Dissecting the Effect of Credit Supply on Trade: Evidence from Matched Credit-Export Data *

Daniel Paravisini
Columbia GSB, NBER, BREAD

Veronica Rappoport
Columbia GSB

Philipp Schnabl
NYU Stern

Daniel Wolfenzon
Columbia GSB, NBER

(*PRELIMINARY DRAFT*)

November 15, 2010

Abstract

This paper presents evidence on the effect of credit supply shocks on exports. Capital flow reversals in Peru during the 2008 financial crisis induced a decline in the supply of credit by domestic banks with high share of foreign-currency denominated liabilities. We use this variation to estimate the elasticity of exports to bank credit. We use matched customs and firm-level bank credit data to control for additional factors that may also affect the level of exports: we compare changes in exports of the *same* product and to the *same* destination by firms borrowing from different banks. Exports react strongly to changes in the supply of credit in the intensive margin, irrespectively of the firms' export volume. In the extensive margin, the negative credit supply shock increases the probability of exiting a product-destination export market, but does not significantly affect the number of firms entering an export market. The magnitude of the respective elasticities, as well as their heterogeneity across firm and export flow observable characteristics, are estimated.

*We are grateful to Saki Bigio, Paul Castillo, Roberto Chang, and Manuel Luy Molinie for helpful advice and discussions. We thank Diego Cisneros, Jorge Mogrovejo, Javier Poggi, Jorge Olcese, Mitchell Canta, Adriana Valenzuela, and Lucciano Villacorta for outstanding help with the data. Juanita Gonzalez provided excellent research assistance. All errors are our own. Please send correspondence to Daniel Paravisini (dp2239@columbia.edu), Veronica Rappoport (ver2102@columbia.edu), Philipp Schnabl (schnabl@stern.nyu.edu), and Daniel Wolfenzon (dw2382@columbia.edu).

1 Introduction

The role of banks in the amplification of real economic fluctuations has been debated by policymakers and academics since the Great Depression (Friedman and Schwarz (1963), Bernanke (1983)). Motivated by the unprecedented drop in world exports during the subprime financial crisis, this debate has permeated to the international trade literature. Do shocks to the balance sheet of banks affect export performance of related firms? What is the magnitude of the sensitivity of exports to changes in the supply of credit? How do credit fluctuations distort the entry, exit, and quantity choices of exporters? In this paper we address these questions.

We analyze the role played by commercial banks in the international transmission of the 2008 financial crisis to Peruvian exports. Peru is an ideal country for studying the consequences of a credit supply shock on trade for three main reasons. First, although local firms were not directly affected by the drop in the value of U.S. real estate, domestic banks' balance sheet was negatively affected by the reversal of capital flows during the subprime crisis, especially those with high share of foreign-currency denominated liabilities. Second, as a small open economy, one can abstract from general equilibrium effects on international demand or prices. And lastly, customs data are publicly available in Peru, and can be matched at the firm level with bank debt data from the Credit Registry. The matched data allow us, among other things, to effectively control for factors other than finance that potentially affect the demand and supply of exports.

The key empirical challenge is to disentangle the effect of credit supply on trade, from changes in credit demand in response to factors affecting the equilibrium amount of exports, such as economic conditions in destination countries or the cost of export production. To address this identification problem our empirical approach compares how the exports of the *same* product and to the *same* destination change by firms that borrow from banks with different shares of foreign liabilities. Banks that had a high share of foreign currency denominated liabilities before the financial crisis suffered a large negative funding shock when capital flows reversed during 2008. We demonstrate, using the within firm estimator in Khwaja and Mian (2008), that the supply of credit by these banks declined by over 17% after July 2008. We use this heterogeneity

in banks' foreign currency denominated liabilities as source of variation in the supply of credit to related firms to estimate the export elasticity to credit.

To illustrate the intuition behind our empirical strategy consider, for example, two firms that export *Men's Cotton Overcoats* to the *U.S.*.[1] Suppose that one of the firms obtains all its credit from Bank A, which had a large share of foreign-currency liabilities before the crisis, while the other firm obtains its credit from Bank B, which did not. Changes in the demand of overcoats in the U.S. should, in expectation, affect exports by both firms in a similar way. Also, any real shock to the production of overcoats in Peru, i.e., changes in the price of cotton, should affect both firms' exports the same way. Thus, the *relative* change in export performance of the two firms before and after the crisis provides an estimate of the effect of the decline in the supply of credit on exports.

Using an instrumental variable approach based on this intuition, we estimate the elasticity of exports to credit on the intensive and extensive margins. On the intensive margin, we find that a 1% reduction in the supply of credit results in a contraction of 0.23% in the volume of export flows for those firm-product-destination flows active before and after the crisis. This elasticity appears to be increasing in firm export amount. Credit supply also affects the number of firms that continue exporting to a given market, with elasticity of 0.36. This effect is particularly important for small export flows; the number of firms that continue exporting product-destination flows of size below the median drops 0.41 % following a reduction of 1% in credit supply. The credit shock does not seem to significantly affect the number of firms entering an export market.

In a *back of the envelope* calculation we assess the importance of the negative credit supply shock in explaining the observed decline in Peruvian exports during the crisis. In the year following July 2008, the value of Peruvian exports declined 9.6% (22% in value), which represents a disacceleration of 13 percentage points with respect to the previous year (see Figure 1). Assuming that credit supply declined only for the banks with above the median shares of foreign liabilities, we find that the negative credit supply shock accounts for about 12% of the missing

[1]The detail of the product coincides with the 6-digits aggregation in the Harmonized System, used in the paper.

volume of exports. Thus, bank credit appears to have a first order effect on trade, but the bulk of the decline in exports during the analysis period is explained by the drop in international demand for Peruvian goods.

The present paper is the first to use matched customs and Credit Registry data. These data have several distinct advantages for understanding the relationship between credit fluctuations and trade. First, they allow estimating an elasticity of exports to changes in credit supply. Second, they allow decomposing this elasticity along different margins. And third, they allow us to control for any factor other than finance that affects exports at the product-destination level. This is particularly important during an international crisis, which has potentially large and heterogeneous real effects across sectors and countries.[2] We find that not accounting for such variation results in overestimating the elasticity of exports to credit by up to 65% in our setting.

The results emphasize the role played by commercial banks in the international transmission of financial shocks to emerging economies. This channel is believed to be an importance source of contagion during the subprime crisis (see Cetorelli and Goldberg (2010) and IMF (2009)). Existing work provides evidence that banks' share of dollar liabilities are a good predictor of lending performance in times of international capital reversal (Schnabl (2010) and Khwaja and Mian (2008)). Our results extend these findings by showing that this transmission channel effects real economic activity.[3]

The effect of finance on the different margins of trade provides information on the impact of finance on the production costs of exporting. Consider for example the benchmark model

[2]See, for example, Alessandria, Kaboski and Midrigan (2010), who focus on the role of inventories in the amplification of export fluctuations, Bems, Johnson and Yi (2010) and Levchenko, Lewis and Tesar (2010), who analyze the role of intermediate goods and vertical linkages, and Eaton, Kortum, Neiman and Romalis (2010), who find that world trade collapse can be explained mainly by real factors.

[3]In general, there has been limited success in determining the consequences of credit supply shocks on real outcomes. Following early work by Bernanke and Blinder (1992) and Kashyap, Lamont and Stein (1994), recent papers have provided evidence that credit supply responds to shocks to bank balance sheets but have not assessed the effect on economic activity (see, for example, Kashyap and Stein (2000), Ashcraft (2005), Ashcraft (2006), Peek and Eric Rosengren (2000), Gan (2007), Khwaja and Mian (2008), Paravisini (2008), Chava and Purnanandam (2009), and Iyer and Peydro (2010)).

of trade with sunk entry costs.[4] In such a framework, a negative credit shock will affect the entry margin, but once the initial investment is covered, credit fluctuations should not affect the intensive margin of trade or the probability of exiting an export market. Our results on the elasticity of the intensive margin of trade suggest that credit shocks affect the *variable* cost of exporting. By increasing the marginal cost of exporting, adverse credit conditions reduce the equilibrium size and profitability of exports. In combination with fixed costs, the profitability decline will induce firms to abandon small export flows that are closer to the break-even point, consistent with our findings. Thus, the results in this paper are in line with substantial anecdotal evidence of the potential link between finance and the marginal cost of trade. Banks provide financial services, such as insurance and letters of credit, extensively used in international trade. Moreover, cross border transactions require more working capital, as the time elapsed between production and closure of the commercial transaction is considerably larger than for domestic sales.[5]

Our results pertain to the elasticity of trade to short-run credit fluctuations. Long-term finance availability has also been found to have an impact on the patterns of trade in other studies: countries with developed financial markets have comparative advantage in sectors characterized by large initial investments (see Beck (2003) and Manova (2008)). It remains to be shown whether those factors found to affect the sensitivity to long-term finance can also predict the effect of short-term credit shocks. To explore this question, we look at the heterogeneity of our estimates across sectors with different external finance dependence, measured as in Rajan and Zingales (1998). This measure represents firms' technological requirements of capital and it is found to predict the sensitivity of sectoral exports to long-term financial conditions. We find that the elasticity of exports to short-term fluctuations in credit is higher in sectors considered to be less dependent on external finance; the elasticities are 0.25 and 0.12 for low and high

[4]See, among others, Baldwin and Krugman (1989), Roberts and Tybout (1999), and Melitz (2003). Motivated by the important fixed costs involved in entering a new market—i.e., setting up distribution networks, marketing– Chaney (2005) develops a model where firms are liquidity constrained and must pay an export entry cost. Participation in the export market is, as a result, suboptimal.

[5]See Hummels (2001), Auboin (2009), and *Doing Business* by the World Bank for evidence on these factors.

external finance dependence products respectively. This result suggests that the elasticity to short-term and long-term changes in financial conditions represent different aspects of the firm's usage of credit; they are complementary measures for understanding the link between trade and finance.

We contribute to a growing body of research that studies the effect of financial shocks on trade. This literature is mostly based on cross-sectoral variations: using sectoral heterogeneity in dependance on external financing as an indicator of export sensitivity to credit, they find that country specific financial conditions are correlated with the relative export performance of finance sensitive sectors (Bricongne, Fontagne, Gaulier, Taglioni and Vicard (2009), Iacovone and Zavacka (2009), Chor and Manova (2010), and Levchenko et al. (2010)).[6] We show that, in our setting, cross sectional analysis does not correctly identify the impact of credit shocks. Our approach is fundamentally different: we focus on firm-level variation within the export sector to identify the impact of finance on trade. In this sense, our paper is closest to Amiti and Weinstein (2009), which documents that bank stock prices are positively correlated with the export performance of related firms during Japan's crisis in the 1990s, after controlling for industry variation. However, data limitations prevent them from measuring the elasticity of exports to credit, or to characterize the different dimensions in which financial shocks affect trade.

The rest of the paper proceeds as follows. Section 2 describes in detail the empirical strategy. Section 3 describes the data. In Section 4 we show the estimates of the export elasticity to credit supply. Section 5 concludes.

2 Empirical Strategy

This section describes our approach to identifying the causal effect of finance on exports. Consider the following general characterization of the level of exports by firm i of product p to

[6]The sign of the correlation is not the same in all studies. The first three studies find that exports in finance-intensive sectors decline more in countries with more adverse finance conditions, while Levchenko et al. (2010) finds the opposite.

destination country d at time t.

$$X_{ipdt} = X_{ipdt}(H_{ipdt}, C_{it}). \tag{1}$$

The first argument, H_{ipdt}, represents demand and supply real determinants of exports, i.e., willingness to pay for product p in country d, the income level of country d, the cost of inputs for producing product p, the productivity of firm i, etc.. The second argument, C_{it}, represents the amount of credit taken by the firm.

We are interested in estimating the elasticity of trade to credit: $\eta = \frac{\partial X}{\partial C}\frac{C}{X}$. The identification problem is that the amount of credit is a function of real demand and supply factors, H_{ipdt}, as well as determinants of the supply of finance faced by the firm, S_{it}:

$$C_{it} = C_{it}(H_{ipdt}, S_{it}). \tag{2}$$

To address this problem, we perform an instrumental variable estimation of a model that accounts for all unobserved heterogeneity in the cross section of firm-product-destination export flows, and controls for shocks at the product-destination level. As an instrument for the supply of credit, we use shocks to the balance sheet of the lenders to firm i. We explain in detail each of these aspects of the empirical strategy below.

2.1 Empirical Model

We separate the real determinants of exports, H_{ipdt}, in three components: 1) time-invariant firm-product-destination heterogeneity, δ_{ipd}, 2) shocks to the productivity and demand of exports at the product-country level, α_{pdt}, and 3) firm idiosyncratic shocks, ε_{ipdt}. The first component captures, for example, the managerial ability of firm i, or the firm knowledge of the market for product p in destination d. The second component captures changes in the cost of production of good p, variations in the transport cost for product p to destination d, or any fluctuation in the demand for product p at destination d. The last component captures firm idiosyncratic shocks,

such as plant stoppages due to machine breakdowns or fire.

The trade data at the firm-product-destination level used in this study, and described in detail in the next section, allow us to fully account for the first two real determinants of exports. The third component is captured in the error term. Specifically, we estimate the following empirical model of exports:

$$\ln(X_{ipdt}) = \eta \cdot \ln(C_{it}) + \delta_{ipd} + \alpha_{pdt} + \varepsilon_{ipdt}, \tag{3}$$

where, as in equation (1) above, X_{ipdt} represents the exports by firm i of product p to destination country d at time t, C_{it} is the the sum of all outstanding credit from the banking sector to firm i at time t. The right-hand side includes two sets of dummy variables that account for the cross sectional unobserved heterogeneity, δ_{ipd}, and the product-destination shocks, α_{pdt}. Our parameter of interest is η, the elasticity of exports to credit.

Despite the flexible empirical specification, OLS estimation of η in equation (3) will be biased because the endogenous relationship between credit and real factors established in equation (2) implies a correlation between C_{it} and the error term, ε_{ipdt}. We estimate equation (3) using shocks to the financial condition of the banks lending to firm i as an instrument for the amount of credit received by firm i at time t, C_{it}. We explain the economic rationale behind the instrument, and discuss the identification hypotheses behind the instrumental variable (IV) estimation next.

2.2 Bank Foreign Liabilities and the Supply of Credit during the SubPrime Crisis

Total bank lending in Peru disaccelerated sharply after the collapse of Lehman Brothers in September of 2008. Although this trend characterizes all Peruvian financial institutions, there were differences across banks depending on their share of foreign currency denominated liabilities (see Figure 2).

Portfolio capital inflows, that were growing prior to the crisis, stopped suddenly in mid 2008; the same evolution characterizes total foreign lending to Peruvian banks (see Figure 3). Closely

related, The Peruvian Sol, that was appreciating prior to the crisis, lost value abruptly after March 2008 (see Figure 4) and the burden of foreign liabilities increased, specially for banks that relied the most in foreign markets. This liquidity shock led to a decline in lending. As Figure 2 illustrates —and we formally demonstrate below–, the market share of domestic lending by banks with above the median foreign liabilities to assets dropped by 6 percentage points during 2008.[7]

We use banks' heterogenous dependence on foreign capital *before* the crisis, interacted with the aggregate decline in dollar funding *during* the crisis, as a source of variation in bank supply of credit. To construct the instrument we first rank banks according to their dependence on liabilities denominated in foreign currency in 2006, a year before the crisis. A bank b is considered to be *exposed* if the share of foreign liabilities in its balance sheet is above the mean (9.5%); in that case, the indicator variable FD_b is equal to one.

Our instrument is a function F_{it} that predicts variations in the supply of credit to firm i in time t. The cross sectional variation in F_{it} comes from the amount of credit that firm i receives from exposed banks in 2006. The classification of banks and firms in 2006 reduces the likelihood that bank foreign dependence and firm-bank matching were endogenously chosen in anticipation of the crisis. The time series variation in F_{it} is given by the aggregate decline of foreign liquidity in the Peruvian economy.

In the baseline estimations the functional form of the instrumental variable is

$$F_{it} = F_i \cdot Post_t, \tag{4}$$

where the indicator function F_i is one if firm i borrows more than 50% from exposed banks in 2006, and zero otherwise. $Post_t$ is an indicator variable that turns to one after July 2008, when the decline in foreign liquidity began. Our results are robust to alternate definitions of the functional form of F_{it}.

[7]See Banco Central de Reserva del Peru (2009) for an analysis of the performance of the domestic financial market during the subprime crisis.

2.2.1 ID Hypothesis 1: Foreign Dependence and Credit Supply

Our first identification hypothesis is that banks that had a larger fraction of their funding from foreign sources reduced the supply of credit relative to other banks after the crisis. This hypothesis is consistent with the observed decline in the market share of total lending by exposed banks observed in Figure 2. We can test formally this identification assumption by following the *within-firm* estimation procedure in Khwaja and Mian (2008) to disentangle credit supply from changes in the demand for credit.

The *within-firm* estimator entails comparing amount of lending by banks with different dependence on foreign capital, to the *same firm*. The empirical model is the following:

$$\ln(C_{ibt}) = \delta_{ib} + \alpha_{it} + \gamma \cdot FD_b \cdot Post_t + \nu_{ibt} \tag{5}$$

C_{ibt} refers to average outstanding debt of firm i with bank b during the intervals $t = \{Pre, Post\}$, where the Pre and Post periods correspond to the 12 months before and after July 2008, respectively. As defined above, FD_b is a dummy that takes value one if the share of foreign liabilities of bank b is above the mean (9.5%), and $Post_t$ is a dummy that signals whether $t = Post$. The regression includes firm-bank fixed effects, δ_{ib}, which control for all (time-invariant) unobserved heterogeneity in the demand and supply of credit. It also includes a full set of firm-time dummies, α_{it}, that control for the firm-specific evolution in overall credit demand during the period under analysis. As long as changes in a firm's demand for credit are equally spread across different lenders in expectation, the coefficient γ measures the change in credit supply by banks with higher dependence of foreign capital.

We present in Table 5, column 1, the estimated parameters of specification (5), obtained by first-differencing to eliminate the firm-bank fixed effects, and allowing correlation of the error term at the bank level in the standard error estimation. We find that, indeed, banks transmitted the international liquidity supply shock to the firms. Banks with share of foreign liabilities above the median contracted lending almost 17% relative to banks with lower exposure,

once the demand for credit is accounted for.

It is important to emphasize that the identification assumption tested above, that the instrument is correlated with the *supply* of credit, is much stricter than the one required by the IV estimation, i.e., that the instrument is correlated with the *amount* of credit. This assumption is tested through the first stage of the IV estimation of equation (3). The coefficient θ of the first stage of the IV estimator:

$$\ln(C_{it}) = \delta_i + \beta_t + \theta \cdot F_i \cdot Post_t + \upsilon_{it}. \tag{6}$$

shown in Column 1, Table 7, is -0.56 and significant at the 1% level. This implies that credit received by borrowers linked to exposed banks declines 56% during the crisis relative other firms. This parameter confounds demand and supply factors, and it is substantially larger than the estimated credit supply shock using empirical model (5), 17%. This highlights the importance of controlling for changes in the firm specific demand for credit to properly identify the magnitude of the supply shock. Still, as long as F_{it} is correlated with credit supply and the exclusion restriction holds (discussed next), the parameters of equation (3) are identified.

2.2.2 ID Hypothesis 2: Exclusion Restriction

Our second identification assumption is that the instrument is conditionally uncorrelated to the error term in equation (3). Formally, the exclusion restriction is:

$$E\left[(F_i \cdot Post_t) \cdot \varepsilon_{ipdt} | \delta_{ipd}, \alpha_{pdt}\right] = 0. \tag{7}$$

This condition will be met if firms are randomly matched to banks, such that firms characteristics and shocks are uncorrelated to bank exposure. However, the instrument is likely to be correlated to other firm level determinants of exports. For example, suppose that banks with higher liabilities in foreign currency specialize in firms that export *Men's Cotton Overcoats* to the U.S.. If the demand for Men's Overcoats in the U.S. drops disproportionately during the crisis, then

the external exposure instrument and changes in the demand for credit will be correlated, i.e., the exclusion restriction (7) will be violated unconditionally.

On the other hand, the exclusion restriction is likely to hold after conditioning on time-invariant flow characteristics, δ_{ipd}, and product-destination shocks, α_{pdt}. Using the above example, our estimation approach compares the change in Men's Cotton Overcoat exports to the U.S. by a firm that is linked to an exposed bank, relative to the change in Men's Cotton Overcoat exports to the U.S. of a firm whose lender is not exposed. More generally, the parameter η in equation (3) is estimated from variations that occur within the same product-destination.

To assess the plausibility of the second identification assumption, it is useful to consider under which circumstances exclusion restriction (7) is violated. This requires that firm level shocks (ε_{ipdt}) are correlated with the identity of the firm's lender after conditioning on product-destination variation. To use the examples considered above, this would require that production stoppages due to equipment breakdowns or fires occur systematically more often among firms related to exposed banks.[8] It is difficult to think of plausible economic stories that would generate such correlation.

3 Data Description

We use three data sets for the empirical analysis: bank level data on Peruvian banks, loan level data on loans provided by Peruvian banks to Peruvian firms, and export level data on Peruvian firms. We obtain the first two data sets from the Peruvian bank regulator Superintendence of Banking, Insurance, and Pension Funds (SBS). We collect the firm level data from the Peruvian tax agency Superintendence of Tax Administration (SUNAT). We match the loan data to export data using the unique tax identifier provided in both data sets. All data are public information.

The bank data consist of financial statements for all of Peru's commercial banks from January 2007 to December 2009. We classify Peruvian banks into two groups: banks with above-mean

[8]Note that a credit supply shock may cause production stoppages, for example, due to financial distress. This does not invalidate our identifying assumptions.

exposure to foreign borrowing and banks with below-mean exposure to foreign borrowing as of December 2007.

Table 1 provides bank descriptive statistics by type of bank. The data set contains 13 commercial banks. High foreign exposure banks are slightly smaller than low foreign exposure banks with total assets of 7.6bn Soles relative to 8.7bn Soles. Both high and low foreign exposure banks have loans worth more than 60% of assets and finance more than 50% of assets with retail deposits. The main difference between the two types of banks is that foreign finance represents 19.6% of total liabilities for high exposure banks relative to 5% for low exposure banks.

Peruvian exports in 2009 totaled almost $27bn, approximately 20% of Peru's GDP. North America and Asia are the main destinations of Peruvian exports; in particular United States and China jointly account for approximately 30% of total flows. Exports are concentrated around extractive activities, goods derived from gold and copper account for approximately 40% of Peruvian exports. Other important sectors are food products (cafe, asparagus, and fish) and textiles.

Table 2 provides the descriptive statistics of Peruvian exporting firms. The universe of exporters includes all firms with at least one export registered between January 2007 and December 2009. The average debt outstanding of the universe of exporters as of December 2007 is 2.9m Soles and the average level of exports is 9.6m Soles. The average firm exports to 2.75 destinations with an average distance of 6,040 kilometers. The average number of four-digit products is 5.3 and the average number of product-destinations is 8.7. The share of bank lending provided by high foreign exposure banks relative to low foreign exposure banks is 24.8%.

We also provide summary statistics for two samples. The first sample includes all firms that have positive debt both before and after the negative credit supply shock. The second sample includes all firms that are in the first sample and that have positive exports in both periods. As shown in Table 2, firms in both samples are larger than in the full sample. For example, average debt outstanding in the first sample is 3.6m Soles and in the second sample 5.8m Soles. Average exports in the first sample is 11.4m Soles and in the second sample is 21.3m Soles. Moreover,

these firms are also more likely to borrow from high foreign exposure banks relative to the full sample. Average borrowing from exposed banks is 29.6% in the first sample and 38.6% in the second sample.

Table 4 provides descriptive statistics on our instrumental variable strategy. We define two instruments. The first instrument is an indicator variable equal to one if a firm borrowed more than 50% from exposed banks and zero otherwise. The second instrument is the share of borrowing financed by exposed banks. We report the correlation between the instruments and firm observable characteristics both for the full sample and the second sample ("analysis sample"). First, we note that there is a low correlation between the instruments and firm characteristics. Second, the correlation often switches signs across samples. Third, both instruments yield similar results. These findings suggests that it is unlikely that firms select high foreign exposure banks relative to low foreign exposure banks because of an unobserved bank characteristic.

Table 3 provides firm descriptive statistics by total exports. We divide our sample in two groups: firms with above-median exports ("large") and firms with below-median exports ("small"). Not surprisingly, we find that large exporters have more debt outstanding with 10.4m Soles relative to small exporters with 1.8m Soles. We also find that large exporters export to 6.6 destinations relative to 2.1 destinations for small exporters. Large exporters borrow more from high foreign exposure banks with 44.0% relative 34.1% for small exporters. Interestingly, both groups export the same number of products with large exporters exporting 5.8 products and small exporters exporting 5.5 products.

4 Effect of Financial Supply Shock on Trade

It was established in the previous section that, although the disacceleration in lending by Peruvian banks after the Subprime crisis was general to all banks, those with higher share of foreign liabilities had a proportionally larger reduction in credit supply. In this section, we exploit the fact that firms borrow from different sets of banks, to analyze the relative export performance of firms related to banks with high foreign dependence. First, we estimate the impact on the inten-

sive margin of trade. And second, we estimate the relative effect of this credit supply shock on the extensive margin of trade. That is, the differential probability that an exporting firm related to a high foreign dependance bank reduced the number of products, or discontinued supplying a given destination; or, correspondingly, that a firm expands the set of products exported and destinations served. Table 6 presents the relevance of these margins in the overall export drop during the period under analysis. In all cases, we focus on firms with positive debt positions before and after the shock. Their descriptive statistics are in Table 2, Sample I.

4.1 Intensive Margin of Trade

In this section we analyze how the identified credit supply shock affects the intensive margin of trade; that is, how a decline in the supply of credit affects the amount of exports by firms which are exporting before and after the crisis. We emphasize the importance of fully controlling for shocks to the productivity or demand by accounting for common fluctuations in product-destination flows. For that reason, we use a restrictive definition of intensive margin. It corresponds to firm trade flows of a given product to a given destination, that were active, both, in the Pre and Post periods.

The richness of the data allows us to control for trade shocks with high precision. As explained in Section 2, we control for trade demand and productivity fluctuations by comparing variations in the magnitude of trade flows of the same destination-product pair across firms, where destination is defined at the country level, and products are aggregated at 4-digit level according to the Harmonized System. As a result, all our estimations are obtained from exports variation within close to 6,000 product-destinations in the baseline specification. Results are also shown with product definition at 6-digit level.

To address concerns related to estimation bias due to serial correlation, we collapse each period, Pre and Post, into a single observation (see Bertrand, Duflo and Mullainathan (2004)). Thus, X_{ipdt} corresponds to aggregate exports of product p to destination d by firm i in the period $t = \{Pre, Post\}$, where the Pre and Post periods correspond to the 12 months before and after

July 2008, respectively. We estimate equation (3) on the Pre-Post panel by first differencing to eliminate the firm-product-destination fixed effects. The resulting estimation equation is:

$$\ln\left(X_{ipdPost}\right) - \ln\left(X_{ipdPre}\right) = \alpha'_{pd} + \eta \cdot \left[\ln\left(C_{iPost}\right) - \ln\left(C_{iPre}\right)\right] + \varepsilon'_{ipd} \tag{8}$$

The product-destination dummies, $\alpha'_{pd} = \alpha_{pdPost} - \alpha_{pdPre}$ in equation (3), absorb all demand fluctuations of product p in destination d.

The results of both the OLS and the Instrumental Variable (IV) estimations of the export elasticity to credit supply in specification (8) are presented in Table 7, for the volume and value of exports respectively. The IV estimate implies that a 1% increase in the stock of credit results in an increase of 0.23% in the volume of yearly export flows and 0.26% in their value. The volume and value elasticities are similar, which confirms that our estimation strategy properly accounts for shocks that affect exports beyond the finance channel, i.e., through export prices. We find similar results if the export data uses product definition at 6-digit level, according to the Harmonized System (see Table 8).

The IV estimate of the export elasticity to finance is ten times that implied by the OLS estimate (the OLS point estimate is 0.025 in the case of export volume). This highlights the importance of firms' credit demand in explaining the drop in total lending during this period. The OLS estimate is biased downwards because the credit credit supply shock explains only a small portion of the overall drop in firms' credit during the crisis.

This raises the question of what would the magnitude of the bias in the estimated elasticity be if we could not account for all shocks to trade at the product-destination level. This is an important question since most empirical estimates of the effect of finance on credit use data that are not disaggregated at the firm-product-destination level, and thus cannot account for such variation.

Table 11 presents the results of specification (8) that would arise in our environment, if the data did not allow to fully control for demand shocks. Columns 1 and 4 in Table 11 present the estimated impact of the supply shock on firm exports if no information on products or destination

was available. In our environment, this would lead to overestimate the impact of the credit supply shock by more than 65% in the volume and 54% in the value of exports. Columns 2 and 5 in Table 11 correspond to the estimation based on firm exports by product, aggregated across all destinations. In this case, the specification imperfectly controls for fluctuations in demand by including product-time dummies, but cannot account for variations in demand driven by destination shocks. The resulting coefficients overestimate the elasticity of the value of exports to credit supply by 16% (9% in value). Finally, columns 3 and 6 are based on overall firm exports by destination, aggregated across all products. The specification includes destination-time dummies, but cannot account for its interaction with product demand. The resulting coefficients, although statistically insignificant, are the ones closest to our estimates in Table 7.

These estimates imply that during the period under analysis, controlling for the country of destination is crucial to correctly estimate the elasticity of exports to finance. A bias in unconditional estimates implies, as discussed in Section 2, that firms and banks are not randomly matched. Specifically, the upwards bias in this context implies that exposed banks with a larger fraction of dollar liabilities were specialized in lending to firms that experienced disproportionate declines in the demand for their exports.

We test the robustness of our estimates to the functional form of the instrument. We substitute the indicator variable F_i to a continuous version, defined as the maximum fraction of total funding that firm i obtained from exposed banks during 2006. The results, qualitatively and quantitatively similar to those described above, are presented in Table 9. Moreover, to assure that our results are not driven by any unobservable characteristic of the match between banks and firms, we perform placebo test: we estimate equation (8) before the crisis; that is, for $t = Pre - 1, Pre$, where Pre is, as above, the period July 2007-July 2008, and Pre-1 corresponds to the previous 12 months. The results are reported in Table 10. The coefficients of interest in the First Stage (FS), in column 1, and the IV regressions, in columns 4 and 7, are not statistically different from zero. This confirms that firms borrowing from banks with high share of dollar liabilities as of December 2007 did not face any differential credit supply prior to the crisis. And,

correspondingly, their exports performance was not different from those of firms linked to banks with lower share of dollar liabilities. Overall, the results of this placebo test suggest that our instrument correctly identifies the effect of credit supply shocks to the firms during the subprime crisis.

Our results are informative about the cost structure of the firm. The impact of credit shocks on the intensive margin suggests that finance affects the variable cost of export activities. The link between the credit shock and the variable cost of exports can be explained by the nature of international trade —i.e, the extra time elapsed in the commercial transaction, insurance, or the use letters of credit–, but also by the general need of working capital used in the production of exporting goods.[9] In both cases, an increase in the cost of funding results in higher effective unit cost and lower international sales.

4.1.1 Size

We analyze whether exports by firms of heterogenous sizes respond differently to the credit supply shock. We also consider the size of the firm overall export to a given country, under the hypothesis that there are economies of scale between multiproduct exports to the same destination.

Table 12 presents the export elasticities to credit supply (estimated with equation (8)) for firms and export flows of different sizes. Columns 1 and 2 present the results for large and small exporters; the size dummy ($X_i > median\ X$) is equal to one if the value of overall exports by firm i is larger than the median. Interestingly, the point estimate of the elasticity of exports to credit is bigger (although not statistically different) for large than for small exporters. Columns 3 and 4 present the results when size is defined at the flow level. The dummy ($X_{id} > median\ X_d$) is equal to one if the value of overall exports by firm i to destination d is larger than the median. We are therefore evaluating the heterogeneous impact of credit on exports, for different sizes of firm-destination flows. The elasticity of the intensive margin of exports is higher for larger

[9]See Auboin (2009) and IMF (2003) for detail on the banking services related to international trade and the increase in their cost when the financial market conditions tighten.

flows.

We interpret these coefficients as elasticities of exports with respect to overall finance, and not only to bank lending. This is usually the case for small firms, which rely almost exclusively on bank credit. During the subprime crisis, this was also the case for larger firms, which traditionally have other sources of credit.[10] This is a conservative interpretation; if alternative sources of finance were still available for large firms, their elasticity to overall finance may be bigger than the one computed here.

Interesting, although exports by large firms are more elastic to credit supply shocks, the overall effect of the credit supply shock on small and large firms is very similar. During the subprime crisis, illiquid banks cut credit disproportionately more to small firms. We estimate equation (5) for firms of different sizes and find that affected banks reduced credit supply by 19.5% in the case of small firms and 13.5% in the case of large one (see Table 5). Combining the magnitude of the credit supply shock and the elasticity of exports to finance, a *back of the envelope* calculation of the drop in the intensive margin of (volume of) export due to reduction in credit is 2.85% and 2.99% for small and large firms respectively (relative to firms borrowing from non affected banks).

This pattern is consistent with a model where firms choose their capital structure according to the stochastic characteristics of their credit shocks. Small firms, traditionally more credit constrained, may well be, in equilibrium, less elastic to credit supply shocks. And correspondingly, larger firms, with more stable access to liquidity, may endogenously be more sensitive to changes in credit supply.

4.2 Extensive Margin of Trade

In this subsection we analyze how the identified credit supply shock affects the extensive margin of trade. As before, we emphasize the importance of fully controlling for shocks to the productivity or demand by accounting for common fluctuations in product-destination flows. For

[10] Between March and October of 2008 the spread on domestic corporate bonds increased more than 400bp and firms avoided issuing new debt until mid 2009. See Banco Central de Reserva del Peru (2009).

that reason, we define a market as a pair product-destination. Then, we analyze how the credit shock affects the number of firms exporting a given product-destination in the Pre period that continue exporting during the Post period. And, correspondingly, we measure the effect of credit on the number of new firms that entry product-destination market in the Post period.

4.2.1 Entry

To measure the effect of supply of credit on the number of new firm-product-destination flows, we classify exporting and non exporting firms into different groups, F, according to their exposure to credit shocks. The dependent variable is a product-destination-group observation: the (log) number of new product-destination flows at time t, for the each group of firms F. We estimate the following equation:

$$\ln N^E_{Fpdt} = \delta_{Fpd} + \alpha_{pdt} + \nu^e \cdot \ln\left(\sum_{i \in F} C_{it}\right) + \xi_{Fpdt} \tag{9}$$

N^E_{Fpdt} is the number of firms in group F that start exporting product p to destination d at time t, for $t = \{Pre, Post\}$. As in the previous subsection, we define each time t to be a 12 month period and, in particular, the Pre and Post periods are the 12 months before and after July 2008, respectively. There are large number of intermittent export flows in the sample; we consider a firm-product-destination flow to be active at time t if it registered positive exports at any time during those 12 months.

This specification includes product-destination-time dummies, α_{pdt}, that control for changes in demand and productivity, and group-product-destination fixed effects, δ_{Fpd}, that control for any invariant characteristic of the group of firms F. We are interested in the effect of a credit shock to group F on its entry margin of trade, which is measured by the elasticity ν^e. As before, we instrument $\ln(\sum_{i \in F} C_{it})$ with a function F_{it} (defined in equation (4)) that predicts the credit supply to the firms in group F, based on the external dependence of its related banks. This implies the existence of two groups of firms, those with at least 50% of their debt with affected

banks (firms i such that $F_i = 1$) and those with most of their debt with non affected banks (firms i such that $F_i = 0$).

We estimate the parameter ν^e after first differencing equation (9) to eliminate the group-destination fixed effect. The dependent variable is therefore $\Delta \ln N^E_{Fpdt}$. The results are presented in Table 13, Column 1 and 2, for product definition at the 4 and 6 digit level, according to the Harmonized System. The entry margin does not seem to be affected by changes in the supply of credit.

4.2.2 Continuation

In the case of the continuation margin, we estimate the effect of credit on the number of export flows that continue active. The dependent variable is a product-destination-group observation: the number of firm-product-destination export flows open at time $t-1$, that continue active at time t for a group of firms, F, that experienced a similar change in credit. This empirical model does not differentiate between firms that stop exporting from those that continue exporting but discontinue a given product-destination flow. We estimate the following equation:

$$\ln N^C_{Fpdt} = \delta_{Fpd} + \alpha_{pdt} + \nu^c \cdot \ln \left(\sum_{i \in F} C_{it} \right) + \xi_{Fpdt} \tag{10}$$

N^C_{Fpdt} is the number of firms in group F that were exporting product p to destination d at time $t-1$ and continue doing so in time t, for $t = \{Pre, Post\}$. This specification includes product-destination-time dummies and group-product-destination fixed effects. As before, we instrument $\ln(\sum_{i \in F} C_{it})$ with the external dependence of the corresponding banks, F_{it}.

We estimate equation (10) on the Pre-Post panel by first differencing to eliminate the group-product-destination fixed effects. The dependent variable is therefore the change in the (log) number of continuing exporters between the Pre and Post periods. The result of the IV estimations is in Table 13, Columns 2 and 3. According to our preferred specification, using product definition aggregated at 4-digit level, a 10% increase in the stock of credit increases the number

of firms continuing exporting a given product-destination flow in 3.6%. More disaggregated product data is likely to be measured with errors, as exports are misclassified in very narrow categories; therefore the elasticity in Table 13, Column 3 is potentially estimated with the classic attenuation bias.

Credit shocks are only expected to affect the continuation margin if export activities are characterized by fixed costs. Then, a worsening in credit conditions can push sales below the minimum level required for the activity to be profitable. In this scenario, credit conditions are expected to affect the exit margin for small export flows, which are more likely to drop below this minimum level. To test this hypothesis, we estimate equation (10) including size considerations.

Table 14 presents the results of estimating equation (10) for export flows smaller and lager than the median, where the size of the flow refers to overall firm exports to a given destination. We find that the elasticity of the continuation margin to credit is positive and significant for export flows of all sizes. But, as expected, smaller flows are significantly more elastic to credit shocks than larger flows, with elasticities 0.41 and 0.14 respectively.

4.3 Contribution of Finance to Overall Export Decline

In this subsection, we use the estimated elasticities to perform a *back of the envelop calculation* of the contribution of finance to the overall export decline during the period under analysis.

The magnitude of the supply shock was estimated with equation (5), which controls for changes in the demand of credit at the firm level. Affected banks contracted credit supply 17% beyond the change in supply by non affected banks (see Table 5). These banks accounted for 30.5% of total credit to exporters in the Pre period (12 months before July 2008). We take the conservative stand that non affected banks —i.e., banks with share of foreign liabilities below 9.5%– were not liquidity constrained. Then, the overall drop in credit supply was 6%.

The effect of the credit shock on exports is found to change with the size of the export flow (Tables 12 and 14). Since small export flows account for less than 2% of total exports, our back of the envelope calculation focuses only on the estimates characterizing the performance of large

flows, 0.27 and 0.14 for the intensive and continuation margins respectively. The exit margin is not found to be affected by the credit supply shock. Then, the drop in credit supply explains a reduction in the volume of exports during the 12 months following July 2008 (Post period) of –2.1%.

Most of the reduction in the value of exports was due to the collapse in international prices of Peruvian goods. The total drop in the annual growth rate of the value of exports between the Pre and Post periods was 33.3 percentage points, while in volume this difference is reduced to 12.8 percentage points (see Table 6). Then, the drop in credit supply can account for approximately 16.5% of this missing volume of trade.

Following the decomposition in export growth rates presented in Table 6, we decompose the total missing volume trade in intensive and extensive margins. The intensive margin, that was growing at 2.1% in the 12 months of the Pre period, declined 2.2% during the Post period. Finance alone can account for more than 32% of this drop. However, the intensive margin accounts for only 33% of the missing trade, while 64% of the missing trade is explained by the increase in the exit margin, which doubled between the Pre and Post periods. The credit shock can explain 9% of the exit margin. This suggests that the large increase in the exit margin during the 12 months following July 2008 was triggered by the contraction in international demand and prices for Peruvian goods, which made the value of the trade flows insufficient to cover the export fixed costs.

4.4 Sectorial Heterogeneity in Credit Sensitivity

In the United States, characterized by relatively frictionless financial markets, firms of different manufacture sectors vary in their *external finance dependence*. Since the seminal work by Rajan and Zingales (1998), this source of heterogeneity across sectors has been widely used to identify the effect of credit constraints on long-term growth and the cross country pattern of international trade. It remains to be shown whether those factors considered to affect the sensitivity to long-term finance can also predict the effect of short-term credit shocks. This subsection explores

this topic.

We analyze how our estimates of the export elasticities to credit shocks vary across sectors with different external finance dependence. Our measure of external finance dependence follows Chor and Manova (2010); it corresponds to the fraction of total capital expenditure not financed by internal cash flows, from cross sectoral data of U.S. firms. This measure is considered to represent technological characteristics of the sector of firm. For example, according to this measure, *textile mills* that transform basic fibers into fabric, intensively require external finance, while *apparel manufacturing* firms that process that fabric into the final piece of clothing, are considered to be less dependent.

We estimate equations (8), (9), and (10), for sectors with external finance dependence above (below) the cross sectoral median. The results are reported in Table 15. We find that the elasticity of (volume of) exports to finance is higher in manufacture sectors considered to be less dependent on external finance; the elasticities are 0.25 and 0.12 for low and high external finance dependence sectors respectively. The elasticity of the continuation and entry margins does not vary across sectors with different levels of external finance dependence.

Our results suggest that the elasticities to short-term and long-term changes in financial conditions represent different aspects of the firm's usage of credit. The measure of external finance dependence may indicate the sensitivity of the firm to long term access to credit, which is potentially related to the presence of important fixed investments or entry costs. The elasticity of exports to credit shocks, on the other hand, is related to the short term needs of working capital.

5 Conclusions

It has long been argued that shocks to banks liquidity are transmitted to the credit conditions of related firms. There is no evidence, however, of their consequences in terms of real outcomes. In this paper, we provide evidence of this link. Banks subject to liquidity shocks change their lending to firms, which in turn adjust their volume of exports.

Our results stem from analyzing Peruvian exports during the subprime crisis. Although Peru was not directly affected by the collapse in the value of U.S. real estate, the capital flow reversal during the international financial crisis affected the lending capacity of domestic commercial banks. We use this drop in the supply of credit to Peruvian firms to estimate the sensitivity of exports to credit. We find that the elasticity of the intensive margin of exports is 0.23, irrespectively of the size of the firm. Credit is found to affect the number of firms that continue exporting, and the elasticity is larger for small export flows. Short term fluctuations in credit supply, on the other hand, are not found to significantly affect the decision of firms to entry a new export market.

These results cast light on the link between finance and production activities. They suggest that credit shocks affect the variable cost of the firm —in particular, of exporting. When credit conditions tighten, the unit cost of exports increases and, as a result, sales drop. Along the same lines, an increase in the variable cost of exporting can trigger firms to discontinue those export flows with size close to the break-even point.

References

Alessandria, George, Joseph Kaboski, and Virgiliu Midrigan (2010) 'The great trade collapse of 2008-09: an inventory adjustment?' *NBER Working Paper*

Amiti, Mary, and David Weinstein (2009) 'Exports and financial shocks.' *NBER Working Paper*

Ashcraft, Adam (2005) 'Are banks really special? new evidence from the fdic-induced failure of healthy banks.' *The American Economic Review* 95(5), 1712–1730

—— (2006) 'New evidence on the lending channel.' *Journal of Money, Credit, and Banking* 38(3), 751–776

Auboin, Marc (2009) 'Boosting the availability of trade finance in the current crisis: Background analysis for a substantial g20 package.' *CEPR Policy Research Paper*

Baldwin, Richard, and Paul Krugman (1989) 'Persistent trade effects of large exchange rate shocks.' *The Quarterly Journal of Economics* 104(4), 635–654

Banco Central de Reserva del Peru (2009) 'Reporte de estabilidad financiera.' May

Beck, Thorsen (2003) 'Financial dependence and international trade.' *Review of International Economics* 11(2), 296–316

Bems, Rudolfs, Robert Johnson, and Kei-Mu Yi (2010) 'The role of vertical linkages in the propagation of the global downturn of 2008.' *Working Paper*

Bernanke, Ben (1983) 'Non monetary effects of the financial crisis in the propagation of the great depression.' *The American Economic Review* 82(4), 901–921

Bernanke, Ben, and Alan Blinder (1992) 'The federal funds rate and the channels of monetary transmission.' *The American Economic Review* 82(4), 901–921

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan (2004) 'How much should we trust differences-in-differences estimates?' *Quarterly Journal of Economics* 119(1), 249–275

Bricongne, Charles, Lionel Fontagne, Guillaume Gaulier, Daria Taglioni, and Vincent Vicard (2009) 'Exports and financial shocks.' *Banque de France Working Paper*

Cetorelli, Nicola, and Linda Goldberg (2010) 'Global banks and international shock transmission: Evidence from the crisis.' *NBER Working Paper*

Chaney, Thomas (2005) 'Liquidity constrained exporters.' *Chicago University Working Paper*

Chava, Sudheer, and Amiyatosh Purnanandam (2009) 'The effect of banking crisis on bank-dependent borrowers.' *Journal of Financial Economics*

Chor, Davin, and Kalina Manova (2010) 'Off the cliff and back? credit conditions and international trade during the global financial crisis.' *NBER Working Paper*

Eaton, Jonathan, Sam Kortum, Brent Neiman, and John Romalis (2010) 'Trade and the global recession.' *Penn State University Working Paper*

Friedman, Milton, and Anna Schwarz (1963) *Monetary History of the United States, 1867–1960* (Princeton University Press)

Gan, Jie (2007) 'The real effects of asset market bubbles: Loan- and firm-level evidence of a lending channel.' *Review of Financial Studies* 20(5), 1941–1973

Hummels, David (2001) 'Time as a trade barrier.' *Purdue University Working Paper*

Iacovone, Leonardo, and Veronika Zavacka (2009) 'Banking crisis and exports: Lessons from the past.' *The World Bank Policy Research Working Paper*

IMF (2003) 'Trade finance in financial crises: Assessment of key issues.' Policy Development and Review Department

—— (2009) 'World economic outlook.' April

Iyer, Rajkamal, and Jose-Luis Peydro (2010) 'Interbank contagion at work: Evidence from a natural experiment.' ECB Working Paper

Kashyap, Anil, and Jeremy Stein (2000) 'What do one million observations on banks have to say about the transmission of monetary policy.' *The American Economic Review* 90(3), 407–428

Kashyap, Anil, Owen Lamont, and Jeremy Stein (1994) 'Credit conditions and the cyclical behavior of inventories.' *Quarterly Journal of Economics* 109(3), 565–592

Khwaja, Asim, and Atif Mian (2008) 'Tracing the impact of bank liquidity shocks: Evidence from an emerging market.' *The American Economic Review* 98(4), 1413–1442

Levchenko, Andrei, Logan Lewis, and Linda Tesar (2010) 'The collapse of international trade during the 2009-2009 crisis: In search of the smoking gun.' *NBER Working Paper*

Manova, Kalina (2008) 'Credit constraints, equity market liberalizations, and international trade.' *Journal of International Economics* 76, 33–47

Melitz, Marc J. (2003) 'The impact of trade on intra-industry reallocations and aggregate industry productivity.' *Econometrica* 71(6), 1695–1725

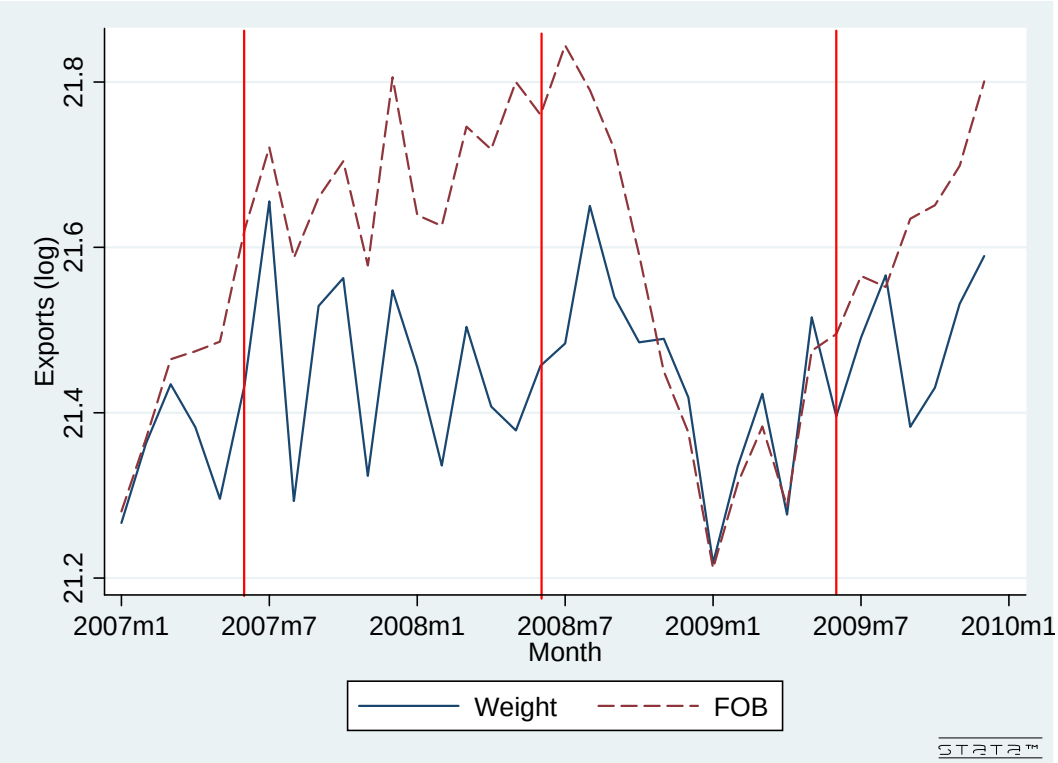
Paravisini, Daniel (2008) 'Local bank financial constraints and firm access to external finance.' *The Journal of Finance* 63(5), 2160–2193

Peek, Joe, and Eric Eric Rosengren (2000) 'Collateral damage: Effects of the japanese bank crisis on real activity in the united states.' *The American Economic Review* 90(1), 30–45

Rajan, Raghuram, and Luigi Zingales (1998) 'Financial dependence and growth.' *The American Economic Review* 88(3), 559–586

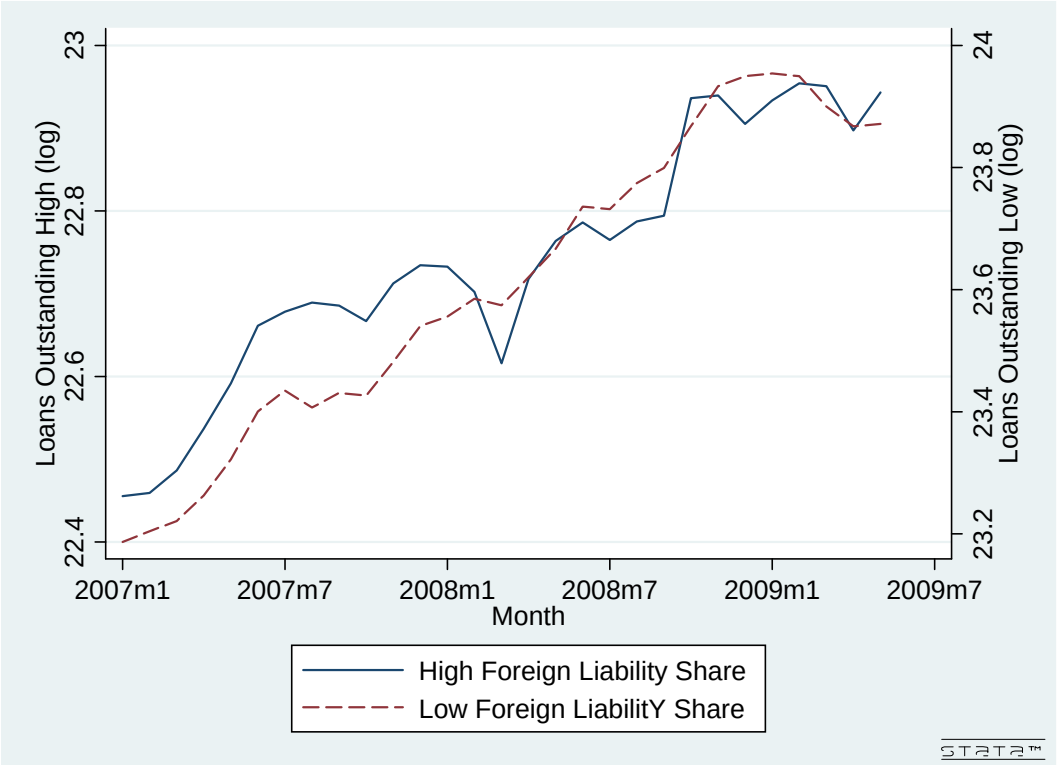
Roberts, Mark, and James Tybout (1999) 'An empirical model of sunk costs and the decision of exports.' *World Bank Working Paper*

Schnabl, Philipp (2010) 'Financial globalization and the transmission of bank liquidity shocks: Evidence from an emerging market.' *The Journal of Finance*



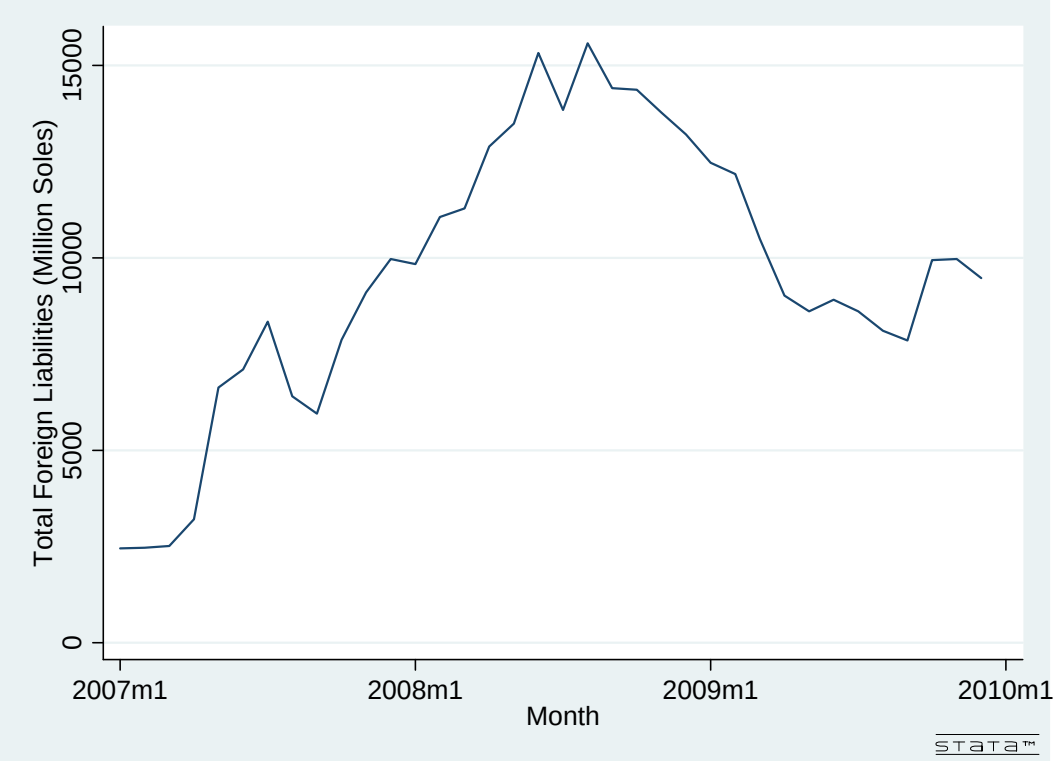
Source: SUNAT. Volume of exports in kg, and value in dollars FOB.

Figure 1: Total Peruvian Exports



Source: Bank Financial Statements and Credit Registry, Superintendencia de Bancos y Seguros de Peru, and SUNAT. Banks with high (low) foreign liability share are those with fraction of foreign liabilities to assets above (below) 9.5% in January-June 2008.

Figure 2: Lending by Banks with High Share of Foreign Liabilities



Source: Bank Financial Statements, Superintendencia de Bancos y Seguros de Peru. Foreign financing: bank liabilities with institutions outside Peru.

Figure 3: Total Banking Sector Foreign Financing

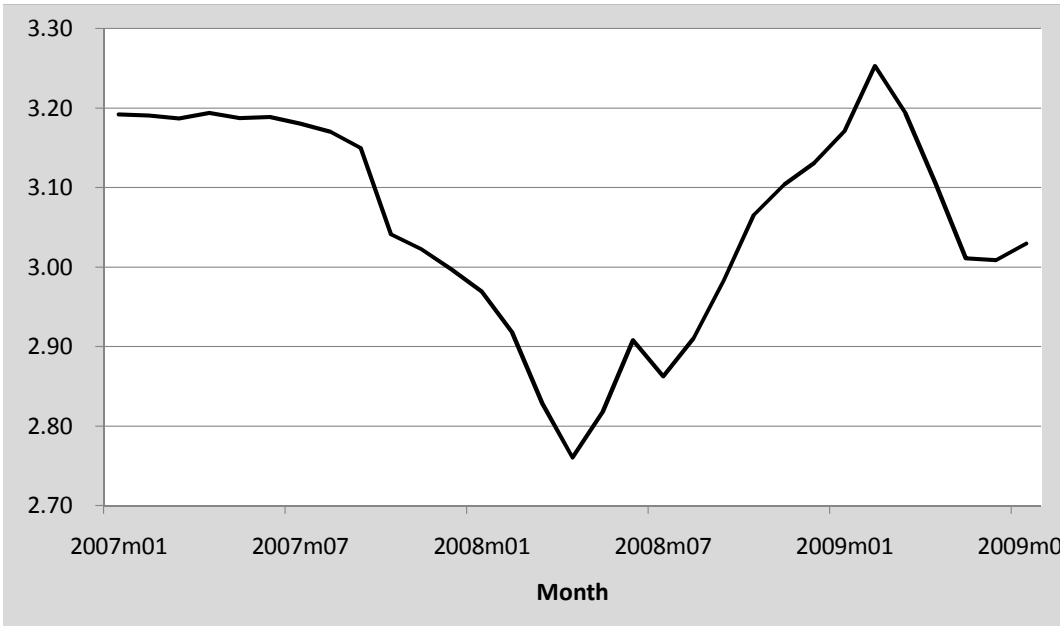


Figure 4: Exchange Rate (Soles/USD)

	High Foreign Exposure (N = 4)			Low Foreign Exposure (N = 9)		
	mean	sd	p50	mean	sd	p50
Assets (M Soles)	7,599	11,451	2,382	8,661	13,630	2,260
Loans (M Soles)	5,127	7,724	1,687	4,949	7,352	1,521
Deposits (M Soles)	5,043	8,045	1,309	6,336	10,078	1,396
Foreign Financing (M Soles)	1,059	1,520	362	637	1,109	155
Loans/Assets	0.659	0.126	0.660	0.661	0.103	0.673
Deposits/Assets	0.573	0.082	0.543	0.665	0.158	0.733
Foreign Financing/Assets	0.196	0.135	0.175	0.050	0.034	0.065

Source: Bank Financial Statements as of December 2007, Superintendencia de Bancos y Seguros de Peru.

Table 1: Bank Descriptive Statistics

	All Exporters (N = 6169)			Sample I (N=4974)			Sample II (N = 2584)		
	mean	sd	p50	mean	sd	p50	mean	sd	p50
Debt (1,000 Soles)	2,889	19,688	4	3,571	21,870	27	5,843	24,990	166
Exports - FOB (1,000 Soles)	9,568	150,450	81	11,447	166,880	88	21,353	230,858	408
Exports (1,000 Kg)	8,529	230,792	11	10,449	256,985	12	19,618	356,251	57
# destinations	2.7	4.3	1.0	2.9	4.5	1.0	4.3	5.8	2.0
Distance (km)	6,040	7,462	4,725	5,962	7,302	4,725	5,793	6,575	3,189
# products (4-digit)	5.3	9.4	2.0	4.7	8.2	2.0	5.6	8.7	3.0
# Product x Destinations	8.7	20.5	3.0	8.0	18.5	3.0	11.5	22.9	5.0
Frac share of debt from exposed bank $> 50\%$	0.248	0.432	0.000	0.296	0.456	0.000	0.386	0.487	0.000
Fraction borrowed from exposed bank	0.247	0.398	0.000	0.295	0.417	0.000	0.388	0.432	0.111

Source: Bank Financial Statements and Credit Registry as of December 2007, Superintendencia de Bancos y Seguros de Peru. Customs data between January 2007 and December 2009, SUNAT. Sample I: firms with positive debt in both periods. Sample II: subsample of firms from Sample I that export in both periods.

Table 2: Firm Descriptive Statistics

	Large Exporters (N = 1212)			Small Exporters (N = 1372)		
	mean	sd	p50	mean	sd	p50
Debt (Th Soles)	10417.6	32328.2	820.3	1801.6	14784.7	50.3
Exports - FOB (Th Soles)	42736.5	334200.4	2580.6	2464.0	31516.4	81.2
Exports (Th kg)	41807.8	519398.1	978.8	15.3	19.1	6.9
N destinations	6.61	7.56	4.00	2.18	2.04	1.00
Distance (km)	6705	6925	5587	4989	6142	2969
N products (4-digit)	5.81	9.61	2.00	5.46	7.74	3.00
N Product x Destinations	15.8	29.2	6.0	7.7	14.4	4.0
Frac share of debt from exposed bank $> 50\%$	0.435	0.496	0.000	0.343	0.475	0.000
Fraction borrowed from exposed bank	0.440	0.424	0.387	0.341	0.433	0.000

Source: SUNAT. Size defined according to the firm export amount in the pre-period (July 2007 to July 2008).

Table 3: Firm Descriptive Statistics by Size of Exports

Variable	Instrument I		Instrument II	
	All exporters	Analysis Sample	All exporters	Analysis Sample
Debt (Th Soles)	0.087	0.033	0.099	0.063
Exports - FOB (Th Soles)	0.014	-0.009	0.024	0.001
Exports (Th kg)	-0.005	-0.022	0.009	-0.005
N destinations	0.118	0.047	0.144	0.078
Distance (km)	-0.007	0.003	-0.010	0.001
N products (4-digit)	-0.045	-0.009	-0.041	0.007
N Product x Destinations	0.004	0.006	0.020	0.037

Correlation between the instrument and dependent variables. Instrument I: dummy=1 if firm borrowed more than 50% from exposed bank in pre period. Instrument II: fraction (max) borrowed from exposed bank in pre period.

Table 4: Instrument Descriptive Statistics

Dependent Variable:	$\Delta \ln C_{ib}$		
	All firms	Small ($< median\ X$)	Large ($> median\ X$)
	(1)	(2)	(3)
FD_b	-0.168***	-0.194***	-0.136***
	(0.046)	(0.049)	(0.049)
Firm FE	yes	yes	yes
Observations	10,336	6,349	3,987
R^2	0.630	0.669	0.557
R^2 adj	0.261	0.264	0.239
# banks	42	41	33
# firms	5157	3490	1667

Estimation of equation (5). FD_b is a dummy that signals whether foreign liabilities of bank b is above the median. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 5: Transmission of Credit Shocks by Banks with High Foreign Dependence

	Value (FOB)		Volume (kg)	
	t=Pre	t=Post	t=Pre	t=Post
Total	10.9%	-22.4%	3.2%	-9.6%
Intensive	10.6%	-15.7%	2.1%	-2.2%
Extensive	0.3%	-6.6%	1.2%	-7.4%
Entry	8.4%	8.2%	8.6%	8.3%
Exit	-8.1%	-14.8%	-7.4%	-15.7%

Source: SUNAT. Extensive and intensive margins defined at the level of product destination flows. For each $t = \{Pre, Post\}$, it corresponds to the growth rate $X_t/X_{t-1} - 1$. Each time t is a 12 months period and Pre and Post periods correspond to the 12 months before and after July 2008. A flow firm-product-destination is considered active at time t if exports were positive at any time during the period. Product definition aggregated at 4-digit level according to the Harmonized System.

Table 6: Descriptive Statistics of Export Growth

Dependent Variable:	$\Delta \ln C_i$	$\Delta \ln Vol_{ipd}$			$\Delta \ln FOB_{ipd}$		
	FS	RF	OLS	IV	RF	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dummy Affected: $> 50\%$	-0.561***	-0.127**			-0.144**		
	(0.192)	(0.058)			(0.062)		
$\Delta \ln C_i$			0.025	0.227***		0.035*	0.257***
			(0.018)	(0.068)		(0.020)	(0.060)
Product-Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Product-Destinations	5,997	5,997	5,997	5,997	5,997	5,997	5,997
Observations	14,208	14,208	14,209	14,210	14,210	14,210	14,210
R^2	0.360	0.438	0.438		0.437	0.437	

Estimation of equation (8). In the IV regression $\Delta \ln C_i$ is instrumented with F_i, a dummy that takes value 1 if the firm borrows more than 50% from an affected bank. Product definition aggregated at 4-digit level according to the Harmonized System. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 7: Intensive Margin Elasticity to Credit Shocks — 4 digits Harmonized System

Dependent Variable:	$\Delta \ln C_i$	$\Delta \ln Vol_{ipd}$		$\Delta \ln FOB_{ipd}$	
	FS	RF	IV	RF	IV
	(1)	(2)	(4)	(5)	(7)
Dummy Affected: $> 50\%$	-0.636**	-0.133*		-0.155**	
	(0.250)	(0.071)		(0.076)	
$\Delta \ln C_i$			0.209***		0.249***
			(0.060)		(0.058)
Product-Destination FE	Yes	Yes	Yes	Yes	Yes
# Product-Destinations	8,567	8,567	8,567	8,567	8,567
Observations	16,472	16,472	16,472	16,472	16,472
R^2	0.447	0.528		0.524	

Estimation of equation (8). In the IV regression $\Delta \ln C_i$ is instrumented with F_i, a dummy that takes value 1 if the firm borrows more than 50% from an affected bank. Product definition aggregated at 6-digit level according to the Harmonized System. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

Table 8: Intensive Margin Elasticity to Credit Shocks — 6 digits Harmonized System

Dependent Variable:	$\Delta \ln C_i$	$\Delta \ln Vol_{ipd}$		$\Delta \ln FOB_{ipd}$	
	FS	RF	IV	RF	IV
	(1)	(2)	(3)	(4)	(5)
Fraction Borrowed from Affected Banks	-0.991***	-0.193**		-0.215**	
	(0.295)	(0.079)		(0.085)	
$\Delta \ln C_i$			0.195***		0.217***
			(0.048)		(0.050)
Product-Destination FE	Yes	Yes	Yes	Yes	Yes
# Product-Destinations	5,997	5,997	5,997	5,997	5,997
Observations	14,208	14,208	14,210	14,210	14,210
R^2	0.371	0.438		0.437	

Estimation of equation (8). In the IV regression $\Delta \ln C_i$ is instrumented with F_i: (max) proportion of firm debt in affected banks. Product definition aggregated at 4-digit level according to the Harmonized System. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 9: Robustness

Dependent Variable:	$\Delta \ln C_i$	$\Delta \ln Vol_{ipd}$			$\Delta \ln FOB_{ipd}$		
	FS	RF	OLS	IV	RF	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dummy Affected: $> 50\%$	-0.138	-0.008			0.001		
	(0.120)	(0.055)			(0.055)		
$\Delta \ln C_i$			0.030**	0.059		0.038**	0.010
			(0.015)	(0.352)		(0.016)	(0.342)
Product-Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Product-Destinations	6,046	6,046	6,046	6,046	6,046	6,046	6,046
Observations	15,265	15,265	15,265	15,265	15,265	15,265	15,265
R^2	0.329	0.417	0.418		0.409	0.411	

Estimation of equation (8) for $t = Pre - 1, Pre$, where Pre = June 2007-July 2008 and Pre-1 = June 2006-July 2007. In the IV regression $\Delta \ln C_i$ is instrumented with F_i, a dummy that takes value 1 if the firm borrows more than 50% from an affected bank. Product definition aggregated at 4-digit level according to the Harmonized System. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 10: Placebo Test

Dependent Variable:	$\Delta \ln Vol_i$ (1)	$\Delta \ln Vol_{ip}$ (2)	$\Delta \ln Vol_{id}$ (3)	$\Delta \ln FOB_i$ (4)	$\Delta \ln FOB_{ip}$ (5)	$\Delta \ln FOB_{id}$ (6)
$\Delta \ln C_i$	0.376***	0.263***	0.234	0.396***	0.280***	0.255
	(0.116)	(0.077)	(0.187)	(0.110)	(0.080)	(0.212)
FE	no	prod	dest	no	prod	dest
Observations	2,438	5,811	5,421	2,438	5,812	5,421
# firms	2,438	1914	1834	2,438	1914	1834
# destination			140			140
# products		759			758	

IV estimation of equation (8). $\Delta \ln C_i$ is instrumented with F_i, a dummy that takes value 1 if the firm borrows more than 50% from an affected bank. Product definition aggregated at 4-digit level according to the Harmonized System. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 11: Estimation Bias

Dependent Variable:	$\Delta \ln Vol_{ipd}$ (1)	$\Delta \ln FOB_{ipd}$ (2)	$\Delta \ln Vol_{ipd}$ (3)	$\Delta \ln FOB_{ipd}$ (4)	$\Delta \ln Vol_{ipd}$ (5)	$\Delta \ln FOB_{ipd}$ (6)
$\Delta \ln C_i$	0.154*	0.181**	0.056	0.130	0.215***	0.235***
	(0.089)	(0.084)	(0.089)	(0.097)	(0.075)	(0.081)
$\Delta \ln C_i \cdot (X_i > median\ X)$	0.078	0.089				
	(0.161)	(0.146)				
$\Delta \ln C_i \cdot (X_{id} > median\ X_d)$			0.271**	0.200		
			(0.136)	(0.143)		
$\Delta \ln C_i \cdot (X_{ip} > median\ X_p)$					-0.043	0.014
					(0.181)	(0.173)
product-destination FE	yes	yes	yes	yes	yes	yes
Observations	14,208	14,218	14,208	14,218	14,208	14,218
# Product-Destinations	4913	4913	4913	4913	4913	4913

IV estimation of equation (8). $\Delta \ln C_i$ is instrumented with F_i, a dummy that takes value 1 if the firm borrows more than 50% from an affected bank. The size of the firm is defined relative to the median value of total exports in the pre period. Product definition aggregated at 4-digit level according to the Harmonized System. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 12: Intensive Margin Elasticity by Size of the Firm

Dependent Variable:	$\Delta \ln N^E_{Fpd}$		$\Delta \ln N^C_{Fpd}$	
	4-digit HS	6-digit HS	4-digit HS	6-digit HS
	(1)	(2)	(3)	(4)
$\Delta \ln(\sum_{i \in F} C_i)$	0.232	0.594	0.363***	0.275***
	(0.185)	(0.435)	(0.095)	(0.065)
Product-Destination FE	Yes	Yes	Yes	Yes
Observations	3,088	3,739	4,658	6,143

Columns (1) and (2) correspond to the IV estimation of equation (9); columns (3) and (4) to equation (10). $\Delta \ln C_i$ is instrumented with F_i, a dummy that takes value 1 if the firm borrows more than 50% from an affected bank. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 13: Extensive Margin Elasticity to Credit Shocks

Dependent Variable:	$\Delta \ln N^C_{Fpd}$	
	Small	Large
	(1)	(2)
$\Delta \ln(\sum_{i \in F} C_i)$	0.409***	0.144*
	(0.138)	(0.083)
Product-Destination FE	Yes	Yes
Observations	4,595	2,018
# Product-Destinations	3,778	1,679

IV estimation of equation (10); columns (3) and (4) to equation (10). $\Delta \ln C_i$ is instrumented with F_i, a dummy that takes value 1 if the firm borrows more than 50% from an affected bank. Columns (1) and (2) are export flows smaller and bigger than the median, where size corresponds to total export to a given destination. Product definition aggregated at 4-digit level according to the Harmonized System. Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 14: Continuation Margin Elasticity to Credit Shocks by Size of Export Flow

Dependent Variable:	$\Delta \ln Vol_{ipd}$ Intensive Margin		$\Delta \ln N^C_{Fpd}$ Continuation Margin		$\Delta \ln N^E_{Fpd}$ Entry Margin	
	Low	High	Low	High	Low	High
	(1)	(2)	(2)	(3)	(4)	(5)
$\Delta \ln C_i$	0.249***	0.117				
	(0.086)	(0.197)				
$\Delta \ln(\sum_{i \in F} C_i)$			0.119	0.084	0.164	-0.082
			(0.685)	(0.058)	(2.925)	(0.092)
Product-Destination FE	yes	yes	yes	yes	yes	yes
Observations	5,077	4,465	2,048	3,176	2,830	5,026
# Product-Destinations	1529	2542	1,535	2,502	2,037	3,950

Intensive, continuation, and exit margins corresponds to IV estimation of equations (8), (9), and (10) respectively. $\Delta \ln C_i$ is instrumented with F_i, a dummy that takes value 1 if the firm borrows more than 50% from an affected bank. The classification of sectors according to their dependence of external finance follows Chor and Manova (2010). Robust standard errors in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 15: Export Elasticity to Credit Shocks by Sector Characteristic