TRADE AND CREDIT: REVISITING THE EVIDENCE

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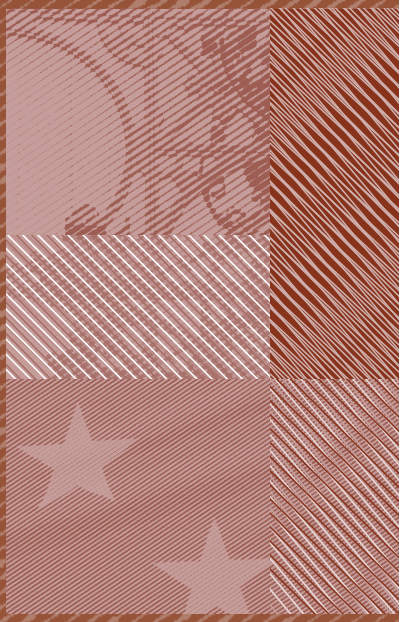

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TRADE AND CREDIT: REVISITING THE EVIDENCE (*)

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Abstract

This paper explores the effects of bank lending shocks on export behavior of Spanish firms. For that purpose, we combine Balance of Payments data on exports at the firm-product-destination level with a matched bank-firm dataset incorporating information on the universe of corporate loans from 2002 to 2013. Armed with this dataset, we identify bank-year specific credit supply shocks following Amiti and Weinstein (2018) and estimate their impact on firms' exports at the product-destination level. According to our estimates, credit supply shocks have sizable effects on both the intensive margin (amount exported) and the extensive margin of trade (decision to export).

Keywords: credit shocks, exports, firm level data.

JEL classification: F10, F30, F40, G15, G21, G32.

Resumen

Este trabajo investiga los efectos de *shocks* de crédito sobre las exportaciones de las empresas españolas. Para ello, combinamos la información procedente de los microdatos de transacciones con el exterior de la Balanza de Pagos con datos de crédito procedentes de la Central de Información de Riesgos a lo largo del período 2002-2013. A continuación, identificamos *shocks* de oferta de crédito específcos para cada banco y año siguiendo la metodología de Amiti y Weinstein (2018) y estimamos su efecto sobre las ventas exteriores de las empresas españolas. Los resultados indican que los *shocks* de crédito tienen efectos significativos tanto sobre el margen intensivo (cantidad exportada) como sobre el margen extensivo del comercio (probabilidad de empezar a exportar o dejar de hacerlo).

Palabras clave: crédito, exportaciones, datos a escala de empresa.

Códigos JEL: F10, F30, F40, G15, G21, G32.

1 Introduction

Bank credit and exports growth are strongly associated (see Figure 1). However, disentangling causes and consequences from this correlation poses a challenge. Credit supply and demand forces are determined simultaneously so that observed credit growth is an equilibrium outcome that is determined in conjunction with the firm's behavior in export markets. The aim of this paper is precisely to isolate the impact of the bank lending channel (credit supply) on exports with special emphasis on the distinction between the intensive and the extensive margins of trade.

Using Spanish administrative data at the firm-product-destination level, our findings suggest that credit supply shocks affect exports growth in the intensive margin as well as entry and exit decisions. Crucially, we uncover a differential effect of bank lending shocks on entry: while the estimated effect is not significant in the case of temporary trade relationships, it is large and significant when looking at stable relationships (i.e. those lasting at least 2 consecutive years).

Figure 1: Exports and Credit Growth in Spain

Source: Banco de España. Data on credit collected by the Banco de España, and captures variation in exporters aggregate credit. Data on exports belongs to the foreign transactions registry of the Banco de España.

From a theoretical viewpoint, financial shocks are expected to distort firms' export decisions along both the extensive and the intensive margins. Kohn et al. (2016) show that in a model of international trade with a borrowing constraint and working capital requirements,[1] negative financing shocks force firms to produce below their optimal scale, thus distorting not only the intensive but also the extensive margin by reducing the expected returns from exporting to a particular market. Alternatively, Bergin et al. (2018) illustrate how lending shocks lead firms to alter their capital

[1] These requirements are assumed to be larger for foreign sales based on the existence of shipping costs, tariffs and insurance, and shipment delays.

structure from debt to more expensive equity financing, which implicitly raises the effective cost of financing the sunk cost of entering new export markets.[2]

On the empirical front, several studies provide support to these theoretical predictions. Berman and Héricourt (2010), and Minetti and Zhu (2011) find evidence that financial shocks affect both export intensity (intensive margin) and export status (extensive margin) using firm-level data. In contrast to previous studies, Paravisini et al. (2015) find no effect of financial shocks on the extensive margin of exports during the 2008-09 financial crisis once they account for demand by including product-destination-time fixed effects in exports regressions. This finding implies that a credit shortage involves shocks to working capital but not to sunk entry costs at the product-country level, which somehow contradicts the theoretical predictions in Kohn et al. (2016) and Bergin et al. (2018).

In this paper, we estimate the impact of credit shocks on the intensive and the extensive margins of trade over the 2002-2013 period in Spain. Following Paravisini et al. (2015), we regress annual exports growth[3] at the firm-product-destination level on arguably exogenous credit shocks at the firm-year level and a set of product-destination-year fixed effects to account for demand. Intuitively, identification is based on differences in credit supply shocks across firms exporting the same product to the same destination in the same year. Also, credit supply shocks are identified as in Amiti and Weinstein (2018) and Alfaro et al. (2018). According to our estimates, the effects of bank lending shocks on exports are sizable both in the intensive and the extensive margins. In particular, our results point to a sizable impact of credit shocks on the probability to leave a product-destination market but we find no effect on the probability to enter to a product-destination market, in line with Paravisini et al. (2015). However, when we estimate the impact of bank supply shocks on the probability to become an exporter or establish a stable trade relationship, we do find a sizable and significant effect.

The remainder of the paper is organized as follows. Section 2 explains the dataset combining Credit Registry information at the bank-firm-year level with Balance of Payments data at the firm-product-destination-year level. In Section 3 we introduce our empirical specification as well as our identification strategy for isolating credit supply shocks. Sections 4 and 5 present our estimated effects of bank lending shocks on trade at the intensive and the extensive margin respectively. Finally, Section 6 provides some concluding remarks.

1.1 Related literature

This paper is part of a growing literature linking finance and trade. Berthou (2006) and Manova (2008) identify the effect of financial development on the selection of domestic firms into exporting and the level of firm exports using data at the country-sector level and exploiting differences in financial development across countries and in financial dependence across sectors. They find that

[2]Baldwin and Krugman (1989) show that entrance in a foreign market involves fixed costs in terms of learning about the foreign market, establishing networks and regulatory compliance.

[3]As we discuss below, we consider different specifications with both exports growth (intensive margin) and entry/exit dummies (extensive margin) as dependent variables.

financially developed countries export more in financially vulnerable sectors because they enter more markets and sell more in each of them.

Greenaway et al. (2007) study the impact of financial constraints on the exporting status in a panel of 9,352 UK firms between 1994 and 2003, and find that liquidity shocks increase the probability of exporting as they make it easier to cover sunk entry costs. Muûls (2008) uses a credit score measure built by a large credit insurance company based mainly on financial statements and industry-specific variables to estimate the impact of credit constraints on exports for a panel of 9,000 Belgian firms over the period 1999-2005. He finds that, controlling for firm size and productivity, credit constraints impact the number of destinations to which a firm exports but not the intensive margin measured as average exports per destination. Berman and Héricourt (2010) study the impact of credit constraints on both the intensive and extensive margins for a panel of 5,000 firms in nine developing countries between 2000 and 2005. They find a positive and significant effect on entry and a small and positive effect on the value of exports. Amiti and Weinstein (2011) find that a deterioration in Japanese banks market-to-book value was associated with a decrease in their borrowers exports in the 1990s. Minetti and Zhu (2011) exploit survey data on credit constraints from Italian manufacturing firms and find that the probability of exporting and exports growth are significantly lower for credit constrained firms. Buono and Formai (2018) find that short run shocks to the supply of bank credit over 1997-2008 induced Italian exporters to decrease their export flows without affecting their domestic sales.

Paravisini et al. (2015) and Del Prete and Federico (2014) exploit banks' exposure to the interbank market during the 2008 global financial crisis to identify a plausibly exogenous bank credit shortage. Del Prete and Federico (2014) use Italian matched bank-firm data to analyze the effect of trade finance on exports and find that credit shortages reduce export activity not just via specific constraints on trade finance but more via a reduction in the availability of ordinary lending. Crucially, Paravisini et al. (2015) estimate the elasticity of exports to credit for Peruvian firms using customs data at the product-destination level and Credit Registry information. They identify the effect on the intensive and the extensive margins and find that credit shocks affect the external sales of a firm that is already exporting to a given market but do not significantly influence the probability of entering/exiting to/from a market.

Turning to differences in the trade and finance relationship across good times and bad, Chor and Manova (2012) and Niepmann and Schmidt-Eisenlohr (2017) explore the trade-credit relationship during different stages of the business cycle for the US by measuring country-specific supply shocks. Chor and Manova (2012) use import data by country and industry and the interbank interest rates as a proxy of credit conditions in each country, and find that worse credit conditions decrease exports of that country to the US and that this effect is larger during the crisis. Niepmann and Schmidt-Eisenlohr (2017) build country-specific letter-of-credit supply shocks employing a data set of all trade-finance claims of US banks and find a positive effect on exports which is larger during the crisis and only present for small countries.

2 Data

We use information from the following data sources:

Balance of Payments data (BP): We exploit a unique administrative database of Spanish exporters for the years 2002 to 2013. This dataset, provided by the Banco de España, contains the micro data information used to construct the official Spanish Balance of Payment Statistics. For each exporter, we observe the fiscal identifier of the Spanish firm involved in the transaction, the product code (2-digits Harmonized System Codes — HS), the country of the foreign client [4] and the year of the operation (no matter when the payment was performed). Financial entities were legally obliged to report this information for external transactions above a fixed threshold. Until 2007 all transactions above 12,500 euros had to be reported and in 2008 the threshold was raised to 50,000 euros. In order to construct a comparable definition of entry/exit, we use an homogenized version of the dataset including only those transactions above 50,000 for all the years between 2002 and 2013 for the extensive margin regressions.

For the sake of assessing the coverage of our database, we aggregate the transactions at the annual level and compare resulting micro-aggregated exports with the official Customs data. Figure 2 reveals a high correlation above 95% between both series, which corroborates the good coverage of our database (for more information see Almunia et al. (2018)).

The dataset comprises trade transactions with 242 partner countries and 119 products at the HS 2-digit level. Figure 3 depicts the number of enterprises, mean exports, average number of products and destinations traded per firm and total firm-product-destination flows per year for all exporting firms and for those exporters that have some credit exposure in the banking system.

The number of exporters increased from 26,111 in 2002 to 28,449 in 2008, to sharply fall in 2009 reaching 25,304 firms and then gradually recover until 2013 when 27,490 firms reported transactions above 50,000 euros. Our subsample with positive credit in those years covers around 90% of exporters (see top-left graph, figure 3). In terms of the amount exported per firm, we can distinguish three periods: 2002-2007, characterized by a continued growth of average exports (from 4.27 to 6.24 million euros), in 2008-2009 they decreased to 6.06 million euros, to then increase in the last period, 2010-2013, to 8.09 million euros, above the pre-crisis level. For our analysis, we take those firms that have positive debt, and as we can see in the top-medium graph the average indebted firm exports more than those without debt during the whole sample period. Our unit of measure to account for fixed effects is firm-product-destination export flows. The top right graph shows that 95% of flows are captured with our sample.

The average firm in 2002-2013 exported around 1.67 2-HS digit products and 2 periods can be defined: before 2008 around 1.62 products were exported per firm and since then around 1.72

[4] In our dataset, the export destination is categorized in terms of the non resident financial institution that is involved in the transaction. The correlation between exports growth at the country level for the main destination markets between customs and our database is 80%. Figure A.1 in Appendix A shows the equivalence between balance of payments and customs data at the country level for Spain's 9 main partners.

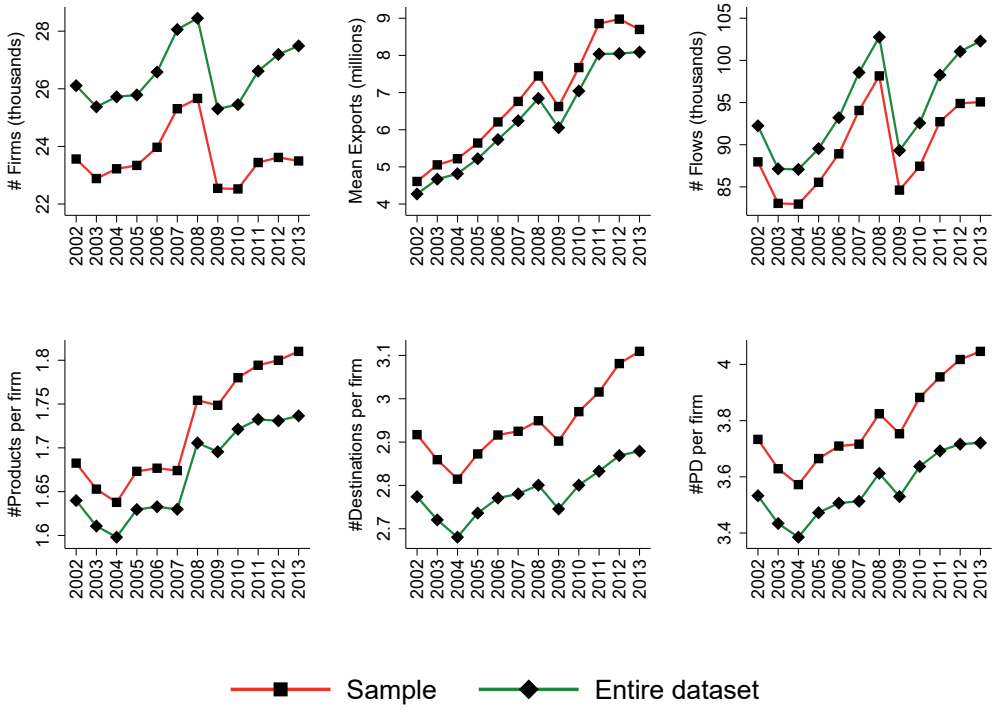
Figure 2: Exports

Sources: Customs and Banco de España. We compare the coverage of our resulting dataset with the official publicly available aggregate data on exports provided by Customs.

were exported. Similarly, the average firm exports to 2.8 destinations. The below-middle graph in figure 3 shows that as a consequence of the crisis the number of destinations to which Spanish enterprises exported decreased, and it increased in 2010-2013, when the average firm exported to 2.85 destinations. Lastly, analyzing the evolution of product-destination markets, we see that they decreased in 2002-2004 from 3.53 to 3.39, to then increase to 3.61 until 2008. In 2009, average product-destination combinations per firm decreased to 3.53, increasing since then until reaching in 2013 3.72 product-destinations per firm. The average indebted firm exports every year more products to more destinations, which confirms that credit is positively correlated also with the number of markets in which a firm operates.

Credit Registry data (CIR): CIR is maintained by the Banco de España in its role as primary banking supervisory agency, and contains detailed monthly information on all outstanding loans over 6,000 euros to non-financial firms granted by all banks operating in Spain since 1984. Given the low reporting threshold, virtually all firms with outstanding bank debt will appear in the CIR. For each loan the CIR provides the identity of the parties involved so that we can match the loan-level data from CIR with administrative data on firm-level characteristics. While CIR data is available at the monthly frequency, firm-level characteristics are only available on a yearly basis. Therefore, we collapse the monthly loan-level data to the annual frequency in order to merge both datasets. At the monthly level, each bank-firm relationship is understood as a loan by aggregating all outstanding loans from each bank-firm-month pair. Annual bank-firm credit exposure is computed as the average value of monthly loans between bank b and firm i. We end up with a bank-firm-year database covering 12 years from 2002 to 2013, 336 banks, and 25,625,695 bank-firm-year pairs (our so-called loans).

Figure 3: Exporters characteristics



Notes. Evolution of number of firms, mean exports, number of flows, number of products per firm, number of destinations and number of product-destinations for exporters and for our sample of exporters holding a credit. Transactions below 50,000 euros exluded.

Firms have relationship on average with 2.15 banks per year, 47% of them borrow from more than one bank and their mean exposure is 1.3 million euros. Exporters borrow from more banks (around 5.42 per year), a higher share of them is multibank, 82%, and their debt averages around 13 million euros (see Table 1).

Table 1: CIR. Summary statistics

	TOTAL				EXPORTERS			
	2003	2006	2009	2012	2003	2006	2009	2012
Firm level								
Exposure (MEUR)								
Mean	0.85	1.29	1.60	1.57	8.10	11.65	17.01	16.79
sd	19.41	36.94	35.78	35.04	90.65	148.11	194.15	177.58
Median	0.06	0.08	0.10	0.09	0.89	1.13	1.30	1.03
N. of banks								
Mean	2.1	2.1	2.2	2.3	4.9	5.2	5.8	5.8
sd	1.9	2.1	2.2	2.2	4.9	5.1	5.7	5.4
Median	1.0	1.0	1.0	2.0	4.0	4.0	4.0	4.0
% Multibank	45%	46%	48%	51%	81%	82%	84%	83%

Notes. Total: firms with positive debt. Exporters: firms with positive debt and that have exported in the current year.

3 Empirical approach

Our strategy to identify the impact of credit supply on exports closely follows Paravisini et al. (2015). We consider the following econometric model:

$$\ln x_{ipdt} = \eta \ln c_{it} + \delta_{ipd} + \zeta_{pdt} + \epsilon_{ipdt} \tag{1}$$

where x_{ipdt} denotes foreign sales reported by firm i of product p to destination country d at year t, c_{it} is the amount of credit granted to firm i, and δ_{ipd} and ζ_{pdt} control for unobserved heterogeneity at the firm-product-destination and product-destination-year levels, capturing differences across firms and markets. Specifically, δ_{ipd} proxies for the firm ability to operate in any product-destination market, while ζ_{pdt} accounts for product-destination-time shocks as, for example, an increase in pharmaceutical products tariff barriers in South Korea in a given year.

In practice, we take first differences in equation (1) to eliminate the firm-product-destination fixed effects (δ_{ipd}) and estimate:

$$\Delta \ln x_{ipdt} = \eta \Delta \ln c_{it} + \omega_{pdt} + \upsilon_{ipdt} \tag{2}$$

Our regressor of interest, credit, is an equilibrium outcome that depends on both firms' demand and banks' supply of credit, being the determinants of exports of product p to destination d correlated with credit demand. To isolate the effect of credit supply we instrument actual credit using bank specific credit supply shocks as estimated in Amiti and Weinstein (2018) — Section 3.1 explains in detail our strategy to identify credit supply shocks.

Armed with our time-varying credit supply shocks together with the firm-product-destination-time stratification of the data, our identification assumption is similar to that of Paravisini et al. (2015). Precisely, we assume that banks credit shocks are not correlated with non-credit factors that might affect differently exports of a product p to a destination d across two firms. In fact, the majority of factors explaining export growth are common to all exporters of a product to a destination. Some of these factors are cost of inputs, exchange rates, and destination and industry demand.[5]

In addition, we also explore in Section 5 the effect of credit supply on the probability that a firm enters/exits a product-destination market using the following linear probability model:

$$\mathrm{e}_{ipdt} = \eta \Delta \ln c_{it} + \delta_i + \zeta_{pdt} + \epsilon_{ipdt} \tag{3}$$

where e_{ipdt} measures the entry/exit of firm i to a product-destination market at time t, c_{it} the amount of credit received by firm i, δ_i firm fixed effects and ζ_{pdt} product-destination-time shocks. Note that,

[5] We acknowledge that we do not control for demand heterogeneity within each product-destination market. The presence of firms that export better quality products within a product category, or sell a product in a different region of a country, could result in biased estimates to the extent that these patterns might be correlated to bank lending specialization as in Paravisini et al. (2017).

in contrast with the intensive margin estimation, in this case we account for firm fixed effects instead of firm-product-destination as most firms only start exporting to a market once.

3.1 Identification of credit supply shocks

To disentangle the bank-lending channel from the firm-borrowing channel, we follow Amiti and Weinstein (2018) and Alfaro et al. (2018) in estimating bank-year-specific credit supply shocks that are used as instruments for credit growth in equations (2) and (3). To be more concrete, we exploit our bank-firm-year dataset in which we observe different banks lending to the same firm and different firms borrowing from the same bank. Intuitively, imagine one firm and two banks in year $t-1$. If the credit of the firm grows more between $t-1$ and t with the first bank, we assume that this is because the credit supply of the first bank is larger than that of the second bank. This is so because demand factors are kept constant given the inclusion of firm-year-specific effects.[6]

More formally, we decompose credit growth between bank b and firm i in year t as follows:

$$\Delta \ln c_{bit} = \delta_{bt} + \lambda_{it} + \epsilon_{bit} \tag{4}$$

where c_{bit} refer to the annual average of outstanding credit of firm i with bank b in year t. δ_{bt} and λ_{it} can be interpreted as supply and demand shocks, respectively, and δ_{bt} captures bank-specific effects that are identified through differences in credit growth between banks lending to the same firm. Finally, ϵ_{bit} captures other shocks to the bank-firm relationship assumed to be orthogonal to the bank and firm effects.

Our identification relies on the crucial assumption that firms' credit demand is the same for all banks and/or that banks' credit supply is not firm-specific. A recent contribution by Paravisini et al. (2017) suggests that this assumption may be violated in the presence of bank specialization to certain destination markets. However, in our case, there are three points that alleviate this concern. First, we identify the bank-year supply shocks (δ_{bt}) from a sample of non-exporting firms and thus they are expected to be uncorrelated to the characteristics of exporting firms used in the main equations (2) and (3). Second, Amiti and Weinstein (2018) show that under these circumstances, i.e. bank supply shocks arguably exogenous to firm level outcomes, the estimates are expected to be unbiased even in the presence of bank specialization. Third, Alfaro et al. (2018) show that including bank-firm covariates as a proxy for bank specialization does not significantly affect the estimated bank supply shocks.

3.1.1 Plausibility of the estimated supply shocks

In order to assess the plausibility of the $\hat{\delta}_{bt}$ estimates, we follow Alfaro et al. (2018) and consider three different validation exercises. For the sake of brevity, we briefly summarize below the main

[6] This identification strategy resembles that of the bank lending channel by Khwaja and Mian (2008). However, instead of considering observed bank supply shocks (e.g. liquidity shocks) we consider unobserved shocks estimated by means of bank-year-specific effects.

conclusions from our validation but we do not report the results since they are virtually identical to those reported in Alfaro et al. (2018). This is so because we consider exactly the same strategy and data but excluding exporting firms from the estimation sample.

First, we divide our sample into healthy and weak banks as in Bentolila et al. (2018) and find that weak banks had higher supply shocks until 2006 and lower afterward, which coincides with the narrative in Bentolila et al. (2018). We interpret this evolution as clear evidence in favor of the plausibility of our estimated bank supply shocks. Second, we regress a loan granting dummy on the estimated bank shocks and a set of firm-year fixed effects to account for demand factors. The estimated effect of the bank-specific shocks is positive and significant in all years, which indicates that the same firm applying to two different non-current banks has a higher probability of getting the loan accepted in the bank with the larger bank dummy.[7] Third, based on Amiti and Weinstein (2018), we explore how well our predicted banks' credit growth explains the banks' actual credit growth by regressing $\Delta \ln c_{bit}$ on $\widehat{\Delta \ln c_{bit}} = \hat{\delta}_{bt} + \hat{\lambda}_{it}$. The resulting R^2s for different subperiods are always in the vicinity of 50%, which indicates that the estimated bank- and firm-specific effects explain a significant fraction of the variation in bank lending.

3.2 Instrumentation strategy

In order to estimate the effect of credit on export behavior from equations (2) and (3), we instrument credit growth at the firm level ($\Delta \ln c_{it}$) with the estimated bank-year-specific shocks ($\hat{\delta}_{bt}$). To be more concrete, we construct credit supply shocks at the firm-year level from the bank-year shocks identified in Section 3.1. Based on Amiti and Weinstein (2018), we weight the supply shocks of all banks lending to firm i in period t with the share of firm i credit hold by each bank in the previous period:

$$\overline{\delta}_{it} = \sum_{b} \frac{c_{bi,t-1}}{\sum_b c_{bi,t-1}} \hat{\delta}_{bt} \tag{5}$$

For instruments to be valid they must be exogenous and relevant. Interestingly enough, $\overline{\delta}_{it}$ can be considered a shift-share instrument in the spirit of Bartik (1991) because it averages a set of bank shocks with bank-firm specific weights measuring shock exposure. A recent strand of the literature discusses alternative exclusion restrictions for this type of instruments. For instance, according to Borusyak et al. (2018), our instrument would be exogenous if bank shocks are uncorrelated with the average unobserved determinants of exports in the firms most exposed to each bank. Since bank shocks are identified from a sample of non-exporting firms (see Section 3.1), we argue that this condition should not be at odds with the data.

Another concern from this strand of the literature is that traditional inference is not appropriate in the case of shift-share regressions designs. In our setting, the concern is that residuals may be

[7] Crucially, the firms used in this validation exercise cannot have any credit exposure with the banks in the regression from which we estimated the bank-year shocks as otherwise they would not be observed in the loan application data. Therefore, the bank-firm pairs exploited in this exercise are not used in the identification of the bank dummies in (4).

correlated across firms with similar bank shares. Adão et al. (2018) develop an inferential framework valid under these circumstances that can be implemented estimating regressions at the bank level as discussed in Borusyak et al. (2018). However, our second-stage regressions are at the firm-product-destination level rather than at the firm level, so it is far from straightforward how to compute the Adão et al. (2018) standard errors in our setting. Alternatively, we cluster the standard errors at the level of the main bank (i.e., the bank with the largest value of outstanding loans) which should alleviate the concern of correlation across firms with similar bank shares.[8]

Turning to relevance, we provide here evidence that firm-specific credit supply shocks ($\overline{\delta}_{it}$) have a strong explanatory power for credit growth at the firm level. In particular, we estimate:

$$\Delta \ln c_{it} = \beta \overline{\delta}_{it} + \epsilon_{it} \tag{6}$$

where $\Delta \ln c_{it}$ refers to actual credit growth of firm i in year t, and $\overline{\delta}_{it}$ is the firm-specific credit supply shock. Table 2 shows the estimates of equation (6) at the firm-level and at the firm-product-destination level. The later include all the observations and covariates in our second-stage equation in (2). The estimated supply shocks ($\overline{\delta}_{it}$) have a positive and significant effect on credit growth in all columns. Also, the F-statistics above 10 in all cases suggest that our instruments are likely to be relevant. Note however that the magnitude of the F-statistics is lower when clustering at the main bank level as expected from the results in Adão et al. (2018).

Table 2: Relevance of the estimated bank shocks as instruments

	Firm Level		Firm-Product-Destination Level	
	No Main Bank Cluster	Main Bank Cluster	No Main Bank Cluster	Main Bank Cluster
	(1)	(2)	(3)	(4)
$\overline{\delta}_{it}$	0.181***	0.181***	0.165***	0.165***
(s.e.)	(0.0099)	(0.0243)	(0.0073)	(0.0078)
# obs	406,896	406,896	883,565	883,565
R2	0.015	0.015	0.013	0.013
F-Statistic	330.5	55.95	509.8	450.1

Notes. This table reports the estimates of the bank lending channel parameter at the firm level estimated from equation (6). The dependent variable is credit growth ($\Delta \ln c_{it}$) and $\overline{\delta}_{it}$ is a firm-specific credit supply shock constructed weighing bank-specific shocks with firm exposure to each of the banks. In addition to the main bank cluster, standard errors are clustered at the firm level in columns (1) and (2), and multi-clustered at the product and destination level in columns (3) and (4). *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

[8]Note also that our instrumental variable is estimated in a first step by linear methods and thus the adjustment factor for the resulting sampling error resembles the traditional sandwich formula that depends on the variance of the estimated parameters in the first step (Murphy and Topel (2002)). Since we are using hundreds of thousands of observations in our first step, we expect the correction factor for the second step to have a negligible effect on our second-step inferences because the first-step variance is close to zero (see Bai and Ng (2006) for a formal proof of this argument in a similar context).

4 Intensive margin results

This section discusses the estimates of the effect of the bank lending channel on the intensive margin of exports growth. In particular, we present the OLS coefficients of equation (2) as well as IV estimates using $\overline{\delta}_{it}$ as an instrument for $\Delta \ln c_{it}$. Our baseline estimates are reported in Table 3. The OLS estimate in column (1) points to an elasticity of 0.117 over the 2002-2013 period.[9] However, when we instrument credit supply in column (2) the coefficient is almost 3 times higher (0.338) and still statistically significant at the 1% level.[10] This implies that a 10 pp. reduction in credit supply decreases exports growth by 3.38 pp. This effect is not only statistically significant but also economically relevant in light of the average exports growth of 1.3%.

Due to data limitations, most of the studies previous to Paravisini et al. (2015) assume that firms and banks are randomly matched by analyzing the effect of credit supply shocks on firm level exports. In practice, this strategy ignores the product-destination fixed effects in equation (2). Not accounting for these fixed effects, we are implicitly assuming that on average firms exporting to better performing product-destination markets are equally exposed to credit supply shocks. We thus consider a set of naive estimates in which the product-destination fixed effects are not included in the regression.

Columns (3) and (4) in Table 3 present the naive estimation of the elasticity of exports (intensive margin) to credit without including the product-destination dummies and show that firms and banks were not randomly matched as the naive estimate for the sample period is significantly lower than that of the baseline. We thus conclude that the availability of data at the product-destination level is crucial for properly identifying the effect of credit on exports.

Finally, Appendix B.1 illustrates that our main findings are robust to alternative definitions of our estimating sample focusing on regular exporters and large product-destinations as well as an homogeneous version of the database using only transactions above 50,000 euros in all years.

5 Extensive margin results

The extensive margin refers to the evolution of the number of foreign markets (product-destination combinations) in which firms operate. We consider three different measures: the entry probability of a firm to a product-destination market, the exit rate and the export status. Specifically, a firm that starts exporting to a new product-destination market is considered an entry, a firm that leaves a market, an exit, and a firm reporting positive sales to a product-destination market, an exporter.

[9] Note that in 2008 the minimum declaration threshold was changed from 12,500 to 50,000 euros, so we exclude 2007-2008 growth from the sample. Results remain unaltered when considering 2008 growth in an homogenized database including only transactions above 50,000 euros in all years.

[10] The difference between the OLS and the IV estimate is expected to be larger when the fraction of variation of credit growth explained by demand is larger. This is so because credit growth can be decomposed in a supply and a demand component, and one of them (e.g. demand) can be interpreted as a measurement error not correlated with credit supply. Under these assumptions, the difference between OLS and IV estimates in analogous to the classical attenuation bias (Arellano, 2003).

Table 3: Credit shocks and exports — Intensive margin

	Baseline		Naive	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
$\Delta \ln c_{it}$	0.117***	0.338***	0.214***	0.115
(s.e.)	(0.002)	(0.102)	(0.004)	(0.138)
# obs	828,285	828,285	275,899	275,899
R2	0.014		0.020	
Avg. $\Delta \ln x_{ipdt}$	0.013	0.013	0.022	0.022

Notes. Dependent variable is export growth. All specifications include a set of product-destination-time dummies. In the IV regression the change in the log of credit ($\Delta \ln c_{it}$) is instrumented with a firm-specific credit supply shock ($\overline{\delta}_{it}$). Standard errors are multi-clustered at the product, destination and main bank level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Most papers studying the impact of credit on trade use export status to measure the extensive margin but thanks to the richness of our dataset we can take into account entry and exit to specific markets.

The exit indicator is well defined because the range of possible exits are those firm-product-destination-period combinations in which a transaction is recorded. However, when constructing the entry and export status indicators, the range of potential positive foreign sales is less straightforward to define. Theoretically, a firm can start exporting any product to any destination, but this is somehow unrealistic and poses a challenge in terms of the computational burden as the number of zeros would be intractable. Following Koenig et al. (2010), our baseline definition of entry/export status assumes that a firm could be present in any product-destination market to which it has ever exported. Paravisini et al. (2015) assume that a firm can only enter to those 4-digit HS categories within the set of 2-digit HS industries exported in the previous period. However, we only have product information at the 2-digit level, so this approach is not feasible in our case.

We argue that the extensive margin is specially interesting because Paravisini et al. (2015) find no effects of credit supply on the extensive margin for Peruvian exporters during the global financial crisis. In our setting, we can investigate whether this finding is specifically given by the granularity of our data or it is more general, even after accounting for product-destination unobserved heterogeneity as in Paravisini et al. (2015).

Columns (1) and (2) in Table 4 present the estimates of the effects of bank lending shocks on the probability to leave a product-destination market. The OLS estimate is -0.04 while the IV estimate is -0.184, statistically significant at the 1% level and the 5% level respectively. However, in line with Paravisini et al. (2015), we do not find a significant effect of credit supply shocks on entry or export status (see Columns 3-6 in Table 4).

Table 4: Credit shocks and exports — Extensive Margin

	Exit		Entry		Export Status	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln c_{it}$	-0.0408***	-0.184**	0.009***	0.0045	0.0107***	0.0292
(s.e.)	(0.0008)	(0.0713)	(0.0002)	(0.0187)	(0.0002)	(0.0267)
# obs	1,017,408	1,017,408	6,049,176	6,049,176	7,125,842	7,125,842
R2	0.139		0.029		0.058	
Avg. e_{ipdt}	0.518	0.518	0.0950	0.0950	0.151	0.151

Notes. Dependent variables are exit, entry and export status. All specifications include a set of product-destination-time and firm dummies. In the IV regression the change in the log of credit ($\Delta \ln c_{it}$) is instrumented with a firm-specific credit supply shock ($\overline{\delta}_{it}$). Standard errors are multi-clustered at the product, destination and main bank level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

5.1 The crucial role of temporary trade

Our setting allows us to identify whether firms are not encouraged to enter new foreign markets due to financial shocks or our estimates are driven by the inherent volatility of temporary trade.

On the one hand, Békés and Muraközy (2012) showed that long term exports differ from short term exports in terms of the sunk costs paid, being in the later distributed across periods and thus initially lower. In our setting, this implies that we are combining entries which require bank credit with others that probably involve a reduced sunk cost. In this sense, according to our database around 50% of Spanish firms' sales to a product destination are abandoned and only 35% of entries last more than one year.

In addition, financial shocks might have contrary effects within a firm. Manova and Yu (2016) showed that financial constraints increase low value added production and decrease the probability of exporting more profitable products. This adds volatility to our dependent variable because in response to a negative credit shock a firm could decide to export to a lower value added product-destination and, in consequence, the reaction of our dependent variable would oppose the findings in previous papers.

To address these concerns, we consider alternative definitions of the extensive margin of trade. First, in line with Melitz (2003),[11] we estimate the credit effect on the probability to enter a foreign market of domestic firms and the probability to stop exporting. Second, we exclude one-off trade relationships by considering only entry, exit and export status if foreign sales to a specific product-destination market are reported for at least 2 consecutive years. Although these stable trade relationships only represent 60% of transactions, they account for 93% of Spanish trade.

[11] In Melitz (2003) the major cost faced by entrants to new product-destination markets arises from leaving the home market.

Table 5: Credit shocks and exports — Extensive Margin. Domestic Producers

	Last Exit		First Entry	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
$\Delta \ln c_{it}$	-0.0612***	-0.156**	0.0087***	0.0828**
(s.e.)	(0.0009)	(0.0709)	(0.0002)	(0.0372)
# obs	568,818	568,818	1,942,848	1,942,848
R2	0.574		0.0562	
Avg. e_{ipdt}	0.157	0.157	0.0629	0.0629

Notes. Dependent variables are last exit and first entry. All specifications include a set of product-destination-time and firm dummies. In the IV regression the change in the log of credit ($\Delta \ln c_{it}$) is instrumented with a firm-specific credit supply shock ($\overline{\delta}_{it}$). Standard errors are multi-clustered at the product, destination and main bank level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Table 5 shows the effect of bank shocks on the probability of becoming a non exporter (Last Exit) and the probability of becoming an exporter (First Entry). Specifically, last exit takes a value of 1 if a firm reported foreign sales in the previous period and leaves the product destination market not reporting any export in the current period and 0 in case it continues exporting. First entry is measured using a sample of firms not exporting in the previous period: a firm not having exported neither in the previous nor in the current period is a 0 and a firm that starts exporting to a product-destination is a 1. Columns (1) and (2) show that the coefficients in the case of the last exit measure are -0.0612, significant at the 1% level, and -0.156, significant at the 5% level; estimated with OLS and IV respectively. Additionally, Columns (3) and (4) in Table 5 show the OLS and IV estimates of the credit supply shocks on first entry. The estimated effects are statistically significant and economically relevant if we compare for instance the 0.0828 coefficient in column (4) with the average first entry rate of 6.3%. These results confirm that credit growth increases the entrance of firms to foreign markets by making it possible to face the fixed cost of leaving the domestic market. In addition, credit shocks increase the probability to remain exposed to the foreign market.

The difference between our baseline estimates and those measuring the probability of becoming an exporter (non-exporter) might be due to temporal trade relationships which involve lower initial sunk costs and are less dependent on credit. This means that the insignificance of credit supply in the baseline entry/status regressions might be given by temporary trade relationships with certain product-destinations. In table 6 we show the impact of credit supply on the probability of exiting a product-destination market to which the firm had reported positive sales during at least two years, the probability of entering a product destination market in which the firm remains two years or more, and the probability of being a stable exporter. Here, we also find a high and significant credit effect on entry and export status. However, the influence of the bank lending channel on the exit probability is not significant in this case. Once a firm is stable in a product destination market, financial shocks might lose importance as firms are able to find additional finance sources.

Table 6: Credit shocks and exports — Extensive Margin. Regular Markets

	Exit		Entry		Export Status	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln c_{it}$	-0.0554***	-0.185	0.0041***	0.0108*	0.0045***	0.0389**
(s.e.)	(0.0013)	(0.155)	(0.0001)	(0.0063)	(0.0001)	(0.0189)
# obs	426,637	426,637	5,575,895	5,575,895	7,125,842	7,125,842
R2	0.135		0.013		0.072	
Avg. e_{ipdt}	0.308	0.308	0.0268	0.0268	0.0911	0.0911

Notes. Dependent variables are exit, entry and export status. All specifications include a set of product-destination-time and firm dummies. In the IV regression the change in the log of credit ($\Delta \ln c_{it}$) is instrumented with a firm specific credit supply shock ($\overline{\delta}_{it}$). Standard errors are multi-clustered at the product, destination and main bank level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

Finally, Appendix B.2 confirms that our main findings are robust to alternative definitions of our estimating sample and an alternative threshold for entry/exit definitions exploiting only transactions above 100,000 euros.

6 Concluding remarks

In standard models of international trade with borrowing constraints and working capital requirements financial shocks are expected to distort firms' export decisions along both the extensive and the intensive margins (e.g. Kohn et al. (2016), Bergin et al. (2018)). In contrast to empirical studies using firm-level data,[12] Paravisini et al. (2015) find no effect of financial shocks on the extensive margin of exports during the 2008-09 financial crisis once they account for demand by including product-destination-time fixed effects in exports regressions.

In this paper, we estimate the impact of credit shocks on the intensive and the extensive margins of trade over the 2002-2013 period using a sample of Spanish firms with information on exports at the product-destination level combined with loan level data on credit from the Credit Registry. In particular, we follow Amiti and Weinstein (2018) in order to isolate credit supply shocks at the firm-year level and we follow Paravisini et al. (2015) in order to disentangle exports demand and supply by means of product-destination fixed effects.

According to our estimates, the effects of bank lending shocks on exports growth in the intensive margin are sizable. Turning to the impact on the extensive margin, we find a large and significant effect of credit supply shocks on the risk of leaving a product-destination market, as well as on the probability of a domestic firm to start exporting, and on the entrance to a product-destination in which the firm remains exporting at least 2 consecutive years. Finally, in line with Paravisini et al. (2015), we fail to find significant effects on entry in the case of temporary trade relationships.

[12] See Greenaway et al. (2007), Berman and Héricourt (2010), Minetti and Zhu (2011).

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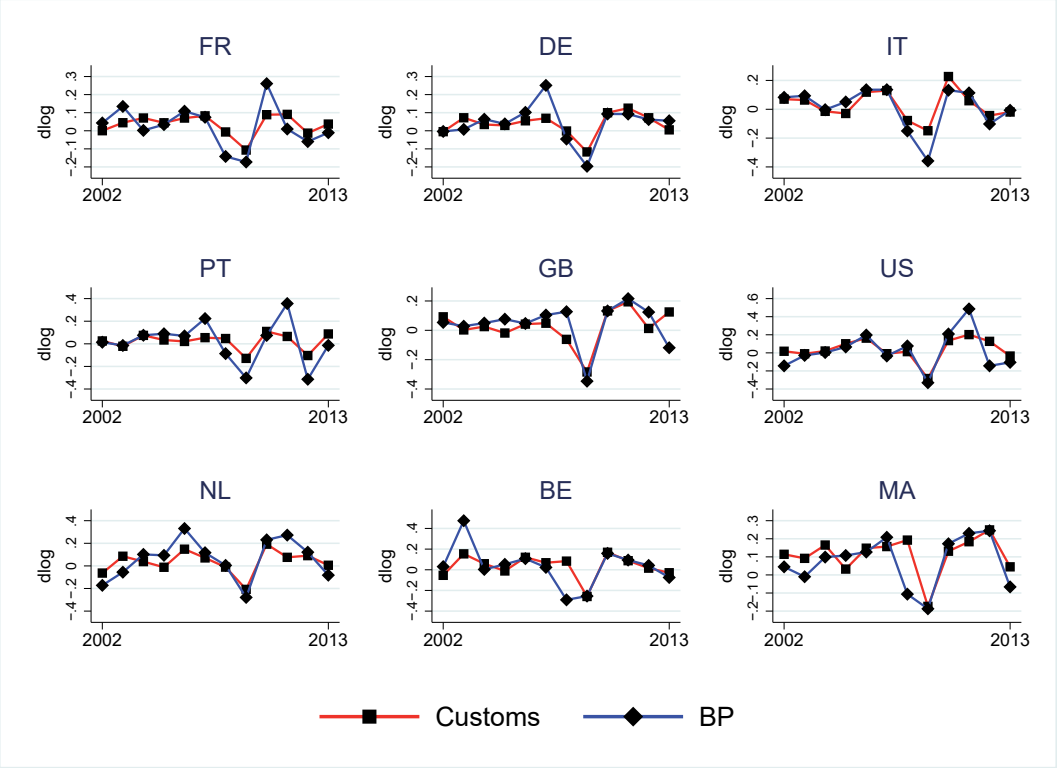
A Dataset coverage

Figure A.1: Exports by country



Sources: Customs and Banco de España. We compare the coverage of our resulting dataset by country with the official publicly available country data on exports provided by Customs.

B Robustness

B.1 Robustness intensive margin

In Table B.1 we conduct additional exercises to explore the robustness of our main findings. In the first 2 columns, we maintain only those countries to which more than 50 firms export in a given year. The main estimates remain unchanged. In columns 3-4, we consider only regular firm-product-destination combinations that are active for 3 years or more in order to avoid the influence of temporary trade. Our main results are also robust to this check.

Finally, we explore the robustness to the change in the declaration threshold that was raised in 2008 from 12,500 euros to 50,000 euros. In columns 5-6 of Table B.1, we consider a fully homogenized database including only transactions above 50,000 euros over the whole period. Again, our results remain virtually unaltered.

Table B.1: Credit shocks and exports — Intensive margin. Robustness

	>50 firms/country		Regular trade		Homogenous database	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta \ln c_{it}$	0.117***	0.336***	0.124***	0.325***	0.112***	0.438**
(s.e.)	(0.002)	(0.103)	(0.003)	(0.113)	(0.004)	(0.172)
# obs	826,635	826,635	753,644	753,644	429,255	429,255
R2	0.014		0.015		0.017	
Avg. $\Delta \ln x_{ipdt}$	0.013	0.013	0.012	0.012	0.006	0.006

Notes. Dependent variable is export growth. All specifications include a set of product-destination-time dummies. In the IV regression the change in the log of credit ($\Delta \ln c_{it}$) is instrumented with a firm-specific credit supply shock ($\overline{\delta}_{it}$). Standard errors are multi-clustered at the product, destination and main bank level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

B.2 Robustness extensive margin

Table B.2 presents additional tests to check the robustness of our findings. First, we restrict the sample to only include those countries to which more than 50 firms export in a given year. The estimates remain unchanged. Then, we restrict the sample to only include those regular firm-product-destination combinations that are active for at least 3 years, and again our main conclusions hold. Lastly, we check whether our results are robust to only taking into account transactions above 100,000 euros for determining our dependent variable.[13] In the three panels our results hold.

Table B.2: Credit shocks and exports — Extensive margin. Robustness

	Exit		Entry		Export Status		Last Exit		First Entry	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PANEL A: >50 firms/country										
$\Delta \ln c_{it}$	-0.0410***	-0.188**	0.0091***	0.0018	0.0108***	0.0279	-0.0612***	-0.158**	0.0087***	0.0822**
(s.e.)	(0.0008)	(0.0720)	(0.0002)	(0.0190)	(0.0002)	(0.0273)	(0.0009)	(0.0719)	(0.0003)	(0.0370)
# obs	1,007,288	1,007,288	5,879,978	5,879,978	6,937,857	6,937,857	566,292	566,292	1,917,242	1,917,242
R2	0.139		0.029		0.059		0.574		0.057	
Avg. e_{ipdt}	0.516	0.516	0.0957	0.0957	0.153	0.153	0.157	0.157	0.0632	0.0632
PANEL B: Regular trade										
$\Delta \ln c_{it}$	-0.0496***	-0.251**	0.0195***	0.0438	0.0202***	0.202**	-0.0428***	-0.110	0.0253***	0.164**
(s.e.)	(0.0011)	(0.118)	(0.0008)	(0.0588)	(0.0007)	(0.0956)	(0.0008)	(0.0683)	(0.0015)	(0.0775)
# obs	578,075	578,075	656,759	656,759	1,256,316	1,256,316	439,511	439,511	134,536	134,536
R2	0.073		0.043		0.087		0.284		0.122	
Avg. e_{ipdt}	0.269	0.269	0.251	0.251	0.476	0.476	0.050	0.050	0.162	0.162
PANEL C: Restricting the sample										
$\Delta \ln c_{it}$	-0.0459***	-0.202**	0.0066***	-0.0037	0.008***	0.0268	-0.0546***	-0.167***	0.00579***	0.0491**
(s.e.)	(0.0010)	(0.0975)	(0.0001)	(0.0128)	(0.0002)	(0.0226)	(0.0009)	(0.063)	(0.0002)	(0.0205)
# obs	674,721	674,721	5,779,579	5,779,579	6,769,436	6,769,436	431,895	431,895	1,877,737	1,877,737
R2	0.153		0.029		0.066		0.52		0.067	
Avg. e_{ipdt}	0.403	0.403	0.053	0.053	0.106	0.106	0.089	0.089	0.031	0.031

Notes. Dependent variables are exit, entry, export status, last exit and first entry. All specifications include a set of product-destination-time and firm dummies. In the IV regression the change in the log of credit ($\Delta \ln c_{it}$) is instrumented with a firm-specific credit supply shock ($\overline{\delta}_{it}$). Standard errors are multi-clustered at the product, destination and main bank level. *** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$.

[13] We are aware of the fact that given the 50,000 euros threshold part of our extensive margin measures are in fact part of the intensive margin. Restricting the dependent variable to values above 100,000 euros we minimize the intensive margin component of our estimates.

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