

# Trade Credit and International Trade During the Global Financial Crisis\*

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July 28, 2010

**PRELIMINARY. PLEASE DO NOT CITE.**

## Abstract

This paper studies the role of the credit crunch at the height of the global financial crisis in the severe contraction of trade and economic activity using firm-level data from a number of emerging market economies in East Asia. We find that, although the dire financial conditions during the crisis adversely affected the sales of all firms, sales declined by less for firms with better pre-crisis financial conditions. In the face of the decline in external financing opportunities, some firms relied more on trade credit to supplement operating capital, and firms that were able to replace external finance with trade credit had better sales performance. In contrast to domestically-oriented firms, export-intensive firms with comparable financial vulnerability resorted less to trade credit as an alternative source of finance, and experienced sharper declines in sales. This finding provides an explanation for the disproportionately large decline in international trade during the crisis.

**JEL classification:** F23, F41, F42, G32

**Keywords:** financial crisis, trade credit, international trade.

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\*We are grateful to seminar participants at the Federal Reserve Board for helpful comments. We also thank Karan Jain, Kavita Patel, and Peter Weyand for excellent research assistance. Correspondence: [Brahima.Coulibaly@frb.gov](mailto:Brahima.Coulibaly@frb.gov), [Horacio.Sapriza@frb.gov](mailto:Horacio.Sapriza@frb.gov), and [Andrei.Zlate@frb.gov](mailto:Andrei.Zlate@frb.gov), Division of International Finance, Board of Governors of the Federal Reserve System, Washington, D.C. 20551, U.S.A. The views in this paper are solely the responsibility of the author(s) and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or of any other person associated with the Federal Reserve System.

# 1 Introduction

The 2008-09 global financial crisis had dramatic effects on economic activity. One of the most salient features was the abrupt decline in international trade.<sup>1</sup> Moreover, the collapse in world exports was even larger than the contraction in the world gross domestic product (GDP), and was experienced by most economies, including the emerging market economies that represent the focus of our paper (Figure 1).<sup>2</sup> Two transmission channels may explain this sharp decrease in international trade: a steep reduction in global demand, and a significant tightening of external financing that limited the firms' ability to obtain operating capital to satisfy demand for their products. The effect of the decline in global demand is well understood and documented. However, there has been relatively limited formal empirical analysis on the importance of external financing as an additional factor that contributed to collapse in international trade and economic activity.

Understanding the contribution of financial frictions to the sharp decline in trade, and learning about their heterogeneous effect on firms and sectors is useful for the design of policy interventions that would minimize the adverse economic effects should similar events occur in the future. To this end, the present paper studies the behavior of trade credit and its effect on domestic and international trade during the recent global financial crisis. Our results add to a growing literature on the role of financial frictions on economic activity, especially international trade. In our analysis, trade credit refers to the financing that firms receive from their suppliers in the form of delayed payments for the transfer of goods and services. Using firm-level data from China, India, Indonesia, Malaysia, Taiwan and Thailand, we explore: (1) the effect of financial constraints on economic activity; (2) how the ability of firms to partially replace external finance with trade credit contributed to their relative performance during the crisis; (3) whether the relative inability of export-intensive firms to use trade credit as an alternative source of finance can explain their larger decline in sales.

We use firm heterogeneity – reflected by firm-specific measures of financial vulnerability – to disentangle the effect of financial constraints from the demand-driven reduction in sales and exports. Our results indicate that, although financial conditions contributed to the decline in sales for all firms, sales declined by less for firms with better financial conditions before the crisis (i.e. firms with more liquid assets and less exposure to external finance, especially short-term debt). However, after controlling for their financial characteristics, export-intensive firms recorded larger

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<sup>1</sup>See WTO, World Trade Report, July 2009.

<sup>2</sup>Amiti and Weinstein (2009) also document that, while the cumulated GDP of a sample of 17 countries (that together account for 70 percent of the world's GDP and exports) fell 10 percent between the first quarter of 2008 and the first quarter of 2009, exports plunged as much as 28 percent (i.e. a 761 billion dollars decline).

declines in sales than their domestically-oriented counterparts. Trade credit declined by less for the financially-vulnerable firms (i.e. those with higher pre-crisis reliance on short-term debt), a sign that these firms were able to relax their financial constraints by using more trade credit from suppliers. In addition, firms that were able to replace external finance with trade credit experienced smaller declines in sales. However, exporters with comparable financial vulnerabilities had limited access to trade credit as an alternative source of finance, suggesting that the credit crunch had a disproportionately larger effect on international trade. These results highlight the interaction between financial constraints and the real sector in propagating the effects of the global financial crisis. In particular, they document the role played by firm-specific credit constraints in the unprecedented drop in global trade during the crisis.

The rest of the paper is organized as follows. Section 2 discusses the related literature, Section 3 describes the data, Section 4 describes the empirical specifications, and Section 5 discusses the findings. Section 6 concludes.

## **2 Previous Literature**

Our study adds to the sparse evidence on the role of trade credit during the recent crisis, as the existing empirical studies are mostly based on aggregate data or surveys of financial institutions. For instance, the World Bank estimates that the reduction in the supply of trade finance accounted for up to 15 percent of the decline in world trade between mid-2008 and mid-2009, whereas the rest reflected the reduced demand for exports (Auboin 2009). A recent bank survey by the International Monetary Fund (IMF) also highlights the reduction in the supply of trade finance and the increase in the price of letters of credit during 2008, particularly in emerging economies, a finding which provides indirect evidence for the reduced supply of trade credit during the crisis (Auboin 2009). Chor and Manova (2009) show that the decline in the United States' imports during the 2008-09 global crisis was larger for countries of origin and sectors with adverse credit conditions, including limited access to trade credit. Love et al. (2007) also use firm-level data to document the reduction in the supply of trade credit during the Mexican devaluation in 1994-95 and the Asian crisis in 1997, but do not distinguish between the performance of exporting and non-exporting firms. Kolasa, Rubasek and Taglioni (2010) use Polish firm-level data, and find that foreign-owned firms proved more resilient during the recent crisis, which they argue was due to intra-group lending mechanisms supporting the credit-constrained affiliates. Bricongne et. al. (2010) use data on French firms,

and argue that export losses were larger for the more financially-constrained firms. In addition, while large exporters were affected mostly on their intensive margin, many small exporters stopped exporting altogether. Amiti and Weinstein (2009) match bank with firm-level data for Japan, and document that banks played a key role in the transmission of financial shocks to exporting firms during the 2008-09 crisis, as well as during the crisis that affected the country in the 1990s.

This paper focuses on the impact of trade credit on the domestic activity and exports of firms from a number of emerging Asian economies, thus providing an explanation for the disproportionate decline in trade relative to GDP during the recent crisis. Due to our focus on firms in emerging Asia, the 2008-09 global financial crisis - which originated in advanced economies - can be viewed as an exogenous event in our analysis.

Our finding that financially-vulnerable firms (i.e. those with higher exposure to short-term debt before the crisis) substituted toward trade credit during the crisis is consistent with the literature on the bank and trade credit channels. In an early study, Meltzer (1960) concludes that when liquidity conditions were tight, “firms with relatively large cash balances increased the average length of time for which [trade] credit was extended. And this extension of trade credit appears to have favoured those firms against whom credit rationing is said to discriminate.” More recently, Kohler, Britton and Yates (2000) use a panel of publicly-traded firms from the United Kingdom and find that, during recessions, firms with direct access to capital markets extended more trade credit and received less in return, thus making credit available to their counterparts that rely more on bank credit. In line with Meltzer (1960), the authors argue that there is a “trade credit channel” that offsets the traditional bank credit channel in the monetary economics literature. While a tightening of liquidity conditions may worsen firms’ access to bank credit, those firms that can directly fund themselves in credit markets may step in to fill the financing gap, thus reducing the effect of the credit tightening on the economy.<sup>3</sup> Using data for firms in the United States, Nilsen (2002) also finds that, during periods of monetary tightening, small firms reduce bank borrowing while large firms increase it. At the same time, small firms increase the use of trade credit as an alternative source of finance whereas, among the larger firms, those with better access to credit markets extend more trade credit. Finally, Mateut et al. (2006) provide a theoretical foundation for the substitution of bank credit with trade credit, and document that pattern empirically using data from a panel of 16,000 manufacturing firms in the United Kingdom.

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<sup>3</sup>An important assumption behind the idea of the offsetting trade credit channel is that the adverse financial shock must cause the external finance premium to rise by more for bank-dependent firms than for firms providing trade credit.

### 3 Data

Our empirical analysis uses both annual and quarterly data of 7,967 publicly traded non-financial firms (out of which 1,765 firms, or 22 percent, reported exports and sales data for 2007) from six emerging Asian countries - China, India, Indonesia, Malaysia, Taiwan, and Thailand - obtained from the Worldscope database.<sup>4</sup> As shown in Figure 2, the firm-level data display contours similar to those of the aggregate data. First, aggregate activity measured by real GDP or industrial output show a significant contraction between 2008:Q3 and 2009:Q1. Firm-level output, measured by sales, displays the same pattern. Second, a notable feature of the global financial crisis was the sharp drop in global trade. The middle panels show the significant decline in exports for the countries in our sample between 2008:Q3 and 2009:Q1. At the firm level, we measure exports by the sales of export-intensive firms (i.e. firms whose exports represent more than 50 percent of total sales). Both the aggregate and firms' exports data display similar contours, with significant declines at the height of the global financial crisis. Third, another notable feature of the crisis was the significant deterioration in credit provision and an attendant run-up in the cost of capital. This feature is captured in the panels to the right by the growth of credit extended to the private sector at the aggregate level, and by the external financing at the firm level.

The similarity between the dynamics of these key aggregate data and the corresponding data for firms during the global financial crisis provides reassurances in the use micro data to understand the linkages between financial conditions, trade and economic activity during the crisis. The richness of the micro data allows us to conduct the analysis while controlling for other factors that otherwise could have confounded estimation.

Using these micro data, we construct a cross-sectional data set as follows. (See Appendix B for a detailed description of the variables.) The contraction in economic activity during the financial crisis is measured by the percent decline in *sales* from peak (2008:Q3) to trough (2009:Q1). We construct the *exports-to-sales ratio* using annual data for 2007; we treat firms reporting sales but not exports as non-exporters. Pre-crisis financial conditions and vulnerability are measured by *short-term debt*, *working capital* (each normalized by *total assets*) as well as the *quick ratio* (the ratio of liquid assets to liquid liabilities) in 2007.

Besides the standard forms of external and internal financing (measured as *total external finance*

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<sup>4</sup>Given our focus on international trade, we work with six emerging market economies where a reasonable number of firms report data on both exports and sales for the pre-crisis year (2007) in the Worldscope database (see Appendix A).

and *retained earnings* normalized by total assets), firms often rely on trade credit - credit obtained from suppliers in the form of delayed payments for the transfer of goods and services - to supplement operating capital. It is important to distinguish between trade credit and trade finance, where the latter refers to funds extended to firms by financial institutions in the form of, for example, pre-shipment finance, letters of credit, and export insurance. Thus, we use trade credit as one of the key variables in our study. We measure the stock of trade credit at the end of the pre-crisis year as the stock of *accounts payable* normalized by the *cost of goods sold*, following Love et al. (2007) and Levchenko et al. (2010).<sup>5</sup>

We use annual data for exports, short-term debt, quick ratio, working capital, external finance and retained earnings, and both quarterly and annual data on sales and accounts payable. Thus, the data allow to link firms' performance at the height of the global financial crisis (i.e. the change in sales between the peak and trough quarters) to a set of firm characteristics measured in the pre-crisis year - 2007 - such as financial vulnerability and liquidity, reliance on various sources of finance and trade credit, as well as export status. The data also allow to link the change in firm's access to trade credit at the height of the crisis (measured as the quarterly change between 2008:Q3 and 2009:Q1 in accounts payable normalized by the four-quarter sum of the cost of goods sold) to similar pre-crisis indicators.

Firms covered by the Worldscope database report their financial indicators according to each country's fiscal year (FY), which coincides with the calendar year for all countries in our sample except for India and Thailand. To match the firm-level data with the period marked by the crisis, we have converted the fiscal year into the calendar year by re-aligning the quarterly data for India (where FY 2009 started in April 2008) and Thailand (where FY 2009 started in October 2008). For the same reason, we have assigned the annual data reported for FY 2009 to the crisis year of 2008 for India and Thailand, given that the trough occurred in the first quarter of 2009.

Out of the initial number of 7,967 firms, our econometric analysis is confined to the sub-sample of firms for which data are simultaneously available for the dependent and explanatory variables (see Tables 1 and 2). The sample size is also reduced by the removal of outliers, which we replace with missing values: For the quick ratio, short-term debt, accounts payable, and the exports-to-sales ratio (for which the lower bound is zero), we exclude the top percentiles only. For external finance (that can take both positive and negative values), we exclude both the top and bottom

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<sup>5</sup>We multiply the accounts payable to the cost of goods sold ratio by 360, and interpret the product as the number of days for which trade credit is received, as in Love et al. (2007).

percentiles. For retained earnings and short-term debt, we remove the bottom percentile only.

## 4 Empirical Methodology

We study the behavior of firm-level sales and trade credit received during the crisis in a cross-sectional framework, with the peak-to-trough decline in sales and trade credit as dependent variables. We aim to explain sales performance using the variation in firm-specific financial characteristics, such as the pre-crisis degree of financial vulnerability, liquidity, and reliance on external financing that became expensive and difficult to obtain during the crisis. We also examine the determinants of firms' ability to relax their financial constraints by increasing their use of trade credit as an alternative source of financing, and investigate the effect of this substitution on firms' performance during the crisis.

### 4.1 Determinants of Firm Performance

First, we explore the link between firm performance during the crisis, expressed as the percent change in firm sales between 2008:Q3 and 2009:Q1 (i.e. the dependent variable), and firm-specific characteristics such as financial vulnerability, reliance on external financing, and exposure to external demand measured in 2007, the year prior to the crisis. We use the following econometric specification:

$$\begin{aligned} \% \Delta Sales_i = & \alpha + \beta_1 * FinVuln_{2007,i} + \beta_2 * FinSource_{2007,i} + \beta_3 * TC_{2007,i} + \beta_4 * Exp/Sales_{2007,i} + \\ & + \sum_s \delta_s * Ind_{s,i} + \sum_v \delta_v * Size_{v,i} + \sum_c \delta_c * Country_{c,i} + \varepsilon_i, \end{aligned} \quad (1)$$

where the set of explanatory variables includes:

1. Indicators reflecting the degree of financial vulnerability and liquidity across firms measured at the onset of the crisis ( $FinVuln_{2007,i}$ ). These are: (i) the stock of *short-term debt* (normalized by total assets); (ii) in separate specifications, the *quick ratio* (i.e. the sum of cash, cash equivalents and net receivables divided by current liabilities) and *working capital* (i.e. the difference between current assets and current liabilities normalized by total assets) as alternative measures of financial liquidity;
2. Measures of firms' reliance on external and internal sources of finance prior to the crisis

( $\text{FinSource}_{2007,i}$ ); for this purpose, we use *total external finance* and *retained earnings* in 2007, each normalized by total assets;

3. The amount of trade credit received from suppliers ( $\text{TC}_{2007,i}$ ), using the stock of *accounts payable* in 2007 normalized by the cost of goods sold;
4. The *exports-to-sales ratio* in 2007, as an indicator of firms' exposure to external demand;
5. Finally, we use dummy variables to isolate the industry, size, and country effects. We rank firms in three size categories based on their total assets in 2007. We also assign firms to 24 industry groups provided by the Worldscope database (see Appendix B). We exclude financial firms from our sample.

The econometric specification allows to measure the peak-to-trough change in sales (i.e. the dependent variable) using quarterly data. Given that the downturn and subsequent recovery of sales and exports for firms in emerging market economies occurred over just a few quarters, the use of annual data to measure the peak-to-trough decline in sales would have underestimated the effect of the crisis on firm performance and the corresponding variation across firms.

## 4.2 Substitution Across Sources of Finance

We explore the firms' ability to substitute across various sources of finance as a strategy to relax their financial constraints and improve sales performance. To this end, we use the dynamic trade-off between the change in trade credit and external financing received in 2008 as a new dimension of firm heterogeneity, in addition to the static pre-crisis indicators 1-5 used in specification (1), to explain sales performance during the crisis.

Figure 3 illustrates the trade-off between external finance and new trade credit received in 2008 for the firms in our sample. On the horizontal axis, the amount of external finance (normalized by total assets) measures the flow of firm financing from outside sources in 2008, such as the issuance/retirement of stock and debt. Thus, negative values of external finance correspond to firms that repurchased equity and/or experienced declines in their outstanding debt during the crisis. On the vertical axis, the difference in the stock of accounts payable between 2007 and 2008 normalized by the cost of goods sold shows the change in trade credit received from suppliers during the crisis. Positive values on the vertical axis correspond to firms that obtained more trade credit

in 2008 relative to the previous year.<sup>6</sup>

In the framework described by Figure 3, we rank firms across the four quadrants defined by the zero lines. We label the quadrants as 1-4, starting with quadrant 1 in the North-West and moving clockwise towards quadrant 4 in the South-West:

1. Firms in quadrant 1 posted an increase in trade credit received from suppliers but negative external financing, thus replacing external finance with trade credit in 2008.
2. Firms in quadrant 2 experienced both an increase in trade credit and positive external financing, thus becoming less constrained along both dimensions.
3. Quadrant 3 includes firms with declines in trade credit but positive external financing, thus substituting trade credit with external finance in the crisis year.
4. Finally, quadrant 4 consists of firms with reduced access to both sources of finance in 2008.

In order to study the extent to which substitution between external finance and trade credit affected sales during the crisis, we introduce a set of dummy variables (*Quad* 1-3) in specification (2). The dummy variables reflect the firms' distribution across the first three quadrants in Figure 1.

$$\begin{aligned} \% \Delta Sales_i = & \alpha + \beta_1 * FinVuln_{2007,i} + \beta_2 * FinSource_{2007,i} + \beta_3 * TC_{2007,i} + \beta_4 * Exp/Sales_{2007,i} + \\ & + \sum_{q=1,2,3} \theta_s * Quad_{q,i} + \sum_s \delta_s * Ind_{s,i} + \sum_{l=2,3} \delta_l * Size_{l,i} + \sum_c \delta_c * Country_{c,i} + \varepsilon_i \quad (2) \end{aligned}$$

On average, after controlling for financial characteristics, export reliance, industry, size and country, we expect firms in quadrant 1 to outperform their counterparts in quadrant 4, since their improved access to trade credit should offset, at least partially, the reduced access to external finance. We also expect firms in quadrant 2 to outperform those in other quadrants. Finally, firms in quadrant 3 should fare better than those in quadrant 4.

### 4.3 Determinants of Trade Credit

We study the behavior of trade credit received during the crisis by exploring the importance of firms' financial vulnerability, exposure to alternative sources of finance, and export reliance in the

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<sup>6</sup>In Figure 3, we are constrained to using annual data on external finance, which is available at the annual frequency only.

year prior to the crisis. In particular, we ask: (1) What are the characteristics of firms that received more trade credit during the crisis? (2) What was the experience of exporters?

$$\begin{aligned} \Delta Payables/CGS_i = & \alpha + \beta_1 * FinVuln_{2007,i} + \beta_2 * FinSource_{2007,i} + \beta_3 * Exp/Sales_{2007,i} + \\ & + \sum_s \delta_s * Ind_{s,i} + \sum_{l=2,3} \delta_l * Size_{l,i} + \sum_c \delta_c * Country_{c,i} + \varepsilon_i \end{aligned} \quad (3)$$

In the specification described by (3), we use quarterly data to construct the dependent variable, which is the peak-to-trough change in accounts payable (normalized by the four-quarter sum of the cost of goods sold) between 2008:Q3 and 2009:Q1. The explanatory variables consist of annual indicators of financial vulnerability, use of alternative sources of finance, and export reliance in 2007, as well as the control dummies for industry, size and country described in section 4.1 above.

## 5 Results

### 5.1 Baseline Results

**Determinants of Firm Performance** Table 1 shows that, although overall there was a sharp decline in sales during the crisis, sales performance was related to the firm-specific financial conditions from the year prior to the crisis. Thus, firms with greater financial liquidity *ex-ante* experienced a smaller drop in sales, as evidenced by the positive and significant coefficients on working capital in columns (1) and (3). Similarly, the results in columns (2) and (4), which use the quick ratio as an alternative measure of liquidity, also indicate that firms with greater liquidity experienced a relatively smaller decline in sales during the crisis. In addition, columns (3) and (4) show that firms with greater reliance on short-term debt prior to the crisis also performed worse than the average. Notably, a relatively large amount of short-term debt relative to total assets in 2007 reflects financial vulnerability, since short-term debt often matured and had to be rolled over or replaced during the crisis.

The firms' reliance on various sources of finance also affected sales. We find that firms with larger exposure to external financing experienced a sharper drop in sales during the crisis, as shown in columns (1) and (2). On the contrary, firms with greater reliance on trade credit from suppliers fared better, as indicated by columns (2), (3) and (4).

Nonetheless, exporting firms experienced a more severe deterioration in sales - by about 5 to

6 percent in excess of their domestically-oriented counterparts - as shown in columns (1) and (2). This result is consistent with the outsized decline in trade observed for the aggregate data shown in Figure 1.

**Substitution Across Sources of Finance** Although greater ex-ante reliance on external finance disrupted sales, the firms' ability to substitute external financing with trade credit during the crisis enhanced their sales performance. In columns (3) and (4), the coefficient on quadrant 1 is positive and statistically significant, suggesting that firms that were able to increase trade credit experienced a smaller decline in sales (i.e. about 6 percentage points less). The coefficient on quadrant 3 is not statistically significant - firms with less trade credit but more external finance did not fare better than firms with less access to both - which highlights the importance of the trade credit dimension in understanding the sales performance across firms. Thus, although the ability to substitute away from external finance towards trade credit enhanced sales, the reverse was not true, possibly owing to the more onerous nature of external finance at times of financial turmoil. Finally, as expected, firms that obtained more trade credit from suppliers as well as more external financing (quadrant 2) enjoyed a smaller decline in sales (i.e. nearly 9 percentage points less) relative to firms in quadrant 4.

Interestingly, once we control for the substitution behavior between external financing and trade credit, the coefficient on the export-to-sales ratio becomes statistically insignificant (columns 3 and 4), suggesting that the relatively poor sales performance of export-oriented firms can be attributed to their lower ability to use trade credit. Indeed, out of the firms in quadrants 1 and 2 (firms that received more trade credit during the crisis), only 5 percent were export-intensive firms (with exports representing at least half of total sales), compared to as much as 8 percent of firms in quadrants 3 and 4.<sup>7</sup>

Why would firms in financial distress receive trade credit from suppliers as an alternative form of finance? First, by extending trade credit, firms that regularly trade with each other diminish the cost of handling cash and invoices, as well as other administrative and payment costs. Ferris (1981) and Laffer (1970) provide early theoretical explanations for the use of trade credit based on this transaction motive. Second, the financing theory of trade credit argues that suppliers have a financing advantage over other credit providers (such as banks) due to the familiarity with the

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<sup>7</sup>Overall, 6.5 percent of the firms in Figure 3 had exports accounting for more than half of sales in 2007. Alternatively, if the export-intensive firms are defined as firms with exports accounting for at least three quarters of total sales in 2007, only 3.1 percent of the firms in quadrants 1 and 2 were exporters, compared to 4.6 percent of the firms in quadrants 3 and 4; across all quadrants, the fraction of exporters was 3.9 percent.

credit-worthiness of their customers (see Schwartz, 1974). Third, suppliers also have an advantage in enforcing debt repayments, especially if they can credibly threaten to cut off future supply and the buyer has few alternative sources to purchase production inputs. Fourth, suppliers also have the advantage of a readily available network for reselling the collateralized goods in case of default.

**Determinants of Trade Credit** Given that increased access to trade credit improved sales performance, the next set of results shed light on the characteristics of firms that were able to use more trade credit as an alternative source of finance during the crisis. Thus, Table 2 shows the link between the change in trade credit and firm-specific indicators of financial vulnerability and export reliance measured prior to the crisis.

First, the more financially-vulnerable firms increased their use of trade credit during the crisis, as shown by the coefficient on short-term debt, which is positive and statistically significant in both columns. The result indicates that the financially-vulnerable firms used more trade credit as an alternative form of finance as their short-term debt matured and became difficult to renew during the crisis. One possible explanation for this result is that suppliers became willing to extend trade credit to financially-constrained firms in order to maintain their customer base. Arguably, the close ties between suppliers and customer firms facilitated this type of lending compared to bank lending, as explained earlier. Additionally, financially vulnerable firms may have to rely more on trade credit due to the difficulty in obtaining other forms of financing, whereas more financially sound firms have less of a need to develop this form of financing.

Second, the more export-oriented firms were less able to use trade credit as an alternative source of finance, after controlling for financial characteristics, industry, size and country. In both columns 1 and 2 of Table 2, the results show an inverse relationship between the export share of sales in 2007 and the peak-to-trough change in trade credit during the crisis. Moreover, this result is consistent with the uneven distribution of export-oriented firms across the four quadrants in Figure 3, as discussed above. The finding suggests that export-intensive firms experienced less access to trade credit as an alternative source of finance, which in turn exacerbated the decline in international trade at the height of the financial crisis.

The headline results described above are subject to some caveats. In the next section, we address some of them.

## 5.2 Robustness Analysis

**Inventories** One potentially important variable missing from the headline analysis is the level of firms' inventories. Inventories play an important role in meeting demand when production is disrupted. During the financial crisis, firms with production constrained by the dire financial conditions could have drawn on inventories to fulfill some or all of the demand for their products. In this case, financial conditions would have a smaller effect on sales. We re-estimate specification (1) while controlling for the pre-crisis level of inventories. The results, shown in columns (1) and (2) of Table 3, are as expected. Firms with a higher level of pre-crisis inventories experienced a relatively smaller decline in sales during the crisis (column 1). The specification in column (2) interacts the level of inventories with the financial variables already discussed. The coefficients on the quick ratio and external finance are statistically significant with the expected signs. Sales of firms with higher pre-crisis levels of inventories were less constrained by their liquidity position or reliance on external finance. These results point to an important role of inventories in alleviating, but not eliminating, the effect of financial constraints on performance. Though our benchmark results are still preserved.

**Sample composition** The sample for the results presented in Table 1 (that correspond to specification 1) is larger than that of Table 2 (specification 3) because trade credit at the quarterly frequency (i.e. accounts payable normalized by the cost of goods sold) is reported only by a subset of firms. To insure that our results are not driven by changes in the composition of our sample across the two specifications, we repeat the estimation by restricting the sample of firms in Table 1 to the subset that also report quarterly accounts payable. The new results (column 3 of Table 3) show that sample composition has little effect on our main results. The coefficients on the quadrant dummies are still positive and statistically significant, and their magnitude is comparable to that from the baseline results in Table 1. This finding re-enforces our earlier results that firms that accessed more trade credit when external financing dried up performed relatively better. In addition, firms with greater exposure to external finance prior to the crisis fared worse, whereas those with more reliance on retained earnings or trade credit fared better.

**Country Effect** Last, we assess whether the results of the study are driven by a particular country. To this end, we re-estimate column (4) of Table 1 and column (2) of Table 2 by excluding one country at a time from the sample. The results are presented in Tables 4 and 5. For example,

the specification in column (1) excludes China; in column (2) we exclude India, etc. Overall the main results are little changed, suggesting that our headline results are broad-based.

## 6 Conclusion

In this empirical study, we explored the extent to which financial conditions contributed to the decline in firms' sales at the height of the 2008-09 global financial crisis using micro data from six emerging market economies. We find that financial conditions adversely affected sales during the financial crisis, and that the use of trade credit played an important role in the performance of firms. When financing conditions dried up, the more financially-vulnerable firms turned to trade credit as a supplement to standard forms of financing. In addition, firms that were able to replace external finance with trade credit had better sales performance. In contrast to domestically-oriented firms, export-intensive firms with comparable financial vulnerability relied less on trade credit as an alternative source of finance, and experienced sharper declines in sales. These results provide an explanation for the disproportionate decline in global trade during this recent crisis episode.

These findings have an implication for the design of policy to cushion the effect of future global financial crises. Policymakers and firms would be well-advised to facilitate the development of trade credit as an additional source of financing when financial and credit markets become impaired. Along these lines, an interesting topic for future research would be to further understand the factors that determine the use or extension of trade credit between firms and, in particular, whether there are impediments to the cross-border flow of trade credit that can be alleviated.

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## A Exports Data by Country

We summarize the number of firms that reported exports and sales in 2007 in the table below.

# firms reporting:	CHN	IND	IDN	MYS	THA	TWN
2007 sales	2,181	2,416	454	1,229	662	1,804
2007 exports	118	1,156	99	51	43	419

## B Definitions of Variables

**Exports:** revenues generated from the shipment of merchandise to another country for sale.

**External Finance:** company financing from outside sources. It includes the issuance and retirement of stock and debt.

**Firm Size:** constructed from total assets. Firms with assets in top 33 percent of distribution are considered large; those in the bottom 33 percent are classified as small; the remaining firms are classified as medium size.

**Industry Group:** we construct dummy variables at the two-digit level for the industry groups provided by Worldscope, described below.

1300 AEROSPACE	3700 ELECTRICAL	6100 PAPER
1600 APPAREL	4000 ELECTRONICS	6700 RECREATION
1900 AUTOMOTIVE	4300 FINANCIAL	7000 RETAILERS
2200 BEVERAGES	4600 FOOD	7300 TEXTILES
2500 CHEMICALS	4900 MACHINERY & EQUIPMENT	7600 TOBACCO
2800 CONSTRUCTION	5200 METAL PRODUCERS	7900 TRANSPORTATION
3100 DIVERSIFIED	5500 METAL PRODUCT MANUFACTURERS	8200 UTILITIES
3400 DRUGS, COSMETICS & HEALTH CARE	5800 OIL, GAS, COAL & RELATED SERVICES	8500 MISCELLANEOUS

**Inventories:** represent tangible items or merchandise net of advances and obsolescence acquired for either (1) direct resale or (2) included in the production of finished goods manufactured for sale in the normal course of operation.

**Quick Ratio:**  $(\text{Cash \& Equivalents} + \text{Net Receivables}) / \text{Total Current Liabilities}$ .

**Retained Earnings:** accumulated after-tax earnings of the company which have not been distributed as dividends to shareholders or allocated to a reserve account. Excess involuntary liquidation value over stated value of preferred stock is deducted if there is an insufficient amount in the capital surplus account. It includes merger reserves, reserves for associated undertakings, etc.

**Sales:** gross sales and other operating revenue less discounts, returns and allowances. It includes franchise sales when corresponding costs are available and included in expenses, consulting fees, service income, etc.

**Short-Term Debt:** portion of debt payable within one year, including current portion of long term debt and sinking fund requirements of preferred stock or debentures. It includes notes payable, arising from short-term borrowings, current maturities of participation and entertainment obligations, contracts payable for broadcast rights, current portion of advances and production payments, current portion of long term debt that must be paid back during the next twelve months and included in long term debt, bank overdrafts, etc.

**Total Assets:** sum of total current assets, long-term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.

**Working Capital:** difference between total current assets and liabilities, normalized by total assets. Total current liabilities represent debt or other obligations that the company expects to satisfy within one year. It includes accounts payable, short term debt, notes payable, current portion of long term debt, all accrued expenses, other current liabilities, income taxes payable, dividends payable, etc.

**Table 1. Determinants of Firm Performance (Sales), Baseline Results**

Dependent variable: % Change in Sales, 2008:Q3-2009:Q1

VARIABLES	(1)	(2)	(3)	(4)
Working Capital/Assets <sub>2007</sub>	7.855** (3.252)		6.690* (3.482)	
Quick ratio <sub>2007</sub>		1.242*** (0.395)		0.941** (0.458)
Short-term debt/Assets <sub>2007</sub>	-7.804 (5.323)	-6.971 (4.891)	-13.26** (5.653)	-14.56*** (5.253)
External Finance/Assets <sub>2007</sub>	-11.50** (4.687)	-9.501** (4.598)	-6.785 (4.872)	-5.580 (4.810)
Retained Earnings/Assets <sub>2007</sub>	-2.904 (2.129)	-0.105 (2.052)	-0.224 (2.415)	0.652 (2.319)
Acc. Payable/CGS <sub>2007</sub>	0.0195 (0.0144)	0.0247* (0.0142)	0.0270* (0.0152)	0.0282* (0.0153)
Exports/Sales <sub>2007</sub>	-5.979** (2.911)	-5.382* (2.888)	-3.521 (2.986)	-3.257 (2.991)
I_Quad1			6.642*** (1.721)	6.351*** (1.726)
I_Quad2			8.839*** (1.765)	8.862*** (1.766)
I_Quad3			-0.690 (1.515)	-0.697 (1.515)
Constant	-29.74*** (9.841)	-29.92*** (9.704)	-28.48*** (9.816)	-28.00*** (9.768)
Observations	3,818	3,796	3,291	3,280
R-squared	0.109	0.113	0.135	0.135

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note: The sample includes firms from China, India, Indonesia, Malaysia, Taiwan and Thailand. We rank firms into three categories by the size of their total assets measured in 2007. We use dummy variables to control for firm size, industry and country effects, but do not report their coefficient estimates.

**Table 2. Determinants of Trade Credit, Baseline Results**

Dependent variable: Change in the Acc. Payable/Cost of Goods Sold Ratio, 2008:Q3-2009:Q1

VARIABLES	(1)	(2)
Working Capital/Assets <sub>2007</sub>	-2.857 (3.443)	
Quick ratio <sub>2007</sub>		-0.191 (0.387)
Short-term debt/Assets <sub>2007</sub>	15.65*** (5.699)	17.32*** (5.286)
External Finance/Assets <sub>2007</sub>	8.428 (5.730)	8.093 (5.713)
Retained Earnings/Assets <sub>2007</sub>	1.180 (2.104)	0.603 (2.037)
Exports/Sales <sub>2007</sub>	-5.025** (2.516)	-4.954* (2.531)
Constant	10.59 (11.02)	9.941 (11.04)
Observations	1,573	1,562
R-squared	0.065	0.066

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: The sample includes firms from China, India, Indonesia, Malaysia, Taiwan and Thailand. We rank firms into three categories by the size of their total assets. We use dummy variables to control for firm size, industry and country effects, but do not report their coefficient estimates.

**Table 3. Determinants of Firm Performance (Sales), Robustness Analysis 1**

Dependent variable: % Change in Sales, 2008:Q3-2009:Q1

VARIABLES	(1)	(2)	(3)
Quick ratio <sub>2007</sub>	1.051** (0.462)	1.338*** (0.501)	0.583 (0.655)
Short-term debt/Assets <sub>2007</sub>	-16.76*** (5.295)	-19.39*** (6.141)	-4.758 (7.849)
External Finance/Assets <sub>2007</sub>	-6.995 (4.800)	-19.30*** (5.707)	-22.25*** (8.359)
Retained Earnings/Assets <sub>2007</sub>	0.547 (2.310)	1.580 (2.726)	6.666** (3.013)
Acc. Payable/CGS <sub>2007</sub>	0.0192 (0.0154)	0.0102 (0.0179)	0.0570** (0.0241)
Exports/Sales <sub>2007</sub>	-2.960 (2.978)	-2.917 (2.972)	-3.177 (3.528)
I_Quad1	6.484*** (1.721)	6.615*** (1.719)	4.798* (2.635)
I_Quad2	8.738*** (1.763)	8.594*** (1.759)	8.392*** (2.694)
I_Quad3	-0.588 (1.511)	-0.636 (1.507)	0.703 (2.170)
Inventories/Sales <sub>2007</sub>	6.504*** (1.954)		
Inv/Sales <sub>2007</sub> × Quick ratio <sub>2007</sub>		-3.041* (1.721)	
Inv/Sales <sub>2007</sub> × Short-term debt/Assets <sub>2007</sub>		9.647 (11.11)	
Inv/Sales <sub>2007</sub> × Ext. Finance/Assets <sub>2007</sub>		53.40*** (12.91)	
Inv/Sales <sub>2007</sub> × Ret. Earnings/Assets <sub>2007</sub>		-3.924 (6.797)	
Inv/Sales <sub>2007</sub> × Acc. Payable/CGS <sub>2007</sub>		0.0270 (0.0259)	
Constant	-29.35*** (9.739)	-27.35*** (9.699)	-39.92** (15.67)
Observations	3,258	3,258	1,233
R-squared	0.139	0.145	0.174

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Note: Column (1) adds the 2007 inventory-to-sales ratio as an explanatory variable to the baseline specification used in column (4) of Table 1, using the full sample of firms; Column (2) adds interactions of the inventory-to-sales ratio with each of the financial variables on rows 1-5; Column (3) uses the baseline specification from column (4) of Table 1, but only for the sub-sample of firms that report both sales and accounts payable at the quarterly frequency (i.e. largely the sub-sample of firms in Table 2). Not reported here, we use the control variables for industry, size and country from Tables 1 and 2.

**Table 4. Determinants of Firm Performance (Sales), Robustness Analysis 2**

Dependent variable: % Change in Sales, 2008:Q3-2009:Q1

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Quick ratio <sub>2007</sub>	1.679*** (0.527)	0.983** (0.452)	0.970** (0.464)	0.327 (0.530)	0.937** (0.459)	0.757 (0.615)
Short-term debt/Assets <sub>2007</sub>	-5.570 (6.832)	-13.57*** (5.189)	-16.55*** (5.462)	-17.26*** (5.696)	-14.59*** (5.262)	-18.18*** (6.684)
External Finance/Assets <sub>2007</sub>	1.810 (6.744)	-8.063* (4.792)	-8.023 (4.941)	-3.026 (5.135)	-5.546 (4.818)	-7.040 (5.993)
Retained Earnings/Assets <sub>2007</sub>	0.765 (2.450)	0.746 (2.276)	-1.324 (2.664)	2.055 (2.789)	0.573 (2.322)	2.005 (2.873)
Acc. Payable/CGS <sub>2007</sub>	0.0342* (0.0197)	0.0299** (0.0151)	0.0192 (0.0157)	0.0333* (0.0170)	0.0278* (0.0153)	0.0293 (0.0191)
Exports/Sales <sub>2007</sub>	-3.677 (2.884)	-3.205 (2.970)	-2.412 (3.075)	-3.290 (3.050)	-3.294 (2.994)	-3.519 (7.878)
I_Quad1	8.150*** (2.152)	6.096*** (1.703)	6.537*** (1.766)	5.289*** (1.912)	6.286*** (1.730)	5.893*** (2.261)
I_Quad2	13.39*** (2.220)	8.898*** (1.759)	9.073*** (1.809)	5.508*** (1.950)	8.774*** (1.772)	8.359*** (2.281)
I_Quad3	0.726 (1.735)	-0.550 (1.499)	-0.751 (1.547)	-2.381 (1.656)	-0.824 (1.518)	0.0244 (2.157)
Constant	-25.39* (13.39)	-26.92*** (9.914)	-26.53*** (9.832)	-29.06*** (10.89)	-28.01*** (9.778)	-28.37** (11.77)
Observations	1,953	3,181	3,165	2,614	3,269	2,218
R-squared	0.153	0.141	0.138	0.158	0.134	0.087

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: Columns (1)-(6) replicate the results shown in column (4) of Table 1 while removing one country at a time from the sample (i.e. China, India, Indonesia, Malaysia, Taiwan and Thailand). We use the same controls variables for firm size, industry and country effects as in Table 1, but do not report their coefficient estimates.

**Table 5. Determinants of Trade Credit, Robustness Analysis**

Dependent variable: Change in the Acc. Payable/Cost of Goods Sold Ratio, 2008:Q3-2009:Q1

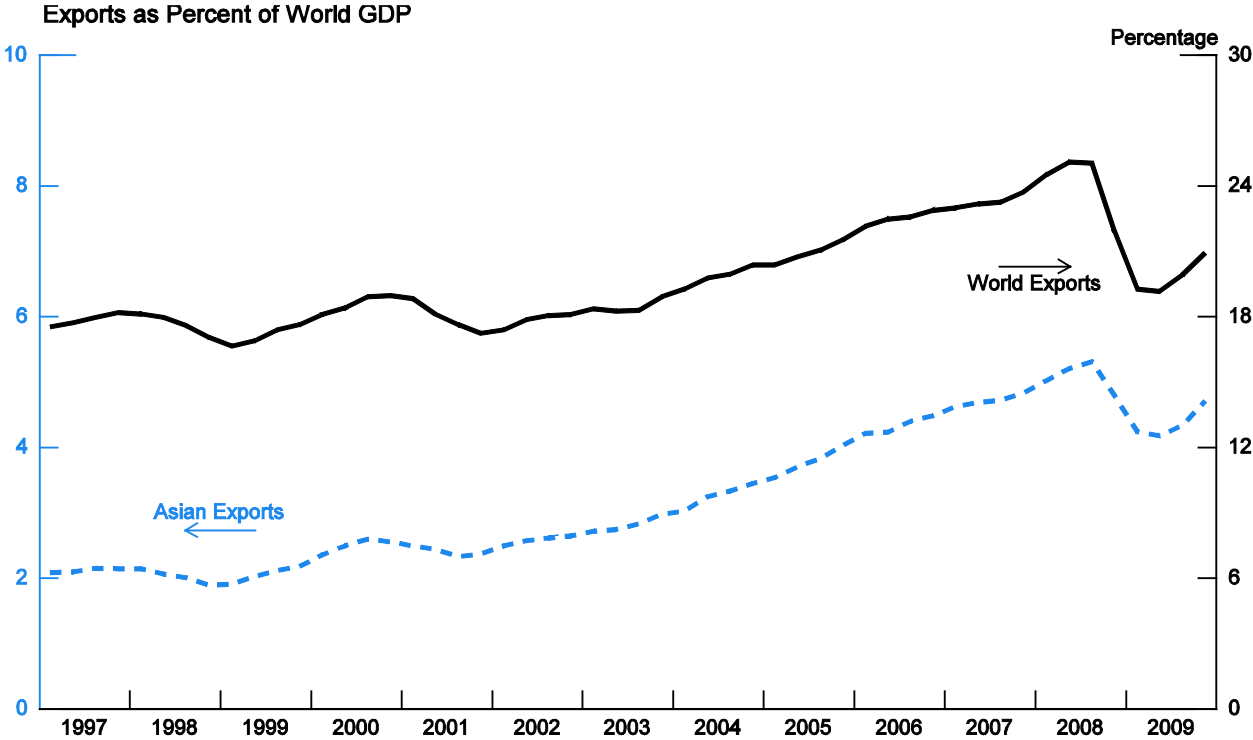
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Quick ratio <sub>2007</sub>	-0.0928 (0.465)	-0.237 (0.384)	-0.129 (0.395)	-0.386 (0.458)	-0.176 (0.400)	-0.0161 (0.478)
Short-term debt/Assets <sub>2007</sub>	16.33*** (5.934)	16.37*** (5.293)	17.47*** (5.667)	19.11*** (5.976)	17.36*** (5.497)	16.93** (6.730)
External Finance/Assets <sub>2007</sub>	13.52* (7.140)	10.92* (5.864)	5.774 (6.038)	9.661 (6.330)	9.004 (5.805)	1.780 (6.900)
Retained Earnings/Assets <sub>2007</sub>	1.942 (2.107)	0.330 (2.025)	-0.269 (2.593)	-0.746 (2.406)	0.418 (2.126)	1.348 (2.314)
Exports/Sales <sub>2007</sub>	-6.716*** (2.517)	-4.750* (2.544)	-4.796* (2.609)	-3.807 (2.656)	-4.395* (2.566)	-3.417 (5.317)
Constant	3.291 (11.80)	5.722 (12.17)	11.03 (11.01)	17.86 (14.02)	9.816 (11.09)	15.33 (13.36)
Observations	1,147	1,497	1,434	1,167	1,519	1,046
R-squared	0.078	0.068	0.048	0.102	0.062	0.067

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: Columns (1)-(6) replicate the results shown in column (2) of Table 2 while removing one country at a time from the sample (i.e. China, India, Indonesia, Malaysia, Taiwan and Thailand). We use the same controls variables for firm size, industry and country effects as in Table 2, but do not report their coefficient estimates.

**Figure 1. Exports Relative to the World GDP**



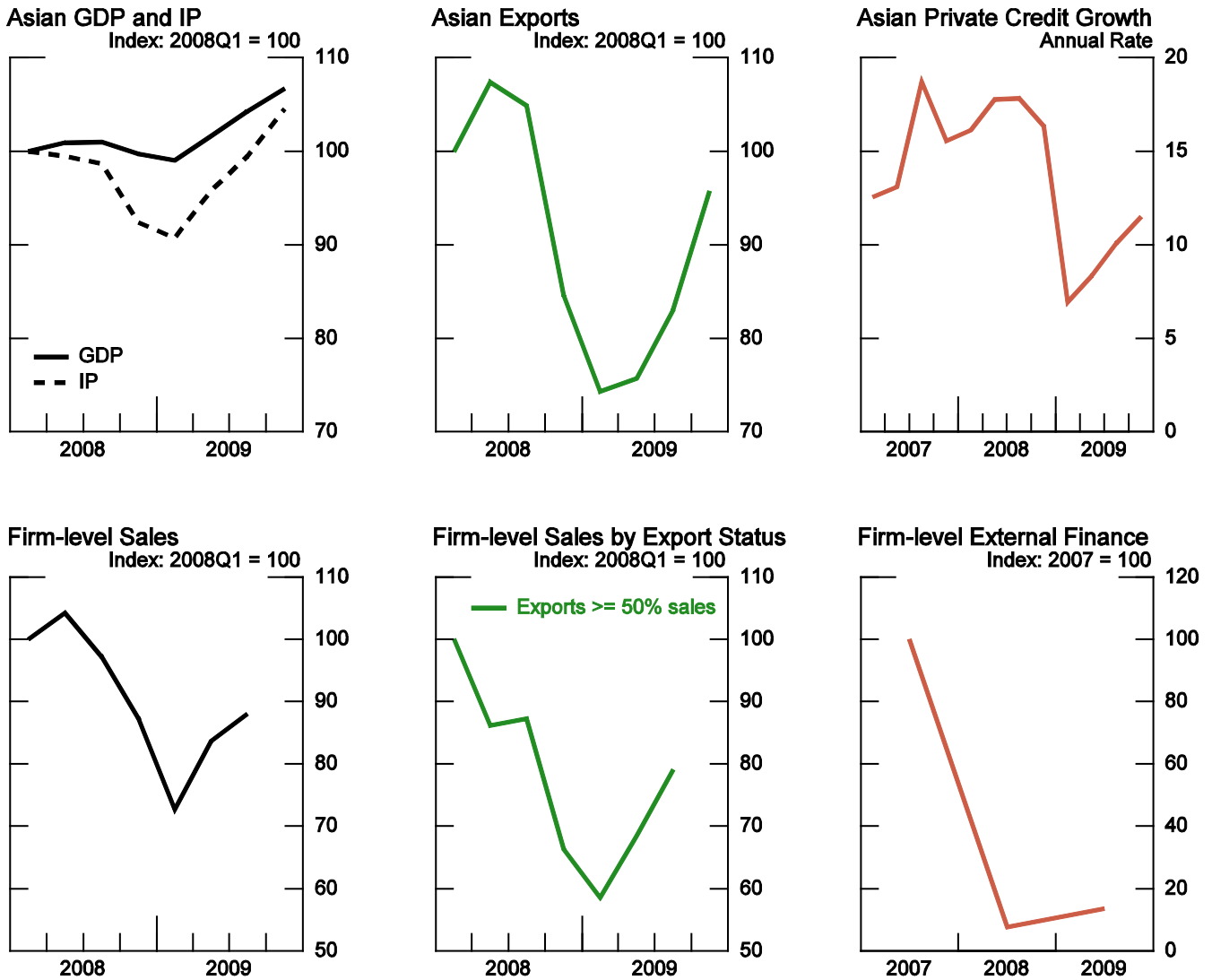
Source: Haver Analytics

Source: Haver Analytics, quarterly nominal GDP and exports (in US\$, seasonally-adjusted).

Note: “World exports” and “world GDP” comprise of: Australia, Austria, Belgium, Canada, China, Denmark, Finland, France, Germany, Hong Kong, India, Indonesia, Italy, Japan, Korea, Malaysia, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Taiwan, Thailand, the United Kingdom and the United States.

“Asian Exports” include the six countries in our sample: China, India, Indonesia, Malaysia, Taiwan, and Thailand.

Figure 2. Aggregate vs. Firm-Level Data



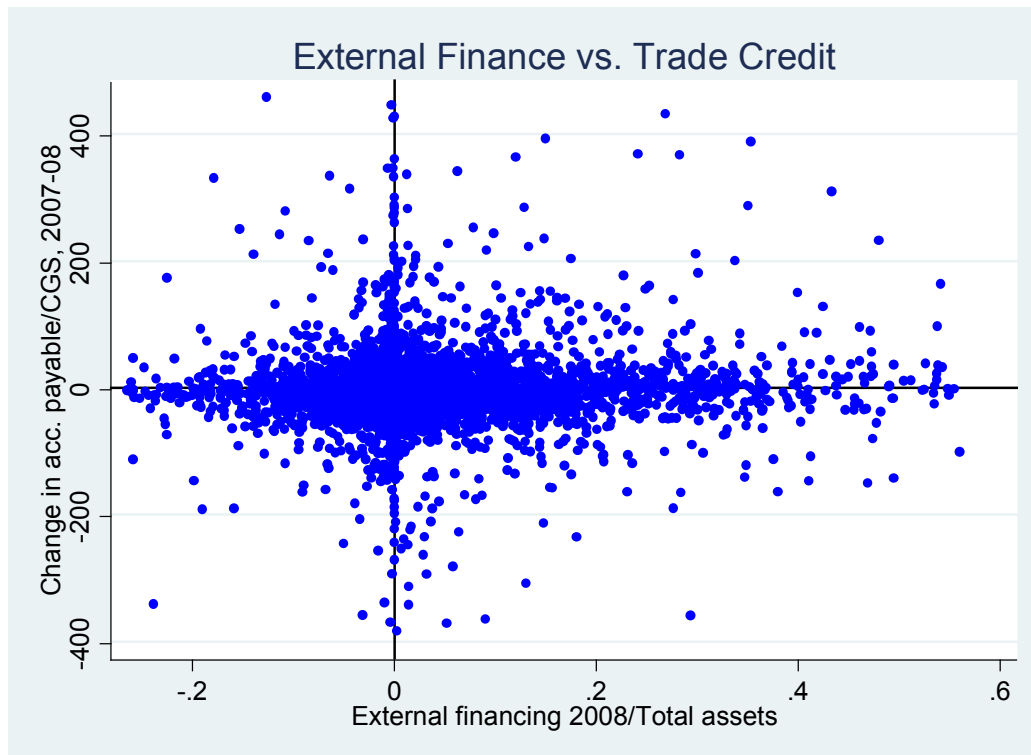
Sources: Haver Analytics (aggregate data) and Worldscope (firm-level data).

Notes: For the aggregate data, we use real GDP (in local currencies, seasonally-adjusted) and industrial production (IP); private credit growth (computed as the q/q annualized growth rate of outstanding private credit in local currencies, non seasonally-adjusted); and exports (in nominal US\$, seasonally-adjusted) for six emerging Asian economies (China, India, Indonesia, Malaysia, Thailand and Taiwan). We normalize the GDP, IP and exports series relative to 2008:Q1, and take non-weighted averages of the resulting indices for the six countries.

For private credit, we use: (1) China: Uses of credit funds of Financial Institutions, 100 Mil. Yuan, NSA; (2) India: Domestic Credit: Commercial Sector, NSA, Millions Rupees; (3) Indonesia: Commercial Bank Credit, NSA Bil. Rupiahs; (4) Malaysia: Banking Sector: Claims on Private Enterprises, NSA, Mil. Ringgit; (5) Taiwan: Loans/Investments of Major Financial Institutions: Claims on Private Sector, NSA, 100 Mil. NT\$; (6) Thailand: Depository Corporations Survey: Claims on Other Sectors, NSA, Mil. Baht.

For the firm-level data (bottom panels), we report medians computed across the full sample of firms from the six emerging Asian countries (China, India, Indonesia, Malaysia, Thailand and Taiwan), and report the values relative to 2008:Q1.

**Figure 3. Interaction between External Financing and Trade Credit, 2008**



Source: Worldscope firm-level data. The sample includes firms from China, India, Indonesia, Malaysia, Taiwan and Thailand.