetoric over the course of 2008 and 2009, there is very little evidence to date that this rhetoric translated into more restrictive trade policy. Evenett (2009) is less sanguine on this topic, noting a steady increase in the number of protectionist measures implemented during 2009. He finds that for several advanced economies the share of goods affected by beggar-thy-neighbor policies exceeds precrisis levels. However, given the short history and nature of the data upon which this assessment rests, it is difficult to know how important the effects are at the aggregate level. Importantly, Evenett also notes that "... few governments have introduced anything like across-the-board discrimination against foreign commercial interests; in this respect, the world economy is still far from a 1930s-style protectionist outcome."

Policymakers seem to have absorbed the lesson of the Great Depression, when protectionist trade policy exacerbated the downturn.³ Meeting in London in April 2009, the leaders of the Group of Twenty publicly declared that they would "... not repeat the historic mistakes of protectionism of previous eras." In the most recent report from the OECD, the U.N. Conference on Trade and

Development and the World Trade Organization on trade and investment policy responses to the downturn in the G-20, it was noted that the responses so far have been "relatively muted" (OECD, UNCTAD, WTO 2010). In the period October 2008 to October 2009, new import-restricting measures introduced by the members of the G-20 covered about 1.3 percent of G-20 imports (0.8 percent of global imports). In the more recent period from September 2009 through February 2010, new import-restricting measures covered 0.7 percent of G-20 imports. The report also noted that no major measures had been identified as reducing market access among the G-20 members in the service sector, although it did draw attention to the potentially distortionary effects of government support for the transportation and financial sectors in a number of countries.

To get a sense of what constitutes the normal behavior of trade over the course of the business cycle, it is useful to look at the time series behavior of trade and economic activity in tandem. Chart 2 plots the growth rate of global real gross domestic product (GDP) and the growth rate of global exports of goods and services over the past 25 years. Two points are worthy of note. First, global exports tend to move in tandem with global GDP: The cor-

relation between the growth rates of the two series over the sample period is 0.84. That is, exports are procyclical: They tend to boom when real economic activity is booming and to slump when real economic activity is slumping. Second, global exports are a lot more volatile than global GDP.

The standard deviation of the growth rate of global GDP from 1986 to 2009 was 1.3 percent, while the standard deviation of the growth rate of global exports over the same period was 4.6 percent.

We see the same pattern at the level of individual countries. Engel and Wang (2007) report a series of statistics on trade patterns in the OECD countries and show that the median (across countries) correlation between the cyclical components of imports and GDP is 0.61, while the median correlation between the cyclical components of exports and GDP is 0.45. Likewise, they show that imports are about three times more volatile than GDP in

the OECD countries, while exports are 2.7 times more volatile than GDP.⁴

Why is that? Part of the reason appears to be that despite recent innovations the composition of international trade is still heavily skewed toward goods rather than services. Approximately 80 percent of all global trade consists of trade in goods, and this share has remained remarkably stable over time. By contrast, the share of goods in global GDP has declined by about 10 percentage points over the past four decades, from about a half in 1970 to slightly more than one-third in recent years. Close to 70 percent of U.S. exports by value are exports of goods, while goods make up about 84 percent of U.S. imports (by value). By comparison, goods production accounts for only about one-fifth of overall production in the United States (measured as a share of value added).⁵ Furthermore, the goods traded across international

The world economy is still far from a 1930s-style protectionist outcome.

Chart 2
International Trade Moves with the Business Cycle



SOURCE: International Monetary Fund *World Economic Outlook*, January 2010 Update.

Some of the decline in trade was a natural cyclical phenomenon.

borders tend to be durable rather than nondurable. Table 4 of Engel and Wang (2007) reports the share of durable goods in the imports and exports of the OECD countries and shows that the median share in recent decades has been around 60 percent.

So, international trade flows tend to move with the business cycle; indeed, they tend to increase by more in good times and decline by more in bad times than the rest of the economy. It should not then come as a great surprise that international trade flows have dried up in the midst of the most severe global recession since World War II. Far from telling us about incipient deglobalization, as some feared at the time, some of the decline in trade was a natural cyclical phenomenon.

The Excess Trade Collapse

It appears that the decline in trade was greater than one might have expected, given what happened over the same period to the usual determinants of trade flows, specifically the relative price of the traded goods and the level of economic activity. For example, following Chinn (2009), Wynne and Kersting (2009) estimate a simple model of U.S. import demand that relates real imports of goods and services into the United States to U.S. real GDP and the real value of the dollar. *A priori* one would expect imports to be positively related to real GDP and negatively related to the real value of the dollar, and a simple model along these lines does a reasonably good job at capturing the quarter-to-quarter changes in the growth of U.S. imports over the past three decades. However, the model predicted a decline in U.S. imports of 3.7 percent in first quarter 2009, but the actual decline (in the vintage of data used in the Wynne and Kersting study) was 11.3 percent.⁶

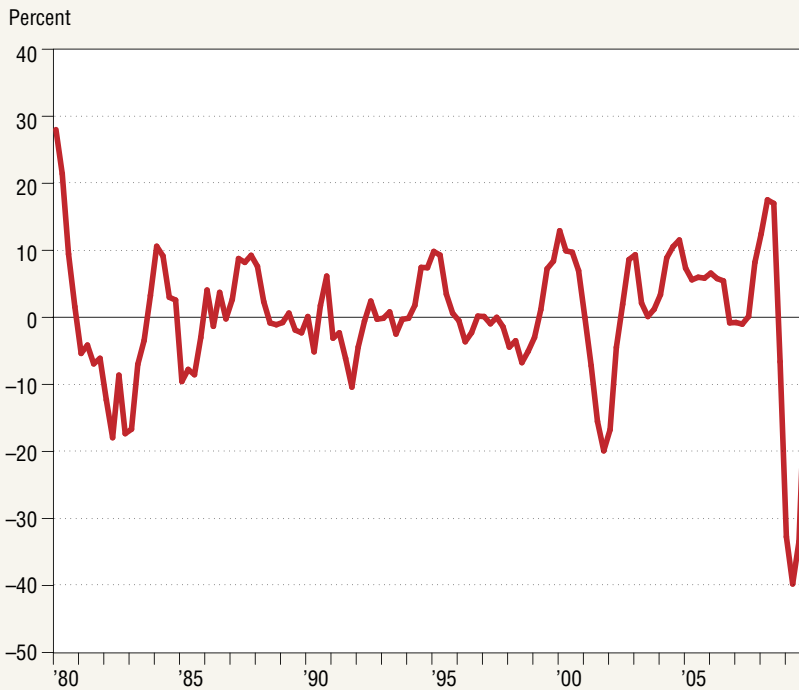
A similar exercise is reported in Levchenko, Lewis and Tesar (2009). However, rather than estimate an import demand equation for the United States, they perform a “wedge accounting” exercise of the sort pioneered by Cole and Ohanian (2002)

in their study of the Great Depression and Chari, Kehoe and McGrattan (2007) in their study of postwar U.S. business cycles.⁷ Levchenko, Lewis and Tesar start with demand relationships that express domestic consumption of foreign output (or imports) as a function of the price of foreign goods relative to domestic goods (with a constant elasticity) and the scale of domestic economic activity (with a constant elasticity of unity). They then calculate for each quarter since 1968 how far actual trade flows are from the levels predicted by these demand relationships. They report that in second quarter 2009, U.S. imports were a lot lower than would have been predicted based on this simple relationship. In Chart 3 I show my own estimates of the trade wedge over the same period. The collapse in 2009 stands out. The trade wedge, the deviation of trade from levels predicted by relative prices and the level of economic activity, was –33 percent in the first quarter of 2009 and –40 percent in the second. This suggests that the financial crisis had a more direct impact on trade flows, over and above the effect it had through the decline in economic activity. Why? One possibility is that stress in the financial system caused financial institutions to cut back on trade finance to exporting firms.

Access to Trade Finance as an Explanation

Before proceeding, we might pause to ask exactly what trade finance is.⁸ The broadest definition of trade finance includes every kind of loan, insurance policy or guarantee that is directly tied to an international sale of a good or service. This definition captures anything from direct trade credit extended by an exporter to an overseas customer to government-backed guarantees issued by a country’s official export credit agency. The other key institutions involved in trade finance are commercial banks, multilateral development banks and private insurers. In addition, various trade finance instruments are used to insure against risks

Chart 3
The Trade Wedge Illustrates 2009 Collapse



SOURCES: Bureau of Economic Analysis; author's calculations.

The form that trade finance takes will typically depend on the degree of trust between the two parties engaged in trade and the degree to which one or both parties is dependent on bank financing.

arising from international transactions, such as commercial risk, transportation risk and political risk. According to some estimates, about 80 to 90 percent of global trade relies on trade finance, and most of this finance is short-term in nature.⁹

The form that trade finance takes will typically depend on the degree of trust between the two parties engaged in trade and the degree to which one or both parties is dependent on bank financing. Transactions that involve only the exporter and importer can be done on a cash-in-advance basis (where the importer pays the exporter before the goods are shipped) or on an open-account basis (where the exporter is paid after the goods are shipped to the importer). The latter arrangement constitutes an extension of trade credit in the usual sense by the exporter to the importer. Cash in advance is used mainly when the importer has particularly high credit risk or is located in a

country with high political risk. Cash in advance is least risky from the perspective of the exporter and most risky from the perspective of the importer. The allocation of risks is reversed when the transaction takes place on open account.

Between these two extremes, banks offer a variety of products to offset the risk of nonpayment or nondelivery. A letter of credit is a commitment by a bank on behalf of the importer that payment will be made as soon as the terms and conditions in the letter are satisfied. With a letter of credit, the exporter need no longer be concerned about the creditworthiness of the importer, but only with the creditworthiness of the issuing bank. However, letters of credit are typically the most expensive form of trade finance. A less expensive option is documentary collection, where the exporter uses a bank as its agent to collect payment from the importer once it presents the shipping documents

While exporters everywhere were confronted with higher trade finance costs, the decline in trade finance availability occurred primarily in the emerging markets.

to the bank. While the bank facilitates payment of the exporter, it does not offer any guarantee, so documentary collection is typically cheaper than a letter of credit. Banks also offer export credit insurance when goods are sold on open account and also finance exports through working capital loans.

What can we say quantitatively about the impact of the financial crisis on the availability of trade finance? Surprisingly little, it turns out. There are no comprehensive measures of the volume of trade finance outstanding or indicators of its cost or availability. Such measures as do exist provide at best a partial picture of what is happening. As Auboin (2009) notes, at present the only source of reliable data on trade finance is the Berne Union database, which covers trade credit insurance. When concerns about the availability of trade credit were at their peak in the fall of 2008, the International Monetary Fund conducted a survey of major banks in emerging markets and advanced economies in conjunction with the Bankers' Association for Finance and Trade to get a more complete picture of the state of trade finance.¹⁰ More than 70 percent of the banks surveyed noted that the prices of letters of credit had risen relative to 2007, while more than 90 percent reported higher rates for short- and medium-term lending facilities where the goods exported served as collateral. Unsurprisingly, most of the survey respondents attributed the higher prices to their increased cost of funds. While exporters everywhere were confronted with higher trade finance costs, the decline in trade finance availability occurred primarily in the emerging markets. Trade among advanced economies seemed largely unaffected by the availability (or otherwise) of trade finance, while the availability of financing for imports from South Asia, South Korea and China had decreased sharply.

Research by Iacovone and Zavacka (2009) shows that banking crises generally do have an impact on exports. They disentangle the effects of banking crises from the effects of other types of shocks that might affect exports (specifically,

demand shocks) and find that the exports of manufacturing sectors that are more dependent on external finance tend to grow significantly more slowly than other sectors during a banking crisis. However, what appears to be key is dependence on bank finance as opposed to other forms of external finance (for example, trade credit), which would be consistent with the idea that the availability of trade finance declines during banking crises. Iacovone and Zavacka also find that sectors with more tangible assets that can be used as collateral also tend to do better in terms of maintaining exports during a banking crisis.¹¹

Additional historical evidence that access to trade finance has important implications for firms' exports is provided by Amiti and Weinstein (2009). They use a unique Japanese data set that allows them to match banks to individual firms to examine the consequences of the Japanese financial crises of the 1990s for Japanese manufacturing exports over that decade. Japanese exports declined 6.7 percent in 1993 and 7.1 percent in 1999.¹² The first decline came on the heels of the first round of bank problems following the bursting of the stock price and real estate bubbles in 1989 and 1991, respectively. The second decline in exports was preceded by an intensification of the financial crisis in late 1997 that culminated in the nationalization of the Long-Term Credit Bank (at the time the eighth-largest bank in the world) at the end of 1998. For each firm in their sample, which covers the period 1986 to 1999, they are able to identify its main "reference bank," which is the bank that would typically handle the firms' payment settlement and foreign exchange dealings, that is, trade finance needs. Amiti and Weinstein find a statistically significant relationship between the health of these banks (as measured by changes in their market-to-book ratios) and firms' export growth. Specifically, a deterioration in the health of a firm's main reference bank is usually followed within a year by a decline in its exports. They also find that while a deterioration in bank health also has a det-

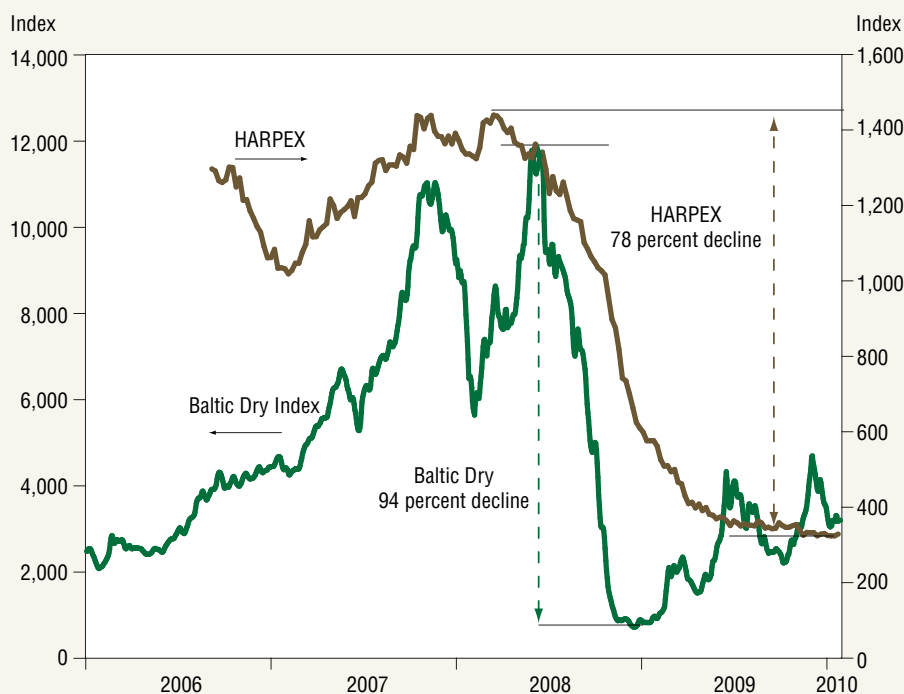
Trade and Shipping

With the collapse of global trade, there was a simultaneous collapse in the demand for shipping services to transport goods internationally. According to media reports, by the summer of 2009 almost 10 percent of the global merchant shipping fleet (container ships, bulk carriers, tankers, car carriers and so on) had been laid up due to the collapse in trade. Naturally this manifested itself in shipping costs. While we do not have a good comprehensive measure of what it costs to ship goods around the world, the chart shows the recent behavior of two closely watched indexes. The Baltic Dry Index tells us what is going on in one segment of the shipping market, namely that for dry bulk commodities such as coal, iron ore and grain. After peaking at 11,793 on May 20, 2008, the index collapsed to 663 on Dec. 5, 2008 (a decline of just over 94 percent), before posting gradual improvements over the course of 2009 and into 2010. The HARPEX index, produced on a weekly basis by the shipbroking firm Harper Petersen, is a measure of the cost of shipping containers. Unlike the Baltic Dry Index, it has yet to show signs of a recovery. As of Jan. 1, 2010, the HARPEX index stood at 317.44, down from a precrisis peak of 1,444.62. The differential behavior of the two cost indexes over the past year as trade volume picked up is interesting and probably reflects

capacity problems in the container liner services. This segment of the shipping market, which accounts for close to two-thirds of the market for seaborne trade, expanded dramatically as supply chains became more globalized.

Movements in shipping costs reflect a number of factors. The capacity of the global merchant shipping fleet adjusts only slowly in response to increased demand due to greater trade volumes. Rapid growth in the demand for shipping capacity to move raw materials to China and other emerging markets is believed to have been instrumental in the run-up in the Baltic Dry Index in 2007 and 2008. However, higher energy prices probably also played a role. Oil prices, as measured by the price of West Texas Intermediate, peaked at \$145.66 a barrel on July 11, 2008. (Prices of fuel oil—No. 2 New York—peaked the same day at \$4.0425 a gallon.) The peak in oil prices came just two months after the peak in the Baltic Dry Index, and then the two series declined dramatically over the remainder of 2008. Both series have since shown a steady improvement. The tight correlation between the two series suggests that oil prices are an important component of overall shipping costs. But it is also consistent with both series being driven by a common third factor—global economic activity.

Shipping Costs Reflect Global Economic Activity



SOURCES: Harper Petersen and Co.; Bloomberg.

The availability of trade finance declines during banking crises.

perimental effect on domestic sales, the effect is a lot smaller than the effect on exports, consistent with the view that exporting is a particularly finance-dependent activity due to its greater riskiness.

But is there any evidence that the drying up of trade finance contributed to the excessive decline in global trade during the recent crisis? Levchenko, Lewis and Tesar (2009) investigate the possibility that a collapse of trade credit was a key determinant of the collapse of U.S. imports and exports over the period June 2008 through June 2009 by examining import and export performance over a large number of sectors and asking whether those sectors that are most dependent on trade credit or most willing to extend it saw larger declines. They are unable to find any statistically significant relationship, and they conclude that a collapse of trade credit is not a plausible candidate for explaining the excess decline.

However, this finding needs to be interpreted with caution. The terms trade credit and trade finance are often used interchangeably, but as we have noted above, there are important differences.¹³ The term trade credit is best defined as credit created or extended by a nonfinancial firm to one of its customers when there is a mismatch in time between when goods are ordered and delivered and when they are paid for. Trade credit in this sense is reflected in the accounts receivable on a firm's balance sheet (with a matching amount showing up in the accounts payable on the customer's balance sheet.) Levchenko, Lewis and Tesar (2009) employ exactly such measures of trade credit (either accounts payable relative to the cost of goods sold or accounts receivable relative to total sales) to assess whether a contraction in trade credit played an important role in the contraction of global trade. Of course, such measures do not distinguish between trade credit extended to domestic customers (or received from domestic vendors) and trade credit extended to foreign customers (or received from foreign vendors). Trade finance, as it pertains to international trade, is best

understood as the entire array of financial products that serve to facilitate international trade. This includes—in addition to that portion of trade credit extended to or received from foreign customers or vendors—bank loans to finance working capital to produce for export; letters of credit; insurance; and the host of other financial products that exist to mitigate the risks associated with international trade.

Some indirect evidence that access to trade finance was indeed a critical factor contributing to the 2008–09 decline in global trade is presented by Chor and Manova (2009). Their idea is to use interbank lending rates in different countries as a measure of the cost of external capital (including trade finance) to firms. They interpret higher interbank rates as being indicative of tighter credit markets, and they document that countries with higher rates tend to export less to the United States. Of course, the need to access external finance varies across sectors, as does the ability to post collateral for loans or the ability to obtain trade credit. Chor and Manova show that countries with tighter credit conditions suffered a larger decline in exports to the United States during the crisis, and these effects were most apparent in the sectors that were most dependent on external finance, had the fewest collateralizable assets or had the least access to trade credit from trade partners. Based on reduced-form estimates, they conclude that “... U.S. imports would have fallen by 25.6% more if interbank rates had remained at their peak September 2008 level through April 2009, essentially doubling the actual percentage decline in trade volumes observed after September 2009.”

The findings of Chor and Manova are consistent with the findings of Bricongne et al. (2009) for French exporters. They look at the performance of about 100,000 individual French exporters through April 2009 and find that firms in sectors more structurally dependent on external finance experienced the biggest declines in exports. However, their data do not allow them to distin-

guish between finance for international trade and finance for generic working capital.

So, evidence in support of the trade finance story is, at best, suggestive. A more conclusive evaluation of the idea will depend on better measures of trade finance becoming available. But the evidence does highlight the need for a better understanding of finance's role in facilitating international trade and points to the existence of a financial accelerator for exports similar to that generally believed to exist for real economic activity.

Conclusions

In 2008–09, global trade collapsed at a pace not seen since the Great Depression, raising concerns in some quarters that the globalization of the past three decades was going to be reversed. Global trade has since recovered (although it has yet to attain its precrisis level), and to date there seems to have been limited use of protectionist measures. However, given the prospect of elevated unemployment levels in many countries for some time to come, the pressures to engage in some form of protectionism will remain and will continue to pose a threat to free trade. Much of the decline in trade can be explained by the severity of the downturn in economic activity. But some of the decline was excessive, over and above what would have been warranted by the collapse in activity.

In this essay, I have focused on limited access to trade finance as a possible explanation for the excessive decline. Existing models of international trade do not assign a prominent role to access to trade finance as an important determinant of trade. And data limitations make it very difficult to determine just how important a role trade finance plays empirically. But the limited evidence available suggests that access to trade finance is an important determinant of a firm's ability to export and that the declines in exports to the United States were greatest among firms in countries where access to finance was already limited and for firms that were most dependent on external

finance, had the fewest collateralizable assets and had the least access to trade credit.

Finance is often viewed as a veil on the engine of the real economy, but as has been observed, “when the veil flutters, the engine sputters.” The collapse of global trade in 2008–09 has drawn attention to the little-studied area of trade finance and the important role it plays in facilitating global commerce.

—Mark Wynne

Notes

¹ An alternative measure of global trade from the OECD's Main Economic Indicators tells a similar story. After peaking at \$2.606 trillion (measured in year 2000 dollars) in first quarter 2008, global imports of goods and services declined to a low of \$2.164 trillion in second quarter 2009 (a decline of just under 17 percent), before rebounding in the third quarter. The OECD's measure of global exports of goods and services peaked at \$2.572 trillion (2000 dollars) in second quarter 2008. This was not all that different from the first quarter figure of \$2.271 trillion. The exports measure bottomed out at \$2.160 trillion in second quarter 2009 (a decline of 16 percent) and subsequently rebounded. The OECD measure has the advantage of including trade in services as well as having a longer time series than the CPB measure. However, it tends to lag the CPB series in terms of availability and also relies more heavily on projections for a number of countries rather than actual published data.

² For example, the measure of global exports reported as part of the International Monetary Fund's International Financial Statistics database, which starts with April 1949, showed exports declining by 25 to 30 percent (on a 12-month basis) each month from January through August 2009. The only declines of comparable magnitude in this measure occurred in 1956, when exports fell about 20 percent each month from June through December. However, these statistics measure nominal rather than real trade volumes. The measure of global exports of goods and services that the OECD reports as part of its Main Economic Indicators is a real series (measured in constant 2005 dollars). This series starts in first quarter 1970. In the first and second quarters of 2009, global exports as measured by this series posted declines in excess of 14 percent (on a four-quarter basis) in both quarters, the largest declines in the series' history.

³ The extent to which the resort to protectionism during the Great Depression contributed to the severity of the Depression is the subject of some controversy. Mario Crucini and James Kahn (1996) were the first to conduct a quantitative analysis of tariffs' contribution to the decline in economic

Much of the decline in trade can be explained by the severity of the downturn in economic activity. But some of the decline was excessive, over and above what would have been warranted by the collapse in activity.

activity during the Great Depression. They showed that even when international trade constitutes a small share of aggregate output, tariffs and other trade barriers can have a significant negative effect on GDP if the goods that are traded are used as intermediate inputs in production. They conclude that the tariff war during the 1930s could have reduced U.S. gross national product by as much as 2 percent.

⁴ The statistics that Engel and Wang (2007) report are based on Hodrick–Prescott filtered data with smoothing parameter of 1600.

⁵ Goods production (defined as the sum of agriculture, mining, construction and manufacturing) accounts for a slightly higher share of gross output, closer to 30 percent.

⁶ The most recent vintage of the National Income and Product Accounts puts the decline of first quarter 2009 at 10.7 percent.

⁷ See also Ahearne, Kydland and Wynne (2005) and Cociuba and Ueberfeldt (2008) for examples of wedge accounting exercises, albeit in closed-economy frameworks.

⁸ See chapter 18 of Bekaert and Hodrick (2009) for a lengthy exposition of various options for financing international trade, or see U.S. Department of Commerce (2008).

⁹ See, for example, Auboin (2009).

¹⁰ See Dorsey (2009) and International Monetary Fund (2009).

¹¹ According to Table 2 of Iacovone and Zavacka, tangible assets are 62 percent of the total assets of firms in the petroleum refining sector but a mere 14 percent of assets in the office and computing sector.

¹² Exports also declined 1.8 percent in 1998 but posted increases in every other year of the decade.

¹³ See also the discussion in footnote 2 of Amiti and Weinstein (2009) on the differences between the accounting and finance uses of these terms.

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