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ABSTRACT

We estimate the elasticity of exports to credit using matched customs and firm-level bank credit data from Peru. To account for non-credit determinants of exports, we compare changes in exports of the same product and to the same destination by firms borrowing from banks differentially affected by capital flow reversals during the 2008 financial crisis. We obtain elasticity estimates for the intensive and extensive margins of exports, size and frequency of shipments, and the method of freight and payment. Our results suggest that the credit shortage reduces exports through raising the cost of working capital for general production, rather than the cost of financing export-specific cash cycles or sunk entry investments.

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1 Introduction

The role of banks in the amplification of real economic fluctuations has been debated by policymakers and academics since the Great Depression (**?**, **?**). The basic premise is that funding shocks to banks during economic downturns increase the real cost of financial intermediation and reduce borrowers access to credit and output. Through this channel, international commercial banks have been shown to represent an important source of contagion during periods of international capital reversals.[1] Although there is now a large body of evidence suggesting that negative bank credit shocks may affect economic activity, the magnitude of the sensitivity of output to credit shortages is unknown, and the underlying economic mechanisms behind this sensitivity are less understood.[2]

In this paper we study empirically the impact of bank credit shortages on economic activity using disaggregated firm export data. Measuring firm output with disaggregated export data allows us to dissect the effect of credit on economic activity along three novel dimensions. First, we can empirically decompose the effect of credit on output into the credit supply shock and the sensitivity of exports to credit fluctuations. In doing so, we provide the first estimates of a firm's elasticity of output to credit, a key input for parameterizing quantitative analysis. Second, customs data at the shipment level allows us to decompose the export elasticity to credit in its intensive and extensive margins, as well as measuring the elasticity of other dimensions of the export activity (shipment size and frequency, freight and payment method). Third, we analyze the validity of the empirical methodologies and assumptions that have been used in the literature to identify the role of credit on export when the data are not sufficiently disaggregated.[3]

We study the export behavior of Peruvian firms during the 2008 financial crisis. The

[1] See **?**, **?**, **?**, and **?**.

[2] For early evidence see, for example, **?**, **?**, **?**, **?**, and **?**.

[3] The literature that studies the effect of financial shocks on trade has been limited by the use of export data aggregated at the sector-destination level or the firm level, and/or the unavailability of bank credit information. See, for example, **?**, **?**, **?**, and **?**.

funding of banks operating in Peru was negatively affected by the reversal of capital flows during the crisis. We use this funding shortage, which was particularly pronounced among banks with a high share of foreign liabilities, as a source of variation for the supply of credit to their related firms. To overcome concerns that unobserved demand and input market shocks might be correlated with the credit supply shock, we rely on the disaggregated nature of our data to account for these non-credit shocks: We compare the export growth of the *same* product and to the *same* destination of firms that borrow from banks that were subject to these heterogeneous funding shocks.

To illustrate the intuition behind this approach consider, for example, two firms that export *Men's Cotton Overcoats* to the *U.S.*[4] Suppose that one of the firms obtains all its credit from Bank A, which had a large funding shock, while the other firm obtains its credit from Bank B, which did not. Changes in the demand for overcoats in the U.S., or changes in the financial condition of coat importers 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, e.g. changes in the price of cotton or wage fluctuation in the garment industry, should affect both firms' exports the same way. Thus, the change in export performance in a product-destination of a firm that borrows from Bank A relative to a firm that borrows from Bank B isolates the effect of credit on exports. We use an instrumental variable approach based on this intuition to estimate the credit elasticity of exports.

We start by showing that banks that rely heavily on foreign funding before the financial crisis reduced significantly the supply of credit when capital flows reversed during 2008. We demonstrate, using the within-firm estimator from recent work on the lending channel, that the supply of credit by banks with above average share of foreign liabilities declined

[4]The example coincides with the 6-digit product aggregation in the Harmonized System, used in the paper.

by 17% after July 2008.[5] Consistent with the hypothesis that the credit supply decline was caused by the foreign funding shortage, the entire credit supply decline occurs through foreign currency denominated loans.

Our results on the credit elasticity of exports are as follows. On the intensive margin, we find that a 10% reduction in the supply of credit results in a contraction of 1.8% in the (one year) volume of export flows for those firm-product-destination flows active before and after the crisis. On the extensive margin, a negative credit supply shock increases the probability that a firm exists a given market by 0.03 percentage points. However, the credit shock does not significantly affect the probability that a firm enters a new export market.

The estimated intensive and extensive margin elasticities provide new insights on the relationship between exporters' production function and their use of credit. Consider, for example, the benchmark model of trade with sunk entry costs.[6] In such a framework, a negative credit shock affects the entry margin, but once the initial investment is paid, credit fluctuations do not affect the intensive margin of trade or the probability of exiting an export market. Yet, we find positive elasticities both in the intensive and exit margins, suggesting that credit shocks affect the *variable* cost of exporting. This would be the case, for example, if banks financed exporters' working capital, as in **?**. By increasing the unit cost of production, adverse credit conditions reduce the equilibrium size and profitability of exports. In combination with fixed costs, the profitability decline induces firms to discontinue small export flows, which are close to the break-even point.

We further characterize the nature of the fixed cost of exporting by analyzing how credit supply alters firms' freight practices. After a credit shock, firms adjust the intensive

[5]For applications of within-firm estimators in banking see, for example, **?**, **?**, **?**, **?**, **?**, **?**, **?** and **?**.

[6]See, among others, **?**, **?**, and **?**. Motivated by the important fixed costs involved in entering a new market—i.e. setting up distribution networks, marketing– **?** 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.

margin of exports by changing the frequency of shipments of a given product to a given destination (with elasticity 0.11), while keeping the volume size of the shipment constant. This suggests the existence of a fixed cost of exporting at the shipment level.

Finally, we also find that the credit arrangements between the exporter and the importer react to funding shocks to the exporting firm. This result relates to **?**, who document stickiness in the terms of the trade credit contracts between established trade partners during the 2008 financial crisis. Differently, we find that, when facing an adverse shock on bank credit, firms partially substitute bank funding for trade credit with the importer. Still, this effect is economically small: A 10% reduction in bank lending triggers an increase of 0.33% in the fraction of the shipment paid in advanced by the importer.

This paper is related to an increasing empirical literature aimed at analyzing the role of credit on export activities. A large portion of this literature has focussed on the link between access to credit and the steady state patterns of international trade and comparative advantages.[7] The focus of our paper is not on the static patterns of exports, but rather the effect of a credit shock on their export performance. Our motivation is, therefore, similar to those analyzing the effect of credit disruptions on the Great Trade Collapse of 2008. Most of these studies are based on the comparison of exports across industries presumed to differ in their sensitivity to credit.[8] However, it remains to be confirmed whether these industry-level indicators are, indeed, predictors of the sensitivity of exports to credit shocks. We find that, for this is not the case for the intensive margin of trade, which accounts for the largest variation in export flows. The elasticities of the intensive and exit margins of exports to credit shocks are constant across sectors with different dependence on external finance, as measured in **?**. Dependence on external

[7] **?**, for example, looks at cross-country differences in financial conditions and the resulting patterns of exports across industries. And, related to *static* models of trade with heterogeneous firms and credit constraints, as in **?**, there is recent empirical literature aimed at analyzing, using cross-sectional firm-level data, the effect of credit constraints on firms participation in export markets. See, for example, **?**, **?**, **?** and **?**.

[8] For studies based on cross-industry comparisons see, among others, **?**, **?**, **?**, **?**.

finance only appears to affect the credit elasticity of the entry probability.

Closer to our paper are studies on the impact of credit shocks on real outcomes using matched firm and bank data. **?** also compares exports by firms related to banks differently affected by funding shocks. Our analysis goes beyond the firm aggregate measures of output and fully exploits the information about the firm's market of operation: products and destinations. These data allow us to decompose the effect of credit supply on the different margins of trade and export flow characteristics. Moreover, we find that accounting for the determinants of exports at the product-destination level is crucial for obtaining an unbiased estimate of the magnitude of the credit shock on output. In our setting, the elasticities of the credit shock on exports is downward biased 93% if the estimation does not account for export demand and input price variations at the product-destination level. This is because firms and banks are not matched at random. Firms with high exposure to foreign liabilities through their banking relationships are specialized in markets less affected during the crisis.[9]

Not accounting for non-credit shocks at the product-destination level also challenges the validity of previous conclusions with respect to the importance of export-specific financial needs in the overall sensitivity of trade to credit. We find that, when those non-credit shocks are properly accounted for, the variables typically used in the literature as a proxy for trade-finance needs do not have the predicted interaction with the effect of credit shocks. That is: the effect of credit shocks on exports does not vary with distance to destination, the mode of transportation (air vs. sea or ground), or whether the exported goods where paid in advanced by the importer.

The sizable magnitude of the bias emphasizes the importance of non-credit factors during the great trade collapse.[10] Indeed, in the case of Peru, our estimates suggest that

[9]Bank specialization is consistent with **?**, which proposes a model in which banks build reputation in export markets through repeated interactions.

[10]For evidence of non-financial determinants of the 2008 trade collapse, see **?**, **?**, **?**, and **?**.

while bank credit appears to have a first order effect on trade, the bulk of the decline in the volume of exports during the analysis period is explained by the drop in international demand for Peruvian goods. Peruvian exports volume growth was -9.6% during the year following July 2008, almost 13 percentage points lower than the previous year. Assuming that only banks with above average foreign liabilities to assets reduced their supply of credit, the estimated elasticities imply that the credit supply decline accounts for about 15% of the missing volume of exports.

The rest of the paper proceeds as follows. Section **??** describes the data. Section **??** describes the empirical strategy. Section **??** shows the estimates of the export elasticity to credit supply. Section complete Finally, section **??** concludes.

2 Data Description

We use four data sets: bank level data on Peruvian banks, loan level data on credit in the domestic banking sector, customs data for Peruvian firms, and information on firms' country of ownership from *Top Peru*, a private data provider.

We collect the customs data from the website of the Peruvian tax agency (Superintendence of Tax Administration, or SUNAT). Collecting the export data involves using a web crawler to download each individual export document. To validate the consistency of the data collection process, we compare the sum of the monthly total exports from our data, with the total monthly exports reported by the tax authority. On average, exports from the collected data add up to 99.98% of the exports reported by SUNAT. We match the loan data to export data using a unique firm identifier assigned by SUNAT for tax collection purposes.

The bank and credit data are from the Peruvian bank regulator, Superintendence of Banking, Insurance, and Pension Funds (SBS). All data are public information. The bank data consist of monthly financial statements for all of Peru's commercial banks from

January 2007 to December 2009. Columns 1 to 3 in Table **??** provide descriptive statistics for the 13 commercial banks operating in Peru during this period.[11] The credit data are a monthly panel of the outstanding debt of every firm with each bank operating in Peru.

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. The main exports are extractive activities: goods derived from gold and copper account for approximately 40% of Peruvian exports. Other important sectors are food products (coffee, asparagus, and fish) and textiles.

In the time series, Peruvian exports grew steadily over the last decade until the 2008 financial crisis and suffered a sharp drop after 2008. Figure **??** shows the monthly (log) export flows between 2007 and 2009. Peak to trough, monthly exports dropped around 60% in value (40% in volume) during the 2008 financial crisis. The timing and magnitude of this decline aligns closely with the sharp collapse of world trade during the last quarter of 2008.

Panel 1 in Table **??** provides descriptive statistics of Peruvian exporters. Our data cover the universe of exporters, which are all firms with at least one export shipment registered between July 2007 and June 2009. The descriptive statistics correspond to the period July 2007-June 2008, prior to the capital flow reversal caused by the 2008 crisis (next section explains this timing choice in more detail). The average bank debt outstanding of the universe of exporters as of December 2007 is $1.01 million and the average level of exports is $3.3 million FOB (Free On Board). The average firm exports to 2.7 destinations, out of a total of 198. The average firm exports 5.3 four-digit products (out of a total of 1,103 products with positive export flows in the data). Our empirical analysis in Section **??** is based on exporting firms with positive debt in the domestic

[11] Although included in the regressions, the statistics in Table **??** do not describe the Savings and Loans institutions because their participation in lending to exporters is negligible.

banking sector, both, before and after the negative credit supply shock. As shown in Table **??**, firms in this subsample are larger than in the full sample. For example, average exports in the analysis sample is $4.0 million, and average debt outstanding is $1.25 million.

The unit of observation in our baseline regressions is a firm-product-destination annual export flow. Panel 2 in Table **??** provides the descriptive statistics for the universe of 53,690 export flows and for the 47,810 observations that correspond to our sample of exporters. The average annual export flow in our sample is US$184,800 FOB (446,400 kg), and is distributed into 2.17 shipments. Approximately a third of these export flows are paid in advanced by the importer. A similar proportion is shipped by air, the rest is transported by sea or ground. To estimate the effect of credit on the intensive margin of trade, the sample is restricted to around 16,500 firm-product-destination export flows that are positive (at least one shipment), both, in the period July 2007-June 2008 and July 2008-June 2009, the years before and after the beginning of the capital flow reversal. The effect on the extensive margin is estimated using all positive firm-product-destination export flows.

In order to analyze how the sensitivity of exports to credit varies across multinational and domestic, we combine the credit and export data with information from *Top Peru*, a private data provider that publishes annual information on the 10,000 largest companies in Peru. For the largest 500 firms, Top Peru provides information on equity held by foreign companies. We use the unique tax identifier to merge our data to the 2004 Top Peru data set and classify firm as multinational if at least 50% of the firm are foreign-owned. With this classification, 4% of the firms in the analysis sample are foreign-owned affiliates of a multinational firm, which account for 9.2% of product-destination export flow (see Table **??**).

3 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 destination country d at time t, X_{ipdt}.

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

The first argument, H_{ipdt}, represents determinants of exports other than finance, i.e. demand for product p in country d, financial conditions in 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, C_{it}, is an equilibrium outcome that depends on the supply of credit faced by the firm, S_{it}, and the firm's demand for credit, which may be given by the same factors, H_{ipdt}, affecting the level of exports:

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

Our empirical strategy to address this problem is based on two pillars. First, we instrument for the supply of credit, using shocks to the balance sheet of the banks lending to firm i. This empirical approach obtains unbiased parameters if banks and firms are randomly matched. However, if banks specialize by firms' product or destination markets, the instrument may be correlated to factors that affect exports though channels other than the supply of credit. For example, suppose that banks suffering a negative balance sheet shock specialize in firms that export *Men's Cotton Overcoats* to the U.S. If the demand for Men's Cotton Overcoats in the U.S. drops disproportionately during the crisis, we would erroneously attribute this decline in exports to the credit supply shock.

To avoid potential bias due to non-random matching of firms and banks, a second pillar of our empirical strategy involves controlling for all heterogeneity in the cross section with firm-product-destination fixed effects, and for shocks to the productivity and demand of exports with product-country-time dummies.[12] Instead of comparing total exports across firms, our estimation compares exports within product-destinations. In the example above, our estimation procedure compares the change in Men's Cotton Overcoat exports to the U.S. by a firm that is linked to a negatively affected bank, relative to the change in Men's Cotton Overcoat exports to the U.S. of a firm whose lender is not affected.

The identification assumption is that factors other than bank credit that may affect the exports of mens' cotton overcoats to the U.S. differentially across these two firms during the crisis are not related to the banks the firms borrow from. This identification assumption is much weaker than the parallel assumption at the firm-level. A violation of this identification assumption would require, for example, that production stoppages due to equipment breakdowns become more frequent during the crisis for firms that borrow from banks with a high fraction of foreign liabilities. REFEREE DOESN'T LIKE THIS EXAMPLE[13] Such a correlation between bank affiliation and idiosyncratic shocks to exports of the same product and to the same destination is unlikely. To corroborate this, we show in Subsection **??** that our point estimates are unchanged when we allow the effect of credit to exports to vary across firms that export products of different quality, firms that have different currency composition of their liabilities, single and multi-product firms, and small and large firms measured both by volume of exports and by number of destinations.

Summarizing, we estimate η, the elasticity of exports to credit, using the following

[12] Subsection **??** shows that the impact of the credit shock on export is severely overestimated if the model does not control for heterogeneity of non-credit factors across product and destinations.

[13] Note that a negative credit supply shock may cause production stoppages, for example, due to financial distress. This does not invalidate our identifying assumptions; on the contrary, this type of effect is precisely the one we are measuring.

empirical model of exports:

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

where, as in equation (**??**) above, X_{ipdt} represents the exports by firm i of product p to destination country d at time t and 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 of product p exported to destination d by firm i, δ_{ipd}, and the product-destination-time shocks, α_{pdt}. 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.

By construction, specification (**??**) measures the export elasticity to credit in the intensive margin: how the volume of exports by firm i of product p to destination d changes with a change in the supply of credit, conditional on the amount on exports by firm i of product p to destination d being positive before and after the credit supply change. To measure the extensive margin elasticity —the change in the probability that firm i starts/stops exporting product p to destination d— we use the following linear probability model:

$$E_{ipdt} = \eta_E \cdot \ln(C_{it}) + \delta_i + \alpha_{pdt} + \varepsilon_{ipdt}, \tag{4}$$

We are interested in measuring separately the elasticity of entry and exit to a credit shock, we estimate two specifications: In the Entry specification, E_{ipdt} is an indicator variable for whether exports by firm i of product p to destination d is positive at time t, conditioning on exports being zero in the previous period. In the Exit specification, E_{ipdt} is one if the firm i *does not* export product p to destination t at time t, conditioning on exports

being positive in the previous period. Note a key difference between the extensive margin specification (**??**) and the intensive margin specification (**??**): it contains only firm fixed-effects, instead of firm-product-destination fixed effects. This is by construction, since a firm that enters (exits) a product-destination market cannot enter (exit) the same product-destination market the following period.

We estimate equations (**??**) and (**??**) 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 next explain the economic rationale behind the instrument, and further discuss the identification hypothesis behind the instrumental variable (IV) estimation.

3.1 Capital Flow Reversals, Bank Foreign Liabilities and Credit Supply

Portfolio capital inflows to Peru, which were growing prior to the crisis, stopped suddenly in mid 2008. Foreign funding to Peruvian banks exhibits the same evolution (see Figure **??**). Although this reversal of the foreign funding trend characterizes all Peruvian financial institutions, there were differences in the foreign funding dependence across banks before the crisis.[14] For example, the foreign liabilities of HSBC and Banco Santander, two large foreign owned banks operating in Peru, were 17.7% and 2.2% of assets in 2006. The hypothesis behind the instrumental variable approach is that banks with a larger fraction of their funding from foreign sources reduce the supply of credit relative to other banks after the capital flow reversal. In this section we test this identification assumption formally using a *within-firm* estimation procedure to disentangle credit supply from changes in the demand for credit.[15]

To do this, we rank banks according to their dependence on foreign liabilities in 2006,

[14] See **?** for an analysis of the performance of the domestic financial market during the 2008 crisis.
[15] This procedure has been used in **?**, **?**, **?**, **?**, **?**, **?**, **?** and **?**.

a year before the crisis. Table **??** shows the heterogeneity of the share of foreign liabilities across the thirteen commercial banks in our sample, which are the most important institutions providing credit to exporting firms. All Savings and Loans Institutions have negligible level of exposure and lend almost exclusively to individuals and non exporting small firms.

The *within-firm* estimator entails comparing the change in the amount of lending by banks with different dependence on foreign capital to the *same firm*, before and after the capital flow reversal. Based on the evolution of total foreign lending to Peruvian banks in Figure **??**, we set July 2008 as the starting date for the capital reversals.[16] This leads to the following empirical model:

$$\ln\left(C_{ibt}\right) = \theta_{ib} + \gamma_{it} + \left(\beta_1 \cdot FD_b + \beta_2 \cdot FD_b^2\right) \cdot Post_t + \nu_{ibt} \tag{5}$$

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. FD_b is a share of foreign debt of bank b, and $Post_t$ is a dummy equal to one when $t = Post$. We include a quadratic term to account for non-linearities in the effect of foreign exposure on lending. The regression includes firm-bank fixed effects, θ_{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, γ_{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 β measures the change in credit supply by banks with higher dependence on foreign funding.

We present in Table **??**, column 1, the estimated parameters of specification (**??**),

[16] Section **??** shows that results are robust to setting the turning point in April 2008, after the collapse of Bearn Stearns.

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 funding shock to firms. The effect of the share of foreign liabilities on lending during the *Post* period is highly convex. How should we interpret the results with the continuum?

In column 2, instead of a quadratic polynomial of FD_b, we use another highly non-linear indicator of exposure: a dummy that takes value one if bank-b's share of foreign liabilities is higher than the mean (i.e., $D(FB_b > \overline{FB})$. This measure is of easier interpretation: Banks with an above-average share of foreign liabilities reduced lending by 17% relative to other banks, after controlling for credit demand. Consistent with the hypothesis that the credit supply decline was driven by shortage in dollar funding, the decline is entirely explained by the evolution of dollar denominated loans, which drop by more than 24% for banks with share of foreign liabilities above the mean (column 4). Local currency denominated loans, on the other hand, increased by 16% relative to those banks with share of foreign liabilities below the man (column 6) and partially offset the reduction in the supply of dollar denominated credit.

This implies that a bank's share of liabilities funded with foreign capital is a good predictor of the supply of bank credit after the capital flow reversals and confirms the main identification assumption behind our instrumental variable approach. It is important to emphasize that the identification assumption tested here, that the instrument be correlated with the *supply* of credit, is much stronger than the typical necessary condition for the IV estimation of equation (**??**), i.e. that the instrument be correlated with the *amount* of credit. We present the first stage regression of the instrument on credit in Section **??**, and show that this weaker necessary condition also holds.

Following the above discussion, in the baseline estimation of specification (**??**) we use the following functional form for the instrumental variable, which takes into account the

non-linearity of the exposure to foreign liabilities of the banks:

$$F_{it} = \left(F_i + F_i^2\right) \cdot Post_t$$

$Post_t$ is an indicator variable that turns to one after July 2008, when the decline in foreign funding started; and F_i refers to the exposure of the firm to the capital flow reversal, given by the share of foreign liabilities of the related banks:

$$F_i = \sum_b \omega_{ib} FD_b, \tag{6}$$

where ω_{ib} is the share of bank b in total credit of firm i and FD_b is the share of foreign liability of corresponding bank. Both shares corresponds to december 2006. The cross sectional variation in F_i comes from the firm-specific amount of credit that it receives from each bank in 2006, and the heterogeneous dependence to foreign capital across banks. 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 robustness checks reported in Section **??**, we also define F_i as a dichotomous function of exposure.

4 Effect of Credit Supply Shock on Exports

In this section we use the methodology described above to estimate the elasticity of exports to credit. We estimate separately the elasticity on the intensive and extensive margins. Since our empirical strategy relies crucially on accounting for shocks to export productivity and demand, we define the margins of trade at the product-destination level. The intensive margin corresponds to firm export flows of a given product to a given

destination, that were active both in the *Pre* and *Post* periods. The extensive margin corresponds to the probability that an exporting firm enters or exits a product-destination market. In the baseline specifications, we define products at the 4-digit level according to the Harmonized System (HS). As a result, our estimations are obtained from exports variation within close to 6,000 product-destinations.

Table **??** presents the decomposition of export growth during the *Pre* and *Post* periods along these margins. Export growth declined over 33 percentage points between the *Pre* and *Post* periods. Most of this decline is due to the change in the price of Peruvian exports. The decline in the growth of export volume was 12.8 percentage points. One third of this decline is explained by the drop in the intensive margin, and two thirds are explained by the reduction in the number of exporting firms within a product-destination market.

4.1 Intensive Margin of Exports

This subsection analyzes the effect of a credit supply shock on the *volume* of exports of firm-product-destination flows that are active in the two periods, $t = \{Pre, Post\}$. Export data are highly seasonal, so we collapse the panel into the two periods to avoid estimation bias due to serial correlation and seasonality. Thus, X_{ipdt} corresponds to the sum of the volume of exports (in kilograms) of product p to destination d by firm i in the period t, and C_{it} corresponds to the average outstanding debt balance (in local currency) of firm i in period t.

We estimate equation (**??**) by first-differencing to eliminate the firm-product-destination fixed effects. The resulting estimation equation is:

$$\ln\left(X_{ipdPost}\right) - \ln\left(X_{ipdPre}\right) = \alpha'_{pd} + \eta \cdot \left[\ln\left(C_{iPost}\right) - \ln\left(C_{iPre}\right)\right] + \varepsilon'_{ipd} \tag{7}$$

The product-destination dummies, $\alpha'_{pd} = \alpha_{pdPost} - \alpha_{pdPre}$ in equation (**??**), absorb all demand fluctuations of product p in destination d. The supply of credit to firm i is instrumented with F_{it}, defined in equation (**??**). The first stage coefficients —i.e., a linear regression of credit of firms i at time t (C_{it}) on the instrument (F_{it})– is shown in column 1. The coefficients are significant at the 1% level, which confirms that the instruments are correlated with the amount of credit ($t = xxx$ and $F = xxx$).

The results of the Instrumental Variable (IV) estimation of the export elasticity to credit supply in specification (**??**) is presented in Table **??** column 3. The IV estimate implies that a 10% reduction in the stock of credit results in a decline of 1.8% in the volume of yearly export flows.

The IV estimate of the export elasticity to finance is an order of magnitude larger than the OLS estimate. The attenuation bias of the OLS estimate emphasizes that variations in credit supply is only a small component of the overall fluctuation of credit across firms. Most of the variation in credit is due to changes in credit demand: If credit supply variation explains 42% or less of the standard deviation in total credit across firms, the OLS estimate will be at least ten times smaller than the true parameter.quote reference and formula

4.2 Extensive Margin of Exports

We analyze the effect of a credit supply shock on the probability that an exporting firm abandons or enters a product-destination export market, by estimating equation (**??**).

As in the previous subsection, we collapse the time series into two periods, *Pre* and *Post*, which correspond to the 12 months before and after July 2008. There is a large number of intermittent export flows in the sample; thus, 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.

First-differencing equation (**??**) to eliminate the time-invariant parameters is not an option in this case explain. Therefore, the estimation includes firm dummies that control for any time-invariant characteristic of the firm and, as before, product-destination-time dummies, α_{pdt}, that control for changes in demand, international prices, etc. Credit supply to firm i is instrumented with the variable F_{it} defined in equation (**??**) that depends on the firm's exposure to the foreign liabilities of the related banks.

The results are presented in Table **??**, columns 4 to 7. Only the exit margin reacts to changes in credit supply and the effect is economically small: A 10% reduction in the stock of credit results in an increase of 0.33 percentage points in the probability that a firms abandons a product-destination market.

4.3 Heterogeneity across Export Flows

Given the importance of the exit margin during the period documented in Table **??**, another question arises: is the average elasticity of the intensive margin, presented in Table **??**, also representative of those export flows that got discontinued during the Great Trade Collapse?

To answer this question, we follow **?** and estimate a Probit equation in which the dependent variable is one if a firm-product-destination export flow active in the *Pre* continues active during the *Post* period, and zero otherwise. We then estimate the elasticity of the intensive margin of exports over samples characterized by heterogenous probability of continuation.

The estimated probability that an observation is positive is $\widehat{P}(X_{ipdPost} > 0 | X_{ipdPre} > 0)$, where X_{ipdt} is the volume of exports of product p to destination d by firm i. We include as control variables the size of the export flow in the *Pre* period ($\log X_{ipd}$), the size of overall exports by the firm ($\log X_i$), the overall stock on credit ($\ln C_i$) and a non-linear polynomial on the measure of exposure, F_i defined in equation (**??**). The results

of the Probit regression are reported on column 1 of Table **??**. Based on this Probit estimation, we define subsamples of export flows to be included in the IV regressions according to their probability of continuation: $\left\{ipd \mid \widehat{P}(X_{ipdPost} > 0 | X_{ipdPre} > 0) \geq \alpha\right\}$ for $\alpha = 0, 0.42, 0.56, 0.68, 0.79$ that correspond to the 0, 20, 40, 60 and 80 percentiles of the distribution of the probability of continuation.

The results are reported on columns 2 to 6 of Table **??**. Note that the group defined by $\alpha = 0$ corresponds to the full sample used in Table **??**. The elasticity of the intensive margin of exports to credit is heterogeneous across export flows with different probability of continuation. It is higher for those export flows most likely to be discontinued and lower (even insignificant) for those export flows most likely to be active in the *Post* period. This result suggests that the average intensive-margin elasticity in Table **??**, computed over those export flows that are active in both periods, is a lower bound of the parameter that characterizes the universe of export flows.

4.4 Effect on Freight Characteristics and Trade Credit

Firms may adjust other dimensions of the trade activity when subject to a negative credit shock. In this subsection we explore the effect of a decline in the availability of bank funding on freight policies and the trade credit conditions with the importer. We estimate specifications parallel to (**??**) using the following left-hand side variables: (i) frequency of shipments for a firm-product-destination export flow during period t ($ShipFreq_{ipdt}$); (ii) average size of shipments (in volume) for a given export flow during the period t ($ShipVol_{ipdt}$); (iii) the fraction of the annual flow (value FOB) transported by air, as opposed to sea and ground, ($FracAir_{ipdt}$); and (iv) the fraction of the annual flow (value FOB) paid in advance by the importer ($FracCash_{ipdt}$).

The results are presented in Table **??**. A negative shock to credit supply is found to reduce the frequency of shipments, with elasticity 0.11, significant at the 1% level

(column 1). The elasticity of average shipment size, on the other hand, is not statistically significant (columns 2). These estimates suggest the existence of fixed costs of exporting at the shipment level. A large per-shipment fixed cost is consistent with the frequency of shipments being more elastic to a credit shock than their size.

Holding the product and the destination constant, firms do not increase the share of exports shipped by air (as opposed to sea or ground) after a negative credit shock (column 3). Finally, the fraction of the transaction value paid in advance by the importer is sensitive to the decline in credit supply (column 4). That is, the credit arrangements between the exporter and the importer reacts to funding shocks to the exporting firm. This result relates to **?**, who document the stickiness of the terms of trade credit contracts between established trade partners during the 2008 financial crisis. Contrary, we find that, when facing an adverse shock on bank credit, firms partially substitute bank funding for trade credit with the importer. This effect, however, is economically small: a 10% reduction in the stock of credit results in an increase of 0.33% in the share of the shipment paid in advanced by the importer.

4.5 Identification and Robustness Tests

As mentioned in Section **??**, the elasticity estimates will be biased if firms associated with banks with high foreign liabilities experience a disproportionate negative shock to exports relative to other firms exporting to the same product-destination for reasons other than bank credit. This could occur, for example, if firms that borrow from exposed banks export products of a higher quality (within the same 4 digit HS code), and the demand for higher quality products dropped more during the crisis. It would also occur if firms with high foreign currency denominated liabilities borrow from banks with high foreign liabilities, and the capital flow reversals affect the balance sheet of firms directly and not through bank lending. In this section we perform identification tests to account for

potential shocks correlated with bank affiliation.

In the first identification test we estimate the export elasticity in the intensive margin measuring exports in dollar FOB values. If price changes faced by firms exporting to the same market are orthogonal to their bank affiliation, then the product-destination dummies should absorb these effects resulting in the same estimates of export elasticities if measured in volume or value. The result in Panel 1 in Table **??** confirms that the volume and value elasticities are of the same order of magnitude and statistically indistinguishable. We also report in Panel 2 the export elasticity to credit when products are aggregated at the 6 digit level, according to the HS code. In Panel 3, we restrict the sample to export flows of *homogenous* goods only, according to the product classification in **?**. These goods are considered to be less differentiated in terms of quality and other potential unobservable characteristics. In all cases, the elasticities of the intensive and extensive margins are statistically identical to those in the baseline regression.

An alternative way to test for unaccounted shocks correlated with bank affiliation is to explicitly control for them. In the fourth identification test we augment equation (**??**) with a set of observable firm characteristics in the *Pre* period as control variables: average unit price of exports at the firm-product-destination level, average fraction of debt denominated in foreign currency, total exports, number of products, and number of destinations at the firm level. Including these pre-determined variables in the first differenced specification is equivalent to including them interacted with time dummies in the panel specification of equation (**??**). Thus, this augmented specification controls for heterogeneity in the evolution of exports after the crisis along the product quality (high unit price within a 4-digit HS classification), firm external exposure, and firm size dimensions. The elasticity of the intensive margin is statistically indistinguishable of the baseline regression. The elasticity of the exit margin, although similar in magnitude, looses significance in this specification (Panel 4, Table **??**).

In Panels 5 and 6 we test the robustness of the results to the definition of the instrument. We verify that the results are not sensitive to the date in which we measure the share of foreign liabilities of the banks or the firm composition of credit across banks. In our baseline regressions, we define this measures according to figures of December 2006, prior to the reversal of capital flows. In Panel 5, the instrument is defined according to banks and firms figures of December 2007, at the peak of the foreign capital inflows. In Panel 6 we alter the functional form of the instrumental variable. Credit is instrumented with a firm level dummy that is equal to one if the firm borrows more than 50% from banks with share of foreign liabilities above the mean. In both cases, the elasticity of the intensive margin is statistically undistinguishable from the baseline results in Table **??**. When using the discrete instrumental variable in Panel 6, the estimates of the extensive margin elasticities are different: the probability of entry increases after a positive credit shock, while the elasticity on the exit margin is no longer statistically significant. complete with extensive panel 5.

Finally, we explore the possibility that firms associated with exposed banks were simply on a different export and borrowing growth path before the crisis. If this were the case, our estimates could be capturing such pre-existing differences across the two groups of firms and not the effect of the credit shock. We perform the following placebo test: we estimate equations (**??**) and (**??**) lagging the debt and export measures one year, as if the capital flow reversals had occurred in 2007 instead of 2008. 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 elasticities of both the intensive and extensive margin of exports, reported in Panel 7 of Table **??**, are not statistically different from zero. This confirms that firms borrowing from banks with a high share of foreign 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 a

low share of foreign liabilities.

Overall, the results in in this section suggest that our empirical approach obtains unbiased estimated of the elasticity of exports to credit. In other words, after conditioning on product-destination shocks to exports, a firm's affiliation to a bank with a high share of foreign liabilities is orthogonal to other non-credit determinants of exports.

4.6 Discussion of the Results

Overall our results are consistent with models of heterogeneous firms ala **?** expanded to allow for multi-product output and exports, as in **?** and **?**. A firm decides to export a product to a destination if the corresponding sales cover the per-period fixed cost of exporting.

In this class of models, a shock that affects the variable cost of production can generate all our results: (i) a drop in the intensive margin of trade in all those firm-product-destination flows that continue active; (ii) given the existence of a fixed cost of exporting, a shock to the variable cost of production will affect the exit decision for those product-destination export flows that are small enough to be near the cutting point (see Figure **??**). In other words, our results are consistent with credit shocks affecting the *variable* cost of production, as modeled in **?**. This is the case, for example, if the credit shock implies an increase in the cost of external finance needed to pay inputs in advanced of receiving the revenues from production. Similar results can also arise if the credit shock affects the variable cost of exporting beyond that of production; however, we show in subsection **??** that we do not find evidence supporting this interpretation.

Our results suggest that the fixed cost of exporting is at the shipment level, that is why the frequency of shipments adjust together with quantities exported, after a credit shock, while the size of each shipment stays fairly constant. On the other hand, our results are not consistent with models where credit is *only* used to pay the entry or fixed

cost of exporting as in **?**, **?**, and **?** or to pay fixed capital investment as in **?** and **?**. In those models, credit shocks only affect the entry decision but not the intensive margin of trade. Needless to say, our results do not imply those credit motives are not present. They point at two different usages of credit, the finance of working capital of production and the funding of physical investment.

The fact that credit conditions affect the variable cost of production, rather than only fixed investment or entry cost, imply that short-lived credit shocks can have large real economic consequences. This is because capital is a stock variable and it does not substantially vary with short-lived shocks. Similarly, in the specific case of international trade, exports are very skewed towards existing large exporters. Aggregate exports are hardly affected by the exit or entry of firms into export markets, as these marginal export flows are typically relatively small. Changes in the cost of credit for working capital, on the other hand, affect the quantities produced and exported instantaneously. Moreover, they affect both large and small firms. This is why macroeconomic models aimed at studying the dynamic consequences of this type of shocks often include working capital in the production function (see, for example, **?**).

5 Corroboration of Empirical Assumptions

Our empirical strategy allows us to explore the validity of assumptions typically made in the empirical literature when data availability prevents the estimation of the effect of credit shocks on real outcomes at the firm-product-destination level. First, we estimate the bias that would arise in our environment if we could not account for the selection of firms to banks in terms of their mix of products and destinations. Second, we analyze whether those variables typically used as proxy for export-specific funding needs are indeed predictors of the elasticity of exports to credit shocks. And finally, we explore the validity of industry-level indicators (i.e. external finance dependence) often used in the literature

as a proxy for sensitivity of output to credit.

5.1 Firm-Bank Selection

Recent work studying real effects of the bank transmission channel during crises has been constrained by data limitations to studying firm level outcomes, such as total sales, total exports, or investment (see for example **?**, **?**, **?**, **?**, **?**). The typical empirical strategy compares outcomes of firms related to banks that are differentially affected by the crisis. This approach provides an unbiased reduced form estimate of the bank transmission channel if banks and firms are randomly matched. If, on the contrary, firms related to exposed banks specialize in certain products or destinations, then estimates based on comparing the outcomes of firms related to exposed and non exposed banks confound the effect of the lending channel with the heterogeneous impact of the crisis across products and destinations. In this subsection we compute the bias that arises in our setting when we do not account for potential shocks at the product-destination level.

Table **??**, column 1, presents the naive estimation of the elasticity of exports (intensive margin) to credit, and in column 2 our baseline estimation, which controls for shocks at the product-destination level. The naive estimator totally misses the effect of credit supply on exports. This finding implies that firms and banks are not randomly matched. In particular, firms borrowing from exposed banks specialize in products and destinations less affected by the international crisis.[17] It also implies that when non-finance shocks at the product-destination level are unaccounted for, the overall importance of credit shocks in explaining output fluctuations can be severely misestimated. In the present case, the bias would lead to conclude erroneously that the negative credit shocks did not contribute with the Peruvian exports decline during the Great Trade Collapse.

These results also call for caution when deriving conclusions regarding the importance

[17]The bias is largest when there are no controls for changes in export demand across destination markets.

of credit in explaining output fluctuations based on comparisons across sectors or destinations. For example, conclusions regarding the specific usage of credit by export activities often rely on comparing the effect of a credit shock on the firm's sales across destinations; i.e., domestic versus foreign sales, or across foreign destinations with different freight time. These comparisons may confound the effect of the credit shock on exports with the heterogeneous impact of the crisis across markets.

5.2 Export-Specific Funding Needs

Substantial fixed exporting costs can make exports more sensitive to credit than domestic sales, as changes in the exporter's availability of credit may trigger discontinuous changes in exports. Furthermore, international trade is characterized by longer freight times and, thus, longer cash cycles than domestic sales. Based on this intuition, the empirical literature uses distance to destination and freight speed (ground and sea versus air) as indicators of export-specific working capital. In order to estimate export-specific credit sensitivity, this approach compares the impact of credit on export flows across destinations of heterogeneous distance or across products typically shipped using by different modes of transportation.

This empirical strategy relies in the comparison across destination and products. But, as it was determined in the previous subsection, products and countries are subject to different non-credit disturbances. Therefore, this empirical strategy confounds trade-specific sensitivity to credit with non-credit shocks affecting disproportionately certain products or destinations. Table **??** columns 3 and 5 present the results of this approach: The estimates correspond to the naive intensive-margin elasticity (without product-destination fixed effect) and its interaction with distance to destination ($dist_d$) and the share of the export flow shipped by air, as opposed to ground or sea (Air_ipd). All interacting variables are standardized and taken according to the firm-product-destination export flow in the

Pre period.

In Columns 4 and 6 we present the results including product-destination fixed effects. The estimates in column 4, instead of comparing the effect of credit on exports across destinations, show how the within-destination elasticity changes across distances. Similarly, the estimates in column 6 focus on products that are shipped both by *Air* and *Sea/Ground*. Then, rather than comparing the effect of credit across products, the estimates show, for the same product and destination, whether the elasticity differs for flows shipped by *Air* or by *Sea/Ground*. We find that, when properly controlling for non-credit shocks at the product-destination level, the interaction terms are not significantly different from zero.

The comparison of columns 5 and 6 is particularly informative. The mode of transportation is intimately linked with the nature of good transported, the bias suggests that exposed firms specialized in products typically shipped by *Air* (presumably more expensive), which were disproportionately hit during the period.

Finally, we also analyze whether exports paid in advanced by the importer have a differential evolution after a credit shock. $Cash_{ipd}$ is the standardize share of the export flow in the *Pre* period paid in advanced by the importer. We do not find any evidence that those sales paid *Cash* prior to being shipped are less sensitive to a credit shock than those that are paid upon arrival (column 8). When not accounting for product-destination shocks (column 7), the estimate would erroneously suggest that the sensitivity of exports to credit shocks increases if the export flow is paid in advanced by the importer.

Since we do not have data on domestic sales we cannot conclusively compare the credit elasticity of exports and local sales. Still, we emphasize that, when correctly estimated, the sensitivity of exports to credit shocks does not vary with those variables signaling trade-specific financial needs.

5.3 Sectorial Heterogeneity in Credit Intensity

Since the seminal work by **?**, heterogeneity in the degree of external finance dependence 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 the same factors that affect the sensitivity of exports to long-term finance can also predict the effect of short-term credit shocks. This subsection explores this question.

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 **?**; it corresponds to the fraction of total capital expenditure not financed by internal cash flows based on cross sectoral data of U.S. firms. This measure is considered to represent technological characteristics of the sector the firm belongs to. 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 report in Table **??** the results of estimating the sensitivity to credit of the intensive and extensive margins of export in equations (**??**) and (**??**), augmented with an interaction with the (standardized) product's external financial dependence. The probability of entry is more sensitive to credit shocks for those sectors highly dependent on external finance (column 3). The elasticities of the intensive and exit margins, on the other hand, do not vary with this measure (columns 1 and 2).

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

6 Conclusions

We use the estimated elasticities to perform a *back of the envelope* calculation of the contribution of finance to the overall export decline during the the 2008 crisis and perform analysis of the potential biases that arise when estimating the contribution of finance shock to output fluctuations when non-credit factors (i.e., demand and price shocks) are ignored in the econometric specification.

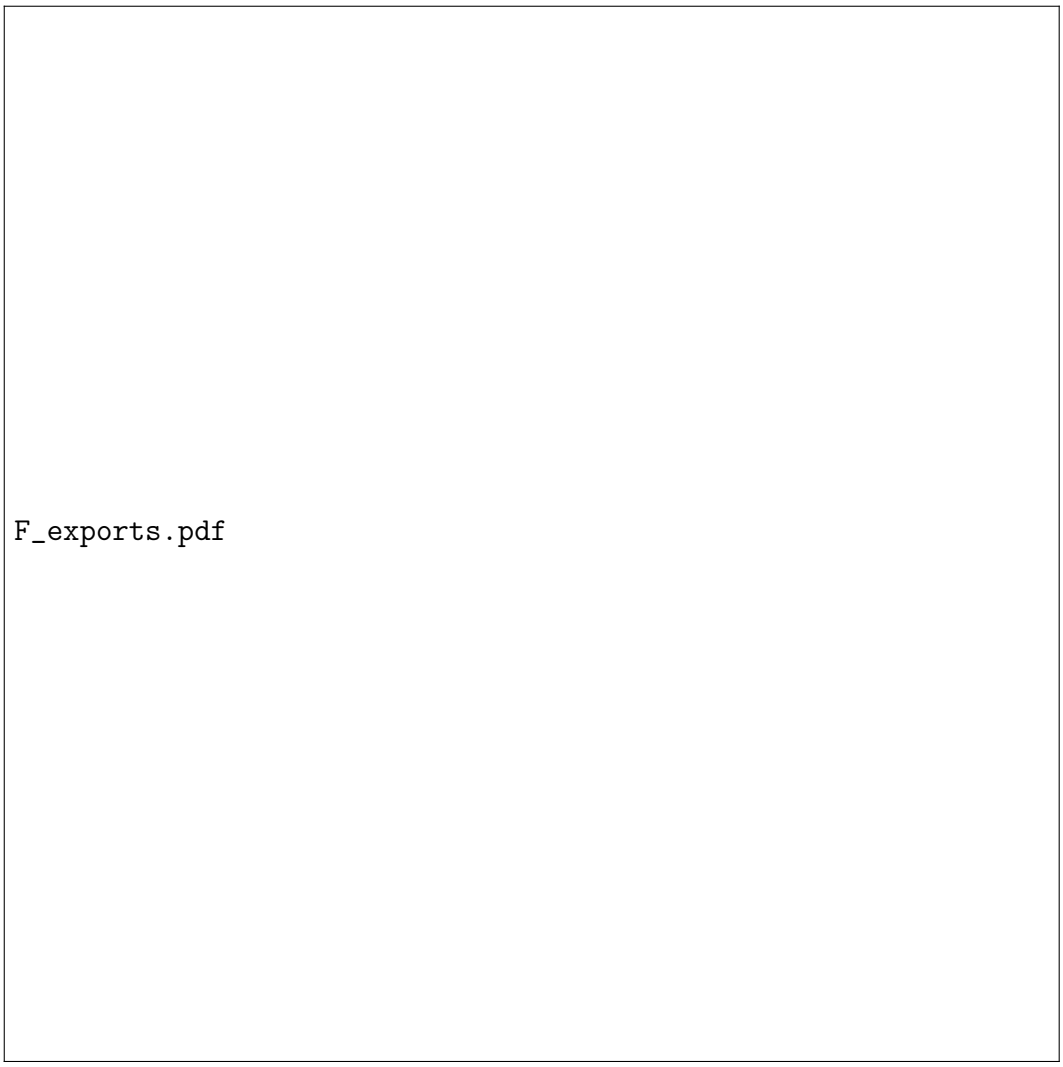
Our estimates are obtained from relative changes in credit by exposed versus non-exposed banks. Thus, to obtain a back of the envelope calculation of the overall effect of the credit shock to firms on the total exports decline we must make an assumption about the change in credit supply of non-exposed banks —i.e. banks with a share of foreign liabilities below 9.5%–. We make the simplifying assumption that credit supply of non-exposed banks is constant throughout the analysis period. This assumption produces conservative estimates of the overall effect of credit if non-exposed banks also reduced credit supply during the crisis. The contrary occurs if non-exposed banks expanded credit supply to substitute for the unfulfilled demand by exposed banks.

The estimates in Table **??** imply that exposed banks reduced credit supply by 16.8% relative to not-exposed banks. Exposed banks account for 30.5% of total credit to exporters in the *Pre* period (12 months before July 2008). Given the above assumption, these estimates imply that total credit supply dropped by 5.1%. For the intensive margin elasticity we use the estimate of 0.23 from Table **??**, and for the continuation margin we use the estimate of 0.15, which characterizes the elasticity of large export flows (small export flows account only for 2% of total exports). The elasticity of the entry margin is not statistically significant in most specifications, so we set it to zero for the calculation. These assumptions imply that the drop in credit supply to Peruvian firms can explain a 1.9% reduction in the volume of exports during the 12 months following July 2008 (*Post* period). We note that this estimate captures the effect of a negative credit supply shock on

the supply of exports by Peruvian firms; they do not reflect the effect of financial frictions outside Peru and their potential effect on the foreign demand for Peruvian exports.

Compared to the total drop in the annual growth rate of the volume of exports between the *Pre* and *Post* periods, 12.8 percentage points (see Table **??**), this estimate implies that the credit shock can account for approximately 15% of the missing volume of trade. When we look separately at the intensive, entry and exit margins, the credit shock can account for 27%, 0% and 9% of each margin, respectively. This suggests that the bulk of the export decline during the 12 months following July 2008 was triggered by the contraction in international demand for Peruvian exports, and this was particularly true regarding firms' decisions to enter or to continue supplying product-destination markets.

Overall, the results in this paper show that credit has a first order effect on the volume of exports. However, the largest determinant of the Peruvian exports collapse during the 2008 crisis is related to non-credit factors (e.g., international demand and prices). In our context, failure to control for determinants of exports other than bank credit at the product-destination level leads to severely biased estimates when studying the effect of a contraction in credit on trade. Our results suggest that estimates that rely on more aggregated data (e.g., outcomes at the firm or sector levels) should be interpreted with caution during crisis episodes, which have potentially large and heterogeneous real effects across sectors and countries.

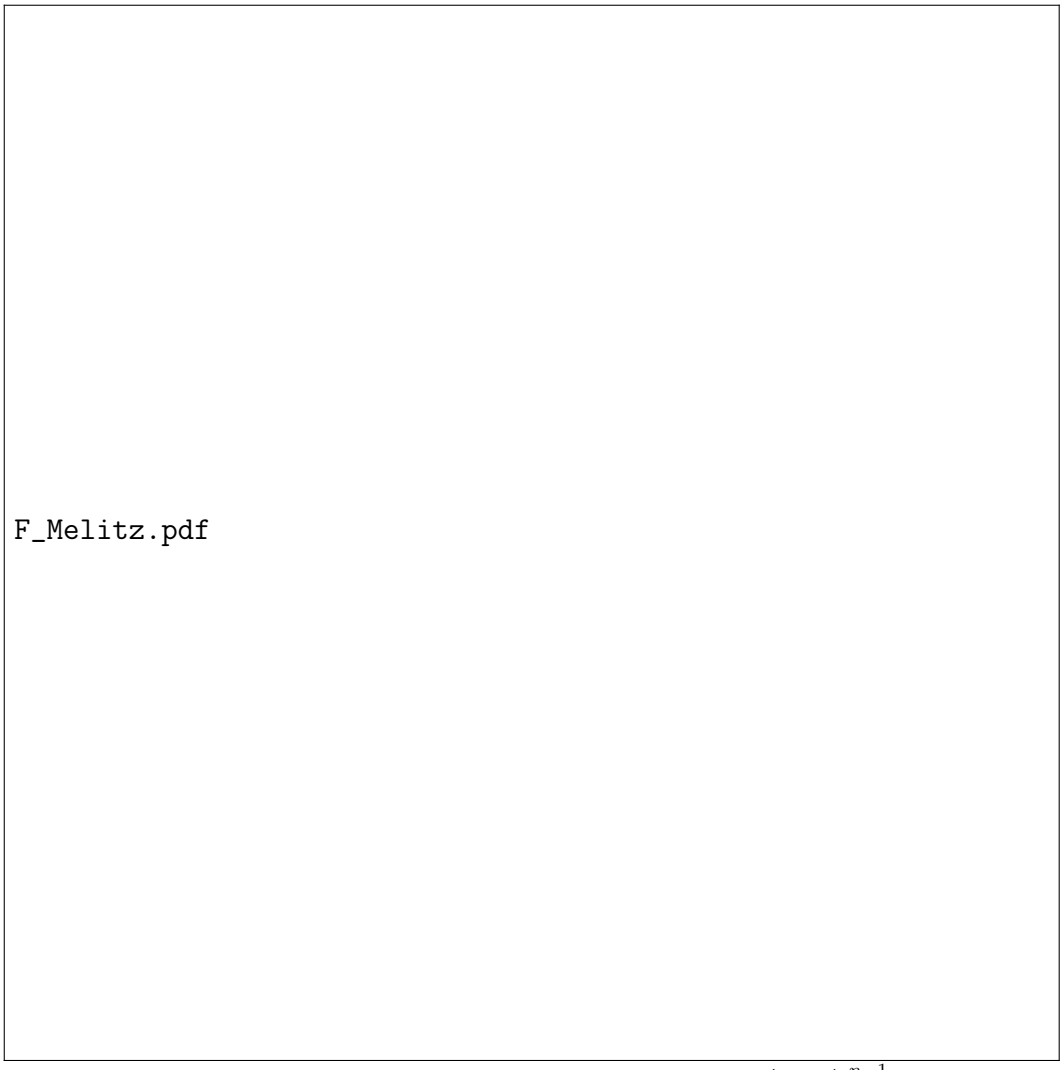


Source: SUNAT. Volume of exports in kg, and value in dollars FOB.

Figure 1: Total Peruvian Exports

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

Figure 2: Total Banking Sector Foreign Financing



Exports of firm-product-destination-time are given by: $X_{ipdt} = \left(\frac{C_{ipdt}}{\varphi_{ipdt}}\right)^{\eta-1} \cdot D_{pdt}$, where η is the elasticity of substitution, φ_{ipdt} is the firm-product-destination-time productivity, D_{pdt} are market factors (i.e., expenditure or price of the competition), and C_{ipdt} is the unit cost of production, which includes financial cost. Given the fixed cost of exporting, f_{pd}, those firms with productivity above the cutoff, φ_{Pre} are active. An increase in the variable cost from C_{ipdPre} to $C_{ipdPost}$, due to a negative credit shock, reduces exports for any productivity level. The cutoff productivity rises from φ_{ipdPre} to $\varphi_{ipdPost}$ which prevents entry and/or provokes exit of those export flows close to the cutoff.

Figure 3: Effect of an Increase in the Financial Cost of Inputs

	All Financial Institutions (N=41)			High Foreign Exposure Banks (N=4)			Low Foreign Exposure Banks (N=9)			C
	mean	sd	p50	mean	sd	p50	mean	sd	p50	m
Assets (M US$)	1,102	2,744	134	2,533	3,817	794	3,559	4,568	1,023	1
Loans (M US$)	598	1,503	105	1,709	2,575	562	1,705	2,422	711	
Deposits (M US$)	4,510	11,061	189	1,681	2,682	436	2,642	3,391	750	
Loans/Assets	0.698	0.178	0.756	0.659	0.126	0.660	0.582	0.189	0.601	0.
Deposits/Assets	0.586	0.197	0.642	0.573	0.082	0.543	0.696	0.147	0.735	0.
Foreign Financing/Assets	0.055	0.108	0.002	0.196	0.135	0.175	0.050	0.034	0.065	0.

Source: Bank financial statements as of December 2007, Superintendencia de Bancos y Seguros de Peru.

Table 1: Commercial Bank Descriptive Statistics

	All Exporters			Full Subsample (Positive Debt after June 2008)		
	mean	sd	p50	mean	sd	p50
Panel 1. Firm	(N = 6,169)			(N=4,974)		
Debt (1,000 US$)	1,013	6,903	1.45	1,253	7,668	9.58
# of Lenders	1.70	1.10	1.10	1.75	1.12	1.19
Fraction of Debt in Foreign Currency	0.708	0.385	0.951	0.713	0.381	0.953
Exports - FOB (1,000 US$)	3,348	52,721	28	4,005	58,478	31
Exports (1,000 Kg)	8,466	230,071	11	10,371	256,182	12
# destinations	2.7	4.3	1.0	2.9	4.5	1.0
# products (4-digit)	5.3	9.4	2.0	4.7	8.2	2.0
# Product x Destinations	8.7	20.4	3.0	8.0	18.5	3.0
Over 50% Debt from Exposed Bank (dummy)	0.248	0.432	0.000	0.296	0.456	0.000
Share foreign liability weighted by firm's debt	0.037	0.036	0.032	0.041	0.036	0.043
Panel 2. Firm-Product-Destination	(N = 53,690)			(N=47,810)		
Value - FOB (1,000 US$)	169.3	3,675.6	0.7	184.8	3,875.5	0.8
Volume (1,000 Kg)	401.7	22,112.8	0.1	446.4	23,432.3	0.1
Distance (km)	6,521	7,696	5,587	6,518	8,005	5,587
Paid in advance (FOB 1,000 US$)	42.2	1,764.5	0.0	46.3	1,869.6	0.0
Transported by Air (FOB 1,000 US$)	37.2	2,181.9	0.0	40.8	2,311.6	0.0
Shipment Value - FOB (1,000 US$)	32.8	470.2	0.5	36.0	497.1	0.5
Shipment Volume - (1,000 Kg)	77.5	2,203.1	0.1	86.1	2,334.4	0.1
# Shipments per year	2.23	2.19	1.00	2.17	2.15	1.00

Source: Customs data from SUNAT, credit registry data from the Superintendencia de Bancos y Seguros de Peru. Sample: firms with at least one export registered between July 2007 and June 2009. The statistics are estimated over the calendar year July 2007-June 2008.

Table 2: Firm Descriptive Statistics

Dependent Variable	$\Delta \ln D_{ib}$					
	All Debt		US Dollar Denominated		Soles Denominated	
	(1)	(2)	(3)	(4)	(5)	(6)
FD_b	-2.344**		-3.255**		2.852*	
	(1.105)		(1.285)		(1.431)	
$S\&L_b$	-0.331***		-0.644**		0.125	
	(0.120)		(0.256)		(0.205)	
$D(FB_b > 10\%)$		-0.168***		-0.241***		0.161**
		(0.046)		(0.047)		(0.076)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,334	10,334	8,433	8,433	6,515	6,515
R^2	0.630	0.630	0.634	0.634	0.651	0.650
R^2 adj	0.261	0.261	0.250	0.263	0.102	0.102
# banks	41	41	33	33	39	39
# firms	5154	5154	4320	4320	3977	3977

Estimation of equation (**??**). FD_b is the share of foreign liabilities of bank b. $D(FD_b > \overline{FD})$ is a dummy that signals whether foreign liabilities of bank b is above the mean. Robust standard errors, clustered at the bank level, in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 3: Transmission of Credit Shocks by Banks with High Foreign Dependence

	Value(FOB)			Volume (kg)		
	t=Pre	t=Post	Diff	t=Pre	t=Post	Diff
Total	10.9%	-22.4%	-33.3%	3.2%	-9.6%	-12.8%
Intensive	10.6%	-15.7%	-26.3%	2.1%	-2.2%	-4.3%
Extensive	0.3%	-6.6%	-6.9%	1.2%	-7.4%	-8.6%
Entry	8.4%	8.2%	-0.2%	8.6%	8.3%	-0.3%
Exit	-8.1%	-14.8%	-6.7%	-7.4%	-15.7%	-8.3%

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 4: Descriptive Statistics of Export Growth

Dependent Variable	$\Delta \ln C_i$	$\Delta \ln X_{ipd}$ Intensive		$\Pr(X_{ipdt}=0\|X_{ipdt-1}>0)$ Exit		$\Pr(X_{ipdt}>0\|X_{ipdt-1}=0)$ Entry	
	FS	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
F_i	8.336***						
	(3.169)						
F_i^2	-119.976***						
	(24.931)						
$\Delta \ln C_i$		0.025**	0.179**	-0.001	-0.033*	0.007	-0.006
		(0.010)	(0.071)	(0.003)	(0.017)	(0.000)	(0.016)
Prod-Dest FE	Yes	Yes	Yes	No	No	No	No
Prod-Dest-Time FE	No	No	No	Yes	Yes	Yes	Yes
Firm FE	No	No	No	Yes	Yes	Yes	Yes
Obs	14,208	14,208	14,208	62,386	62,386	61,909	61,909
R^2	0.358	0.438		0.591		0.600	

Estimation of equations (**??**) and (**??**). In the IV regression, the change in (log of) credit, $\Delta \ln C_i$, is instrumented with the measure of exposure $F_i = \sum_b \omega_{ib} FB_b$, where ω_{ib} is the share of bank b in overall credit of firm i and FB_b is the share of foreign liability of bank b. Standard errors clustered at the product-destination level in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 5: Export Elasticity to Credit Shocks

Dep. Variable	$Pr(X_{ipdPost} > 0 \mid X_{ipdPre} > 0)$	$\Delta \log(X_{ipd})$				
	Probit	$Pr > 0$	$Pr > 0.42$	$Pr > 0.56$	$Pr > .68$	$Pr > .79$
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln C_i$		0.179**	0.210**	0.242**	0.146	0.028
		(0.071)	(0.085)	(0.121)	(0.129)	(0.105)
$\log X_{ipd}$	0.145***					
	(0.003)					
$\log X_i$	0.040***					
	(0.004)					
$\ln C_i$	0.018***					
	(0.002)					
F_i	0.886					
	(0.770)					
F_i^2	-2.745					
	(5.845)					
Prod-Dest FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	29,763	14,208	10,708	8,031	5,354	2,677
R^2	0.166					

The dependent variable in the Probit regression is the probability of continuation in *Post*-period for a firm-product-destination export flow active in the *Pre*-period (column 1). Columns 2 to 6 correspond to IV estimation of equation (**??**), restricting the sample to those flows with probability higher than the indicated threshold, which correspond to 0, 20, 40, 60, and 80 percentiles of the distribution of continuation. Change in (log of) credit, $\Delta \ln C_i$, is instrumented with $F_i = \sum_b \omega_{ib} FB_b$, where ω_{ib} is the share of bank b in overall credit of firm i and FB_b is the share of foreign liability of bank b. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 6: Heterogeneity of the Export Elasticity to Credit

Dependent Variable	$\Delta \ln(ShipFreq_{ipd})$ (1)	$\Delta \ln(ShipVol_{ipd})$ (2)	$\Delta \ln(FracAir_{ipd})$ (3)	$\Delta \ln(FracCash_{ipd})$ (4)
$\Delta \ln(C_i)$	0.108***	0.071	0.004	-0.033*
	(0.032)	(0.057)	(0.011)	(0.018)
Product-Dest FE	Yes	Yes	Yes	Yes
Observations	14,208	14,208	14,208	14,208

IV estimation of equation (**??**). Dependent variable in column 1 is the (log of) frequency of shipments; in column 2 is the (log of) average size of shipments (in volume); in columns 3 and 4, it is the change in the fraction of annual export flows (FOB) transported by air and paid in advanced by the importer, respectively. Change in (log of) credit, $\Delta \ln C_i$, is instrumented with $F_i = \sum_b \omega_{ib} FB_b$, where ω_{ib} is the share of bank b in overall credit of firm i and FB_b is the share of foreign liability of bank b. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 7: Effect of Credit on Export Arrangements

Dep. Variable	$\Delta \ln X_{ipd}$	$\Pr(X_{ipdt} > 0 \mid X_{ipdt-1} = 0)$	$\Pr(X_{ipdt} = 0 \mid X_{ipdt-1} > 0)$
	Intensive	Entry	Exit
	(1)	(2)	(3)
Panel 1:	X_{ipd} is Value (FOB) of Exports		
$\Delta \ln C_i$	0.239***	–	–
	(0.072)		
Panel 2:	Product Classification at 6 HS digits		
$\Delta \ln C_i$	0.250***	-0.009	-0.035***
	(0.055)	(0.015)	(0.013)
Panel 3:	Sample of Homogeneous Goods		
$\Delta \ln C_i$	0.154**	-0.016	-0.042**
	(0.072)	(0.017)	(0.018)
Panel 4:	Controlling for Observable Firm Characteristics		
$\Delta \ln C_i$	0.140**	-0.016	-0.026
	(0.069)	(0.016)	(0.017)
$\ln X_i$	-0.052***	0.006	-0.021***
	(0.013)	(0.005)	(0.006)
ln dollar debt	0.010	-0.060***	-0.048**
	(0.022)	(0.022)	(0.019)
unit price	0.058**		0.000
	(0.029)		(0.000)
ln # products	0.116*	-0.048***	0.114***
	(0.067)	(0.008)	(0.010)
ln # destinations	0.000	0.021	0.088***
	(0.000)	(0.019)	(0.016)
Panel 5:	*Post*-period of two years		
$\Delta \ln C_i$	0.272***	-0.005	-0.053***
	(0.051)	(0.011)	(0.016)
Panel 6:	Measure of Exposure as of December 2007		
$\Delta \ln C_i$	0.203**	-0.001	-0.027**
	(0.077)	(0.012)	(0.012)
Panel 7:	Alternative IV functional form (dummy)		
$\Delta \ln C_i$	0.227***	0.018*	-0.013
	(0.066)	(0.011)	(0.015)
Panel 8:	Placebo Test		
$\Delta \ln C_i$	-0.009	-0.077	-0.048
	(0.075)	(0.057)	(0.041)

IV estimations of (**??**) and (**??**). In Panel 1, exports measured in US$ FOB. In Panel 2, products aggregated at 6-digit level according to the Harmonized System. Panel 3 restricts the sample to homogeneous goods as defined in **?**. Panel 4 adds the following controls: overall volume of export, fraction of dollar debt, unit price of exports, # products exported, and # destinations. In Panel 5, the foreign liabilities of banks and the share of firm's credit with each bank correspond to Dec 2007. In Panel 6, $\Delta \ln C_i$ instrumented with a dummy that takes value one if the firm borrows more than 50% from banks with share of foreign liabilities above the mean. The placebo test in Panel 7 estimates the effect of credit, instrumented with F_{it} defined in (**??**)-(**??**), for the periods $t = Pre - 1, Pre$. Standard errors clustered at the product-destination level in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 8: Identification Tests

Dependent Variable	ΔX_{ipd}							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta \ln C_i$	0.012	0.179**	0.002	0.191**	0.028	0.156***	0.086	0.237***
	(0.067)	(0.071)	(0.066)	(0.080)	(0.058)	(0.060)	(0.060)	(0.061)
$\Delta \ln C_i \times dist_d$			-0.006	-0.033				
			(0.023)	(0.064)				
$\Delta \ln C_i \times Air_{ipd}$					-0.132***	-0.075		
					(0.039)	(0.056)		
$\Delta \ln C_i \times Cash_{ipd}$							0.056*	0.012
							(0.033)	(0.040)
Prod-Dest FE	No	Yes	No	Yes	No	Yes	No	Yes
Observations	14,208	14,208	14,146	14,146	14,208	14,208	14,208	14,208

IV estimations of equation (**??**). The instrument F_i is $\sum_b \omega_{ib} FB_b$, where ω_{ib} is the share of bank b in overall credit of firm i and FB_b is the share of foreign liability of bank b. Credit is interacted with the following (standardized) variables: distance to market of destination ($dist_d$), an indicator on whether the export flow was shipped by air (Air_{ipd}), and the fraction of the transaction payed in advanced by the importer ($Cash_{ipd}$). Standard errors clustered at the product-destination level in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 9: Estimation Bias

	Intensive Margin	Extensive Margin	
Dependent Variable	ΔX_{ipd}	$\Pr(X_{ipdt} = 0 \mid X_{ipdt-1} > 0)$	$\Pr(X_{ipdt} > 0 \mid X_{ipdt-1} = 0)$
	(1)	(2)	(3)
$\Delta \ln C_i$	0.145**	-0.032*	-0.008
	(0.070)	(0.018)	(0.017)
$\Delta \ln C_i \times HighFinDep_p$	-0.109	0.005	0.012***
	(0.082)	(0.004)	(0.004)
Product-Destination FE	Yes	No	No
Product-Destination-Time FE	No	Yes	Yes
Firm FE	No	Yes	Yes
Observations	14,208	56,215	56,179

IV estimation of equations (**??**) and (**??**). The (log of) credit, $\ln C_i$, is instrumented with $F_i = \sum_b \omega_{ib} FB_b$, where ω_{ib} is the share of bank b in overall credit of firm i and FB_b is the share of foreign liability of bank b. The classification of sectors according to their dependence of external finance follows **?**. Standard errors clustered at the product-destination level in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$

Table 10: Elasticity by Product Characteristic