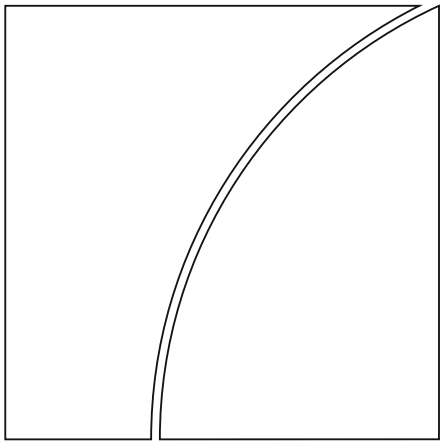
BANK FOR INTERNATIONAL SETTLEMENTS



BIS Working Papers

No 877

Export survival and foreign financing

by Laura D'Amato, Máximo Sangiácomo and Martin Tobal

Monetary and Economic Department

August 2020

JEL classification: F10, F13, G20, G28.

Keywords: international trade, credit, foreign financing, export survival.

This paper was produced as part of the BIS Consultative Council for the Americas (CCA) research conference on "Macro models and micro data" hosted by the Central Bank of Argentina, Buenos Aires, 23–24 May 2019. BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The papers are on subjects of topical interest and are technical in character. The views expressed in them are those of their authors and not necessarily the views of the BIS.

This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

Export Survival and Foreign Financing

LAURA D'AMATO MÁXIMO SANGIÁCOMO MARTIN TOBAL*

ABSTRACT

Exporting is a finance-intensive activity. But credit markets are frequently underdeveloped and domestic financing tends to be scarce in developing countries, for which a strong export sector is crucial for economic development. Thus, this paper investigates whether foreign financing provides better financing conditions than domestic financing and/or otherwise unavailable external finance, thus increasing export survival rates in a developing country. To that end, it assembles a unique dataset, rarely available for other countries, containing information on foreign credit obtained by Argentine exporters. Based on the empirical models conventionally used in the export survival literature—specifically the probit random effects and the clog-log setups—we provide evidence of a positive link between foreign financing and export survival. This finding is confirmed using an instrumental variable approach.

DECEMBER 2019

JEL codes: JEL Classification codes: F10, F13, G20, G28.

Keywords: international trade, credit, foreign financing, export survival

* The views expressed are those of the authors; they do not necessarily represent those of Banco de México, Banco Central de la República Argentina, the University of Buenos Aires, or the University of La Plata. This research did not receive a specific grant from any funding agency in the public, commercial, or not-for-profit sectors. Please address e-mail correspondence to martin.tobal@banxico.org.mx. We are grateful to Gene Grossman, Samuel Kortum, Verónica Rapoport, Juan Carlos Hallak, Ariel Burstein, Daniel Lederman, Alexander Mas, Raymond Robertson, Paul Castillo, David Lagakos, Andrés Neumeyer, Kensuke Teshima, Daniel Chiquiar and participants in the various seminars in which the paper was presented for helpful comments.

1. Introduction

Understanding the determinants of export survival is crucial for developing countries, in which export growth and a strong export sector are critical to economic development (see Besedeš and Blyde, 2010; and Besedeš and Prusa, 2011). While low export survival might, in part, reflect experimentation, the fact that survival rates are so low for developing countries can be the result of their specific characteristics, among which, underdeveloped financial markets stands out (Eaton et al., 2008; Besedeš and Blyde, 2010; Besedeš and Prusa, 2006a and 2011; Brenton, Saborowski, and Von Uexkull, 2010). It is, therefore, paramount to assess whether external finance and better financing conditions increase export survival rates.

This paper addresses this question for Argentina. In doing so, it assembles a rich dataset on trade flows and financing at the firm level. In addition to domestic financing, this data set provides information on foreign financing obtained by Argentine exporters. Because of two specific characteristics we observe in the data, we assimilate foreign financing to better financing conditions. The first characteristic is that in our sample, from 2004 to 2008, exporters tended to borrow in foreign countries where the money market interest rate was lower than in Argentina. Second, 2004 was the only year when this tendency was not evident, and that was precisely the year when Argentine lenders seemed less willing to lend. This suggests that exporters looked to foreign financing to obtain finance more cheaply.[1]

Motivated by this evidence, the paper contributes by linking financing, particularly foreign financing, to export survival. To make this link, it uses standard econometric techniques used in the literature of survival, specifically a probit model with random effects and a clog-log model with frailty. These models can offset potential bias stemming from annual aggregation of trade data and stochastic unobserved heterogeneity. The probit model has the added benefit of avoiding the restrictive assumption of proportionality, according to which the effects of regressors on the hazard are constant over time (Hess and Persson, 2012; Esteve-Pérez, Requena-Silvente, and Pallardó-Lopez, 2013). The results show that, even after controlling for firm-level characteristics, such as domestic financing and size, the foreign financing obtained by an exporter is significantly and positively correlated with its export survival. Based on Manova (2013), we build a simple model of foreign financing and export survival to rationalize these results.

Moreover, we complement the standard techniques mentioned above with a Linear Instrumental Variable Model (LIVM). Borrowing insights from Peek and Rosengren (2002) and Peek, Rosengren, and Tootell (2003), we build a financial index that reflects the shadow price of foreign financing for a firm. This index exploits variation over time in the interest rates of the foreign countries in which Argentine firms borrow and is used to instrument for their amount of

[1] Ahn (2011) suggests that since information is more asymmetric in foreign than domestic financing, the use of foreign funding would be harder to justify in the absence of more favorable terms for firms. This is because, asymmetric information costs are higher when parties are from different countries.

foreign financing.

The estimation of the LIVM shows that foreign financing has a statistically significant and positive impact on export survival. We interpret this result as evidence that foreign financing makes it possible to cover and reduce recurrent exporting costs and, thereby, increases export survival rates. These results are robust to the introduction of clustered errors at the firm level, the introduction of variables at the firm-financial country source level, and regressors controlling for macroeconomic shocks.

The paper relates to consolidated literature that provides evidence that external finance is important for covering exporting costs and that better financing conditions increase export volumes (Manova, 2008; Muûls, 2008; Manova, 2013; Feenstra, Li, and Yu, 2014; Molina and Roa, 2015). Our claim is that, just as export volumes do, export survival also increases with external finance and better financing conditions.[2] This is because export survival depends on firms' ability to face recurrent exporting costs, which, in turn, requires external finance to be affordable and on good terms.[3]

This paper is also tied to the export survival literature (Besedeš and Prusa, 2006a, 2006b, and 2011; Esteve-Pérez, Mañez-Castillejo, Rochina Barrachina, and Sanchis-Llopis, 2007; Fugazza and Molina, 2009; Nitsch, 2009; Brenton, Pierola, and von Uexkull, 2009; Volpe-Martincus, and Carballo, 2009; Brenton, Saborowski, and Von Uexkull, 2010; Iacovone and Javorcik, 2010; Hess and Persson, 2011; Stribat, Record, and Nghardsaysone, 2013; Fu and Wu, 2014; Fugazza and McLaren, 2014; Jaud, Kukenova, and Strieborny, 2015; Araujo, Mion, and Ornelas, 2016; among others), and to Albornoz, Pardo, Corcos, and Ornelas (2012), who show that export survival rates in Argentina are low. Finally, it is related to studies suggesting that external finance enables an increase in production scale and, in so doing, diminishes exporting costs (Gross and Verani, 2013; Kohn, Leibovici and Szkup, 2016).

This paper is organized as follows. Section 2 describes the dataset and presents the motivation for our econometric exercise. Section 3 reviews the literature on the links between development, export survival and financing. Section 4 develops the theory model and presents the empirical approach. Section 5 presents the results and robustness checks. In section 6, we conclude.

---

[2] As noted above, export survival can also reflect experimentation, as Cadot, Iacovone, Pierola, and Rauch (2013) and Fanelli and Hallak (2015) show. These authors argue that firms experiment because of uncertainty about market-specific demand.

[3] This paper is also related to the literature that shows how financially developed countries have a comparative advantage when it comes to finance-intensive goods (Beck, 2002; Svaleryd and Vlachos, 2005; and Manova, Wei, and Zhang, 2011). While Berman and Héricourt (2010) link export survival to some notion of finance, they are not included on this list because their main focus is export volume and decisions to enter the export market. They find that foreign finance and better financing conditions increase export volume and entry. This analysis appears in their work's extensions, which do not follow standard practices for the survival literature—and that has implications for the interpretation of their results. For instance, their studies do not constrain the sample to new exporters, which is standard practice, even though those are precisely the firms with the greatest impact on building a strong export sector and for whom financing conditions are likely to be very important. Similarly, Berman and Héricourt concentrate solely on a particular set of industries and, most importantly, use a sample they admit to be biased toward large firms. Finally, they do not directly address endogeneity.

2. Data Description and Empirical Motivation

2.1. The Data

Our dataset comes from four sources. The source of the information on foreign financing is a unique dataset collected by the Central Bank of Argentina between 2003 and 2008. In 2002, that institution established an information-reporting regime called S*istema de Relevamiento de Pasivos Externos y Emisiones de Títulos de los Sectores Financiero y Privado no Financiero,* according to which regulated financial institutions had to collect and report data on credit obtained by financial and non-financial firms in foreign countries. This regime yielded valuable information rarely available to central banks, such as the country where the financing originated and the type of creditor involved in the relationship, classified into three categories: financial institutions located abroad, related companies, and clients and suppliers.[4]

The information on domestic financing comes from the Credit Bureau of the Central Bank of Argentina (*Central de Deudores*). While this dataset makes information on households and firms available to the public, we focus on the financing directed to non-financial manufacturing firms by domestic banks in the form of debt. The information on exports comes from the records of the Argentine Customs Office. For each export transaction, we identify the Argentine firm involved, the export's destination country, and the value of the export in U.S. dollars. This paper also uses data on the number of employees at each exporting firm, annual information obtained from the Argentine Tax Collection Agency.

Finally, to construct our instrument, we looked to the International Financial Statistics of the IMF for information on the money market interest rates of the countries in which the funds originated ("source countries"). That database contains information for a relatively large number of countries. After excluding nations for which the data were not available for the five years under consideration, we end up with a dataset of fifty-eight source countries.

We then effect sequential cuts in the sample for different reasons. To avoid measurement error, we exclude firms with fewer than five employees on average over the course of the five-year period.[5] This leaves us with a sample of 6,577 manufacturing exporters, some of which obtained foreign financing from 2004 to 2008 and some of which did not. Second, we retain those firms known as "starters," i.e., firms that began to export in the first year of the sample. That came to 3,265 firms.[6] This strategy of restricting analysis to starters is widely used in the survival literature

[4] The survey does not provide information on bond issuance in international markets—a form of financing that gained predominance in developing countries immediately after the Global Financial Crisis. International bond issuance seems to have been an important factor for the corporate sector in Latin American countries such as Mexico and Brazil, but not Argentina (Acharya, et al., 2015; Bastos, Kamil, and Sutton, 2015). Table A2.1 in Appendix 2 shows that the ratio of financial-to-commercial debt contracted by the Argentine non-financial private sector and the ratio of securities in foreign financial debt decreased in 2007 and 2008.

[5] As a robustness check, all estimations presented in this paper were replicated on a sample including firms reporting fewer than five employees; the results did not change significantly. These estimations are available upon request.

[6] Like Besedes and Prusa (2006a) and Fu and Wu (2014), in our sample firms are represented by their first spell.

as a means to avoid bias arising from left-censored samples (for details, see Besedeš and Prusa, 2006b). To be consistent, when complementing the probit and the clog-log models with the Instrumental Variable model, we use the same approach.

2.2. The Motivation in the Data: A Descriptive Analysis

A first insight on our initial sample is that export relationships are short-lived. Table 1 shows that almost 50% of the firms in this sample are starters. For the sample of 3,265 starters, the average length of export spell is 2.2 years, but 46 percent exported for just one year (not shown in Table 1). This finding is consistent with Besedeš and Prusa (2006b) for a sample of several developing countries, and with Albornoz, Pardo, Corcos, and Ornelas (2012) for Argentina, during our sample period.

To show the link between export duration and financing, Table 2 presents the percentage of firms with domestic and foreign financing by length of export spell. Longer export spells are associated with firms that have some sort of financing. Strikingly, though, the increase in the proportion of firms with financing is monotonic and sharper in the case of foreign, rather than domestic, financing. In a similar vein, Table 3 shows that, while domestic financing is associated with an increase in the mean spell (seven months or 0.6 year), foreign financing is associated with a greater increase (ten months or 0.83 years).

Table 1. Composition of Initial Sample

Condition	Number of firms	%
Already exporters in 2003	3,312	50.4
Starters	3,265	49.6
Total	6,577	100

Notes: Number and % of firms that were already exporters or started exporting in 2003.
Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

Table 4 looks at export destinations and funding-source countries and the matching between them for our sample. By spell length in years (column 1), it shows the number of export-destination countries (column 2) and the number of funding-source countries (column 3) for the average firm. Columns 4 to 6 break those figures down into where export-destination and funding-source countries match (column 4), the number of countries that are solely export destinations (column 5), and the number of countries that are solely funding sources (column 6). A comparison of the figures in columns 3 and 4 shows that, for the average firm, matching is not the norm in cases of foreign financing. We also found that the number of destination and funding-source countries increases with the length of the spell. On average, firms with a spell length of one year export to 1.20 destination countries and receive financing from 0.28 countries, while those with

a spell length of five years export to 2.49 countries and receive financing from 0.57 countries, that is, both the number of destinations and the number of funding-source countries doubles.

Table 2. Length of Export Spell and Different Forms of Financing

Spell	**1**	**2**	**3**	**4**	**5**
Foreign Financing	19.6	28.8	40.5	44.7	57.7
Domestic Financing	42.8	58.6	67.4	71.9	68.3

Notes: Percentage of firms with financing by length of spell.
Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

Table 3. Financing and Length of Spell

Type of Financing	**Mean of spell**	**p-value**
Without Foreign Financing	1.93	0.000
With Foreign Financing	2.75	
Without Domestic Financing	1.85	0.000
With Domestic Financing	2.45	

Percentage of firms with access to financing by length of spell.
Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

Table 4. Average Number of Export-Destination and Funding-Source Countries by Spell Length

Spell length	**Exports destinations countries**	**Source countries of financing**	**Of which:**			**Memo:**	
			Matching	**Destination only**	**Foreign financing only**		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(4) + (5)**	**(4) + (6)**
1	**1.20**	**0.28**	0.13	1.07	0.15	**1.20**	**0.28**
2	**1.53**	**0.32**	0.15	1.38	0.18	**1.53**	**0.32**
3	**1.81**	**0.39**	0.21	1.60	0.18	**1.81**	**0.39**
4	**2.22**	**0.46**	0.23	1.99	0.23	**2.22**	**0.46**
5	**2.49**	**0.57**	0.26	2.23	0.31	**2.49**	**0.57**

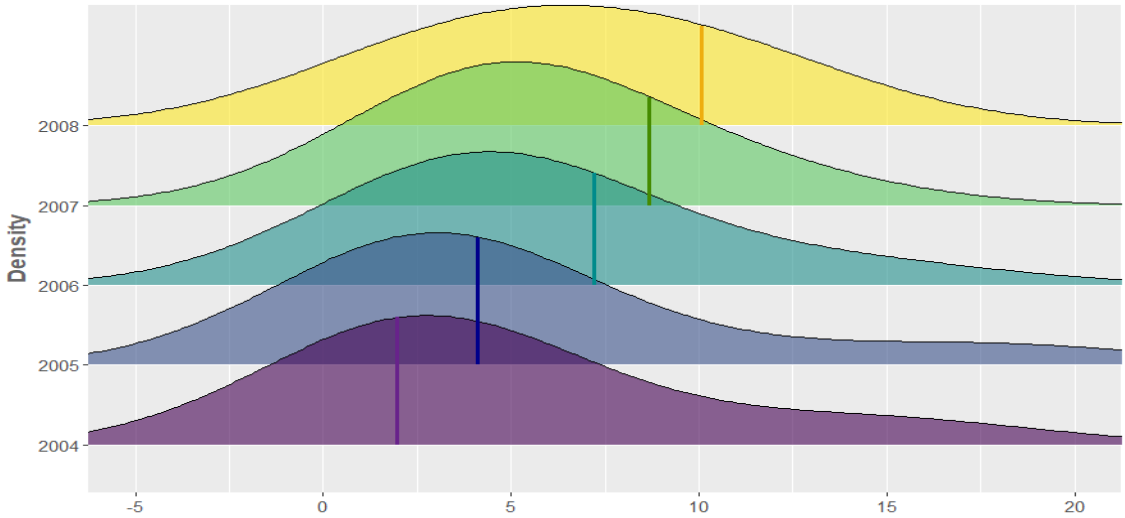
Notes: Spell length, average number of export destinations, and average number of funding-source countries for firms that were already exporters or started exporting in 2003.
Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

2.3. Foreign Financing

Figure 3 shows the distribution of Argentine firms according to value of an index that reflects the cost of foreign financing. For each exporter, this index is a weighted average of the money market interest rates in the foreign countries in which it borrowed at least once (referred to as "source countries"); relative weights depend on the importance of each source country in the total amount of foreign financing obtained by the firm (for details, see Section 4). In the five panels, the vertical line indicates the money market interest rate in Argentina during the corresponding year.

Two patterns emerge from Figure 3. In all panels, except for the one for 2004, the distribution is skewed left of the vertical line. Over the sample period, exporters tended to borrow in countries where the money market interest rate was lower than in Argentina, possibly because both the liquidity in those economies and lenders' willingness to lend were greater. This is consistent with the hypothesis that foreign financing is associated with lower financing costs, i.e., it provides better financing conditions.

Figure 3. Distribution of Average Money Market Interest Rate across Countries of Origin of Financial Funds Received by Argentine Exporters between 2004 and 2008

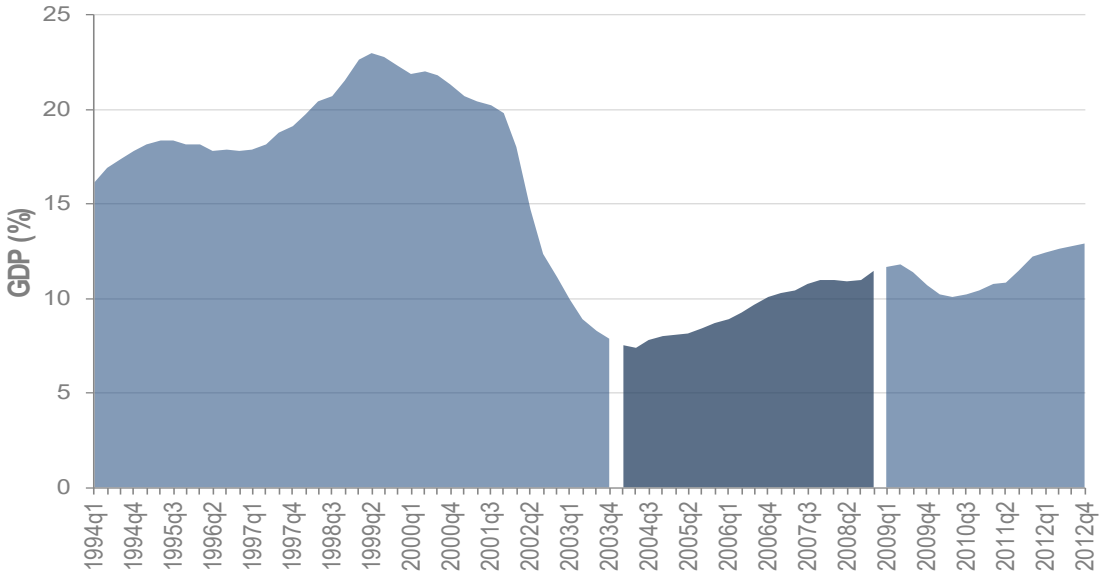


Source: IMF International Financial Statistics; Central Bank of Argentina: and authors' own calculation.
Notes: Distribution of firms according to the financial index, a weighted average of the money market interest rates in countries where an exporter borrowed. The average uses constant weights by source country, with weights calculated from 2004 to 2008. For each year, the lighter blue line depicts the money market interest rate in Argentina.

The only year in which most firms seem to have borrowed in countries with higher interest rates than Argentina was 2004. While that might suggest that interest rates are not overly important to determining sources of foreign financing, Figure 4 provides evidence against that hypothesis. It shows that 2004 was the exact year when the non-financial private sector credit-to-GDP ratio was at the lowest value in the 1993-2012 period. It was that year in the wake of the deep external and financial crisis of 2001 that domestic lenders seemed least willing to lend. In that context, firms may have looked to foreign financing to obtain otherwise unavailable external finance, regardless of interest rates.

Finally, all panels in Figure 3 exhibit a heavy right tail, mainly because a small, but not negligible, share of Argentine firms borrowed in Brazil, even though interest rates were higher there than in Argentina. The exception is 2008, when the rates in the two countries were closer.[7] This feature of the data will inform the empirical strategy described in Section 5.

Figure 4. Bank Credit to the Non-Financial Sector relative to Nominal GDP in Argentina



Sources: Central Bank of Argentina and INDEC, the Argentine statistical office.
Notes: Bank credit to the non-financial sector relative to nominal GDP in Argentina.

3. Development, Foreign Financing, and Export Survival

3.1. Export Survival and Development

By addressing export survival, this paper is tied to a strand of economics literature that links trade—particularly the consolidation of an export sector—to development in poor and middle-income economies. This literature identifies three main sources of export growth. First, the establishment of new export relationships, that is, entry into export markets. Second, the persistence of existing export relationships or "export survival." Third, increase in the volume of exports in existing relationships, that is, deepening existing export relationships (see Besedeš and Blyde, 2010; and Besedeš and Prusa, 2011). Much of this literature argues that export survival and the deepening of existing relationships are intrinsically linked; (Besedeš and Prusa, 2011). Export survival, then, contributes to export growth not only directly but also indirectly by deepening existing export relationships.

This literature considers export survival the most important of the aforementioned three factors in export performance for both developing and developed countries. It shows that export survival rates are lower in developing countries than in developed ones, and that difference explains, in large part, the enormous discrepancies in long-term export growth between those two sets of

[7] In Brazil, rates were equal to 16.24; 19.12; 15.28; 11.98; and 12.36 in 2004, 2005, 2006, 2007 and 2008, respectively.

countries. Regarding differences in survival rates, Besedeš and Prusa (2006a) show that, in the period that runs from 1982 to 1988, U.S. import relationships with developed countries had higher survival rates than with developing countries. Similarly, Besedeš and Blyde (2010) show that export survival rates of Latin American firms from 1975 to 2005 were, on average, lower than those of firms in the U.S., the European Union, or East Asia.[8] By the same token, Brenton, Saborowski, and Von Uexkull (2010) show that, from 1985 to 2005, export survival rates were lower in high-income countries than in medium- and low-income ones.[9]

In keeping with the intuition that differences in survival rates are a key driver of differences in export growth, Besedeš and Blyde (2010) show that if export survival rates in Latin America had increased to the same level as survival rates in East Asia, its annual export growth rate would have increased by 1.4 percentage points between 1975 and 2005. These higher annual growth rates, the authors emphasize, would have brought a large increase in exports (between 670% and 900%) over the same period. Along the same lines, Besedeš and Prusa (2011) show that while differences in the number of new export relationships (export entry) between developing and developed countries cannot account for the huge differences in their respective long-term export growth rates, even small differences in survival rates can generate significant differences in long-term export growth. The authors show that if developing countries had had the same export entry rate as South Korea or Spain from 1975 to 2003, their annual growth rate in exports would have changed by only around +/-0.2 percentage points. If, however, the hazard rates in Central America had been just 5 percentage points lower, or the same as the hazard rate in South Korea, its annual growth rate in exports would have increased by 1.5 percentage points over the same period. Moreover, Besedeš and Prusa (2011) show that even though export deepening—that is, an increase in the export volume of existing relationships—is an important driver of export growth, its impact is significantly diminished by low survival rates. Export relationships in developing countries, they show, simply do not last long enough to yield the deepening necessary to have a significant impact on export growth.[10]

Low export survival rates are not necessarily associated with low long-term growth in exports, however. If low export survival rates reflect robust experimentation in which firms discover what they are good at exporting (i.e., the goods they can produce and export profitably at relatively low

[8] In particular, Besedeš and Blyde (2010) show that over this period export survival rates in Latin America were 13 percentage points lower than in the U.S., about 6 percentage lower than in the European Union, and about 7 percentage point lower than in East Asia (Indonesia, Malaysia, Korea, and Thailand).

[9] Brenton, Saborowski, and Von Uexkull (2010) show that while 59% of export flows survive longer than one year in high-income countries, only 39% of export flows survive that long in low-income countries. Moreover, they show that, after twenty years, 23% of export flows survive in high-income countries but only 8% in low-income countries. In turn, survival rates in medium-income countries lie somewhere in between.

[10] To be more precise, Besedeš and Prusa (2011) show that while small differences in survival rates have a large impact on export growth, large differences in deepening often have a modest impact on that growth. The authors interpret this as evidence of the critical role played by export survival. They illustrate their point with the case of Africa: if the average deepening rate in Africa had increased from 2.6% to 7.2% to match the average deepening rate of Spain, its annual export growth rate would have increased by only 0.2 percentage points. The reason for that modest increase is, the authors argue, low export survival rates in Africa; African export relationships simply do not last long enough to yield deepening capable of driving a significant increase in long-term export growth.

cost), these low survival rates are associated with higher efficiency, higher export growth in the long-run, and thus—at least potentially—more development (see Fanelli and Hallak, 2015). Consistent with that idea, Cadot et al. (2013) interpret low export survival rates in Malawi, Mali, Senegal, and Tanzania during the 2000s as evidence that firms in those countries experiment intensely with new products and new foreign markets. Nonetheless, the evidence in the empirical survival literature suggests that higher export survival rates are key to strong and sustainable export growth and, thereby, to fostering, potentially, economic development. It is imperative, then, to identify the potential drivers of the low survival rates in developing countries.

3.2. Financing Conditions and Exporting Costs

Insofar as foreign financing can prove more favorable and diminish the costs associated with exporting, this paper is also tied to the literature on the role of exporting costs in export decisions. The costs of entering the export market (Melitz 2003) are not the only ones that affect export-related decisions. Once a firm enters the export market, it faces a range of fixed and variable costs associated with increases in the scale of production, manufacturing for export, shipping, duties, financial insurance, compliance with regulatory requirements, and maintenance of distribution networks. Unlike entry costs, these other costs are faced multiple times over the export experience, i.e., they are recurrent. They are also paid upfront, which explains in part why exporters rely on external financing. Indeed, there is a body of literature that shows how finance and exports are linked.

In an influential early piece, Manova (2013) investigates how financial-market imperfections distort trade by exploiting heterogeneity in financial development and financial vulnerability across 107 countries and twenty-seven sectors. Her results show that most distortions are due to trade-specific effects—most often reductions in export volume—rather than to limited entry into the export market. This result indirectly suggests that external finance is important to facing the variable and recurrent costs of exporting. Our finding that external finance and better financing conditions increase export survival supports Manova's results (2013).[11]

Molina and Roa (2015) also match firm-level data with bank-level information for Colombian manufacturing firms. They show that bank credit increases export volume and reach, i.e., the number of destinations attained by a firm. They interpret that as evidence that external finance makes it possible to tackle exporting costs unrelated to entry into the export market.

Moreover, and as noted above, financing can diminish recurrent variable costs by allowing exporters to increase their scale of production. After calibrating a model with plant-level data for

[11] Besedeš, Kim, and Lugovskyy (2014) investigate the link between market imperfections and export growth by developing a partial-equilibrium dynamic model in which, as a firm establishes an export relationship, it reduces credit constraints by diminishing the perceived risk of the export project. They test their model to show that credit constraints affect export growth, but also that this effect is not persistent over time. Their work, as ours, links finance to the export dimension. Our focus is on export survival, though, not on export growth, and on credit, particularly foreign credit, not on credit constraints. Moreover, their main contribution is theoretical and ours empirical.

Chile, Kohn, Leibovici, and Szkup (2016) find a greater distortion of scale in firms more dependent on external funds relative to productivity than in those less dependent. In Gross and Verani's model (2013), firms need working capital to cover both variable and fixed recurrent costs paid upfront. In this setup, new exporters begin operating below their desired level but constraints eventually ease (see also Feenstra, Li and Yu, 2014).[12]

In summary, the literature suggests that external finance and better financing conditions make it possible to cover or even reduce fixed and variable recurrent exporting costs. Considering that, and the fact that survival also depends on the ability to cover recurrent costs, it makes sense that external finance and better financing conditions increase not only export volumes but also export survival rates. It is surprising, then, that the link between finance and export survival has not received more attention. Insofar as export survival also depends on the ability to cover recurrent exporting costs, external finance and better financing conditions should also help bolster it. While lack of external finance to cover recurrent costs may force market exit outright, lack of liquidity to increase the scale of production can drive it indirectly through higher variable costs. Moreover, high interest rates mean large interest payments, thus diminishing export profitability and, with it, export survival.

4. Estimation Methodology

4.1. Traditional Methods

The earliest studies of export survival used the Cox model. In 2012, Hess and Persson tied that model to three major flaws, and its use diminished dramatically (see Esteve-Pérez, Mañez-Castillejo, Rochina, Barrachina, and Sanchis-Llopis, 2007). Hess and Persson argued that while the Cox model was a continuous-time specification, the trade data was recorded in discrete time units, which generated "heavy ties," i.e., trade relationships of equal length and, thus, bias. Furthermore, they argued that the Cox model could only incorporate the effects of unobserved heterogeneity by complicating its estimation procedure. Finally, they argued that the model ignored that the effects of the covariates on survival were non-linear, due either to intrinsic non-linearities or to dependence on spell duration.

Later studies started to use discrete-time methods, such as the probit with random effects model or the clog-log model (Fugazza and McLaren, 2014; Stribat, Record, and Nghardsaysone, 2013; Fu and Wu, 2014). Unlike the Cox model, these frameworks group continuous time observations

[12] Feenstra, Li, and Yu (2014) include "time to ship" in their heterogeneous firm model in which the longer the time lag between production and sales the more working capital exporters need on hand, which forces them to borrow from banks. Banks, though, do not heed productivity or whether the capital is used to supply domestic or foreign markets. They therefore offer different contracts for domestic firms and exporters, and the scale distortions are greater in the case of exporters due to higher working capital needs. An application of their model shows that credit conditions grow tighter as a Chinese firm's export share increases, the time to ship lengthens, and information incompleteness is more acute. Paravisini et al. (2015) also matches firm-level data with bank-level information and explores whether bank credit fosters exports in Peru. They find that export elasticities to credit are positive and interpret this result as evidence that external finance enables exporters to afford exporting costs that are unrelated to entry into the export market

and control for random unobserved heterogeneity by introducing frailty and random effects, respectively. Furthermore, the probit model has the advantage of not making any assumption about the proportionality of the covariates effects. Hence, Section 5 uses a probit with random effects model and a clog-log model as a robustness check.

These frameworks base their analysis on hazard rates. In this paper, the hazard rate must be understood as the probability that a firm cease exporting in a given time interval $[t_k, t_{k+1})$, with $k = 1,2, \ldots, k_{max}$, and $t_1 = 0$, conditional on its survival up to the beginning of that interval and on the covariates considered. Hence, this rate can be expressed as:

$$h_{ik} := P(T_i < t_{k+1} | T_i \geq t_k, x_{ik}) = F(x'_{ik}\beta + \gamma_k) \quad (1)$$

where T_i is a continuous, non-negative random variable that measures the survival time of a firm at a given spell i, x_{ik} is a vector of covariates, γ_k controls for duration dependence by allowing the hazard to vary over time, and $F(\cdot)$ is a distribution function ensuring that $0 \leq h_{ik} \leq 1$ for all i, k. In our work, which considers a single spell per firm (the first spell), the i index denotes not only a spell but also a given exporting firm. Moreover, the x_{ik} vector refers to characteristics of firms, industries, and export destinations.

Using Equation (1), the log-likelihood for a given sample can be represented. Denoting the terminal time for firm i by k_i, we define a binary variable that equals one if the firm ceases exporting during the k^{th} time interval and zero otherwise, and express the log-likelihood as follows:

$$ln\,\mathcal{L} = \sum_{i=1}^{n} \sum_{k=1}^{k_i} [y_{ik} ln(h_{ik}) + (1 - y_{ik}) ln(1 - h_{ik})] \quad (2)$$

Equation (4) suffices to estimate the parameters and a particular choice for $F(\cdot)$. Thus, we assume that $F(\cdot)$ is Normal in the probit and an extreme value in the clog-log model.

4.2. Linear Instrumental Variables Model

We complement the probit and c-log-log models with an Instrumental Variable (IV) Model setup to address endogeneity or reverse-causality concerns that may have not been addressed in these frameworks. The IV model draws on insights from Peek and Rosengren (2002) and Peek, Rosengren, and Tootell (2003), as well as from the theory model we develop below. Using that setup, we build a financial index as an instrument for foreign financing.

4.2.1. A Motivating Theory Model

By borrowing from Manova's static, partial equilibrium setup (2013), we build a simple theory model to the following ends: (a) to show an additional channel through which better financing conditions increase export survival, complementing Subsection 2.1; and (b) to justify the intuition for the construction of the instrument in Section 5.

4.2.2. Model Setup

Consider a continuum of firms from the same country and a representative period after their entry into the export market, i.e., they became exporters at some point in the past. Preferences in this market are given by the C.E.S. function $U = [\int_o^{\cap} q_f(w)^{\alpha} dw]^{1/\alpha}$, where $\cap$ is the set of varieties produced by the exporters and each variety is produced by a single firm; $\varepsilon = 1/(1-\alpha) > 1$ is the elasticity of substitution and $P = [\int_o^{\cap} p(w)^{1-\varepsilon} dw]^{1/(1-\varepsilon)}$ the ideal price index, i.e., since all the action will occur in the representative period, we abstract from time subscripts.[13]

Exporters make two types of decisions. First, they decide whether to stay in the export market for an additional period. If an exporter stays, she must sign contracts with foreign investors to obtain external finance and overcome liquidity constraints.[14] Export profitability depends, then, on the costs of foreign financing and, thus, when deciding, at the beginning of the period, whether to keep exporting, exporters anticipate the contract terms they would obtain.

If they stay in the market, exporters face both variable and fixed costs as modeled as in Manova (2013). Because at the beginning of the period firms are already exporters, none of these costs is related to entry into the export market and, as such, must be interpreted as recurrent. The variable costs depend on two components: unitary costs denoted by a_i for firm i that follow a cumulative distribution $G(a_i)$ with support $[aL, aH]$; and iceberg trade costs, i.e., $\tau > 1$ units of a product must be shipped for one unit to arrive.[15] Denoted by fe, fixed costs involving the purchase of tangible assets must be borne upfront.

Because exporters face liquidity constraints, they must cover a fraction d of fe with external finance.[16] We consider two investors from different countries and exporters who can engage one or both of them. Like Manova (2013), we consider an exogenous probability *1-λ* that, at the end of the period, the firm defaults, the contract is not enforced, and the collateral is seized. Anticipating this, at the beginning of the period firms and investors bargain over contract terms: the size of the loan, the repayment *F* in case the contract is enforced, and the fraction of the collateralizable used as collateral.

The investors differ in two ways. First, the fraction of the collateralizable asset that an investor accepts depends on her nationality and on characteristics of the firm, i.e., γ_{i1} and γ_{i2} are the fractions acceptable to firm i by investors from countries one and two. This reflects variations in firms' ability to overcome the asymmetric information characteristic of financial contracting, and the fact that, for a given firm, that ability varies with the investor's nationality (by way of example,

[13] For simplicity sake, local producers are not considered. Regardless of that assumption, the LHS in Equation (2) increases with a_i as long as there is no strategic integration and, therefore, qualitative results are not affected.
[14] The theory focuses on foreign investors, but the empirical analysis controls for domestic financing.
[15] Our model departs from Manova (2013) by assuming that the per-period fixed costs do not depend on *a.* Assuming otherwise does not change the fact that the LHS in (2) falls with *a.* and, thus, the qualitative results are not affected.
[16] While it would be relatively easy to consider variable costs, doing so would not enrich the model's mechanism much.

as noted in Subsection 2.2, for some Argentine firms it may be more advantageous to deal with Brazilian investors than those in other countries). Second, in keeping with differences in interest rates across countries, investors face distinct opportunity costs. For simplicity sake, we assume that investors break even in expectation.[17]

Finally, to abstract from determinants of export survival other than finance, we assume that a firm stays in the market if it anticipates a profit in the representative period.

4.2.2.1. Two-Step Optimization Process

In the first step of the optimization we consider the case of a firm that stays in the export market and, under this consideration, find the debt it contracts with each investor by minimizing its financial costs. Second, using this solution, we derive the conditions under which the firm actually stays in the export market. For a given firm i, financial cost minimization is represented by:

$$min_{\phi_{i1};\phi_{i2}} F_i = F_{i1} + F_{i2} \quad (3)$$

subject to:

$$\lambda F_{i1} + (1-\lambda)\phi_{i1}\gamma_{i1} fe = \phi_{i1} dfe(1+r_1)(1+\phi_{i1}); \quad (3.1)$$

$$\lambda F_{i2} + (1-\lambda)\phi_{i2}\gamma_{i2} fe = \phi_{i2} dfe(1+r_2)(1+\phi_{i2}); \quad (3.2)$$

$$\phi_{i2} = 1 - \phi_{i1}\ ;\ 0 \leq \phi_{i1} \leq 1. \quad (3.3)$$

where ϕ_{i1} and ϕ_{i2} are the fractions of debt contracted with investors in countries one and two; γ_{i1} and γ_{i2} are firm i's ability to deal with those investors; Equations (3.1) and (3.2) are their participation constraints; r_1 and r_2 are the interest rates in their countries. To avoid collateral duplication, the value of the collateralizable asset is assumed not to surpass the size of the loan, i.e., no firm can collateralize more than $\phi_{ij} fe$ when contracting with the investor from country $j \in [1,2]$. On the right-hand side of (3.1) and (3.2), investors' outside options increase with the size of the loans. This is critical to preserve the model's tractability and can be easily justified, for instance, by making the realistic assumption that investors have a preference for diversified portfolios.

The solution to the optimization problem in Equations (3)-(3.3) is fully derived and shown in Appendix Section 1. Using the expression for the equilibrium value of ϕ_{i1} yielded by this solution, we posit the following propositions concerning γ_{ij} (for the proofs and a more detailed description of the propositions, see Appendix Section 1):

Proposition 1. Under the assumptions in 4.2.1, there is a cutoff ability to deal with the foreign investor from country j ($j \in [1,2]$) $\overline{\gamma_{ij}}$, below which exporters with less ability do not borrow in this country.

[17]Assuming that investors keep a positive fraction of the quasi-rents would add an unnecessary dimension of heterogeneity between foreign and domestic investors, without impairing the main mechanism described in the model.

Proposition 2. If the assumptions in 4.2.1 are true, then if firm i borrows from countries j and j' (j and $j' \in [1,2]$ and $j \neq j'$),everything else being constant, it will be more successful in its dealings with the investor from j the larger the fraction of its debt contracted in that investor's country.

Propositions 1 and 2 state that exporters tend to borrow in countries where they find it easier to overcome asymmetric information constraints. In the model, these propositions state that firms characteristics can determine their sources of foreign financing—that may well be the case for Argentine firms in Brazil, for instance. Moreover, Proposition 1 can be used to derive the following propositions (for formal definitions and proofs, see the Appendix).

Proposition 3. Under the assumptions in 4.2.1, a rise in country j's interest rate increases the financial costs to firms that borrow in that country.

Proposition 4. Under the assumptions in 4.2.1, a rise in country j's interest rate induces some of the exporters to stop borrowing in it.

Proposition 5. If the assumptions in 4.2.1 are true, and a rise in country j's interest rate leads a firm to stop borrowing in it, the firm's financial costs increases.

On the basis of Propositions (3)-(5), note that a rise in r_j increases the financial costs both to firms that borrow in country j and to firms that stop borrowing in it due to that increase. We can thus say that the rise in r_j increases the shadow price of foreign financing. This is consistent with the evidence on money market interest rates in Section 2.

We can now proceed with the second step of the analysis and obtain results on export survival. A firm will stay in the export market as long as $p_i(a_i)q_i(a_i) - q_i(a_i)\tau a_i - (1-d)fe \geq F_i^*$. If we plug into this profit-function the expression for $p_i(a_i)$ yielded by utility maximization, and if we use the results of the first step, we can derive all $(1/a_i; \gamma_{ij})$ combinations under which a firm stays in the export market. For a given value of $\gamma_{ij'}$, the frontier of these combinations, shown in Figure A1 of Appendix 1, is expressed as follows:

$$(\alpha P/\tau a_i)^{\varepsilon-1}Y - (1-d)fe = F_i^*(\gamma_{ij}, r_j) \qquad (4)$$

where Y is income in the export market. Figure 3 and Propositions (1)-(5) assume that a rise in r_j increases financial costs, the shadow price of foreign financing, and, thereby, diminishes export survival probabilities. In Figure 3, financial costs and export survival also depend on the ability to deal successfully with foreign investors ($\gamma_{ij}, \gamma_{ij'}$). Unobservable factors set at the exporting firm-source country level can, then, determine a firm's survival probability as well as the countries in which it borrows.

4.2.3. Constructing the Financial Index

To instrument for foreign financing, we use the money market interest rates of the foreign

countries in which a firm borrows. These rates help construct a valid instrument because they capture relevant information on the monetary and liquidity conditions of foreign countries. They determine the financing costs faced by firms. Furthermore, money market interest rates are correlated with firms' foreign financing—an insight garnered from the theory laid out in Section 2 and from its Figure 1.[18] These rates are also useful to constructing an instrument that meets the exclusion restriction because, as features of foreign countries, they are exogenous to unobservable features of the firms and not affected by firm-level decisions, i.e., Argentine firms are price-takers in foreign financial markets. The use of foreign interest rates also makes it possible to isolate time variations arising only from the supply-side of foreign financial markets.

In this regard, our paper is related to other studies. For instance, Peek and Rosengren (2002) proxy for the financial health of Japanese banks with Moody's ratings, which allows them to show that firms more exposed to troubled banks reduced their foreign investments by a greater amount than those less exposed. Along these lines, Peek, Rosengren, and Tootell (2003) employ CAMEL ratings to construct an index that captures exogenous time-variation in the financial conditions faced by firms, which enables them to show that credit-supply conditions affect economic activity in the U.S.[19] Like Peek, Rosengren, and Tootell (2003), we use money market interest rates to construct an index that reflects financial conditions faced by firms.

When constructing this index, we are confronted with two choices: (i) we must choose which interest rates are relevant to a firm at a given moment, i.e., which foreign countries are relevant to a firm; and (ii) when there is more than one relevant rate, we must decide how to combine them to create a single index. In making those choices, we impose two conditions to ensure that our index captures the "shadow price" of foreign financing.

The first is based on the theory model, specifically Propositions 1 and 2. We assume that firms tend to borrow in a particular set of foreign countries. In theory, those countries are the ones for which a firm has ample ability to overcome asymmetric information ($\gamma_{ij} > \overline{\gamma_{iJ}}$), i.e., the ones for which there is some value of interest rate at which the firm decides to borrow in that country. In applying this concept to the data, these countries are associated with the ones in which the firm has borrowed at least once, i.e., source countries, over the sample period. The second condition is based on Propositions 3-5 of the theory model. Specifically, we ensure that a rise in a source country's interest rate increases the index for: (a) firms borrowing there at the time of the increase; and (b) firms not borrowing there, but for which the country is a source nation.

Under these conditions, a rise in the interest rate of a source country always brings a rise in a firm's index, regardless of whether it was borrowing there at the time of the increase. Thus, we construct the time t financial index for a firm i that has borrowed abroad (r_{it}^{B}) as follows:

[18] To the extent that there is arbitrage, a lower interest rate in the money market goes in hand and in with lower interest rates in other markets in the same country and, therefore, reduce the financing costs faced by Argentine firms.
[19] CAMEL ratings are based on five categories: capital, assets, management, earnings, and liquidity.

$$r_{it}^{B} = \sum_{j=1}^{N_i} w_{ij} r_{ijt} \quad (5)$$

where:

$$FF_{ij} = \sum_{j=1}^{T} FF_{ijt}\,; \quad FF_i = \sum_{t=1}^{T} \sum_{j=1}^{N_i} FF_{ijt}\,; \quad w_{ij} = FF_{ij}/FF_i; \quad (6)$$

r_{ijt} is the money market interest rate at time t in a nation j that is a source country for firm i; FF_{ijt} is the financing obtained by the firm from that country at t; N_i refers to the firm's number of source countries; thus, FF_i and F_{ij} are the amounts of foreign financing obtained by the firm from all source countries and from country j, respectively, over the whole period; r_{it}^{B} is a weighted average of the source countries' interest rates, w_{ij} is the relative weight assigned to country j in all years, and r_{it} is obtained by dividing FF_{ij} by FF_i. The relative weight assigned to each foreign country w_{ij} varies across firm but, for a given exporter, does not vary over time.

Regarding the firms that did not borrow abroad and are, thus, not factored into Equations (5) and (6), we start with the observation that they did show a tendency to borrow in a particular set of countries. While we ensure that their index (r_{it}^{NB}) is constructed to reflect global financial conditions, we acknowledge in every case that they are Argentine exporting firms, which means that their experience with obtaining foreign financing is likely to hold common challenges or to be explained by common factors. We capture these two considerations by constructing the index of firms that did not borrow abroad as follows:

$$r_{it}^{NB} = \sum_{j=1}^{N} w_j r_{jt}\,; \quad (7)$$

where:

$$w_j = \sum_{i=1}^{\omega} w_{ij}\,/\omega; \quad (8)$$

N is the total number of source countries in the sample; r_{jt} is source country j's money market interest rate; ω is the number of Argentine exporters having borrowed abroad; and w_j, the relative weight of country j, is computed as an average of the weights for all exporters having borrowed abroad at least once. As in the cases of (5) and (6), the index for firms that did not borrow abroad is a weighted average of money market interest rates in source countries. Unlike r_{it}^{B}, r_{it}^{NB} considers the interest rates of all source countries and computes relative weights on the basis of averages across all Argentine exporters that have borrowed abroad. These features of r_{it}^{NB} ensure that it captures changes in global financial conditions; r_{it}^{NB}also acknowledges that the exporters are Argentine firms.

4.2.4. Threats for Identification

There are two sources of variation in the financial indexes. Time-variation arises from changes in foreign interest rates. This variation is exogenous to the firms' unobservable characteristics and decisions. The indexes can also vary across firms at a given moment, reflecting their tendency to borrow in different countries. This second form of variation poses a threat for identification. For

instance, if time-unvarying unobservable characteristics of a firm led it to borrow in specific countries and those countries happened to have consistently higher or lower interest rates, these unobservable characteristics would correlate with our index. If those characteristics also correlated with export survival, they would bias our results (though not always explicitly mentioned, this is a common threat in the trade literature that links firm-level data with bank-level information).

To tackle this issue, we use two strategies. The first adheres to the theory model insofar as it holds that the countries in which a firm borrows depend on idiosyncratic factors at the exporting firm-source level, such as cultural and historical factors. On this ground, and in light of the evidence on Brazil in Section 2, we incorporate a variable to identify firms that borrowed in Latin America. Significantly, the introduction of variables at the exporting firm-source country level directly addresses the empirical concern noted above—because the actual threat for identification is not the existence of unobservable characteristics *per se* but, rather, the possibility that those characteristics led firms to borrow in countries that have consistently different interest rates.

The second strategy also consists of including an additional variable at the exporting firm-source country level. Rather than using the theory model, though, this strategy takes a more agnostic approach and more directly addresses the possibility that firms borrow in countries with different interest rates. More precisely, we introduce a dummy that identifies exporters that borrowed in countries that had consistently different interest rates over the sample period.

A final threat for identification arises when a firm's source countries are also its export destinations. Imagine the case of a firm that exports to and obtains foreign financing from the same country, and assume that a macroeconomic shock hits that economy, e.g., the crisis of 2008. If the shock affects the real and financial sides of that foreign economy, it may reduce the likelihood of survival in the products market and also have an impact on financing conditions. That could induce a correlation between our instrument and survival that is not a causal result of foreign financing on export survival rates. On that potential threat for identification, we reiterate what we said in Section 2: export destinations tend not to match source countries.

Nonetheless, Section 5 explicitly addresses this point in two ways. First, its estimation includes information on the GDP growth of the export-destination countries. This accounts for the impact of macroeconomic shocks on the real side of export destinations. Second, it uses different variables to identify firms with a tendency to export to and borrow from the same countries.

5. Empirical Results

5.1. Random-Effects Probit Estimation

Table 5 shows the results of the probit model with random effects. The dependent variable equals one in the event of exports ceasing and zero otherwise; thus, a negative coefficient indicates that the covariate has a negative impact on the hazard of export ceasing. In keeping with standard

practices, we incorporate the variable Ln(Export year), the natural logarithm of firms' export year. Columns (1)-(6) sequentially introduce firm, industry, and destination-specific characteristics.

Before proceeding to Columns (1)-(6), note that Ln(Foreign financing), the natural logarithm of one plus the foreign financing obtained by a firm, has the expected sign; it is significant at the 1% level in all specifications. Column (2) incorporates two firm-specific variables: Ln(Size), the natural logarithm of a firm's number of employees, and Ln(Domestic financing), the natural logarithm of one plus the debt incurred with domestic banks. Incorporating Ln(Size) helps improve identification to the extent that it is likely to correlate with unobservable determinants of foreign financing and export survival (Forbes, 2007; Manova and Zhang, 2009; and Manova, 2013 provide evidence that size, for instance, correlates with firm productivity). Moreover, a number of the unobservable determinants of foreign financing (and export survival) are likely to affect domestic financing; thus, Ln(Domestic financing) should also help identification.

Turning to the results, the effect of Ln(Size) on the hazard is not statistically significant, which contradicts the results of Fu and Wu (2014). They argue that larger exporters have higher survival rates due to, among other factors, greater access to capital. In our model, that effect is captured by Ln(Foreign financing) and Ln(Domestic financing), which, along with the fact that Fu and Wu (2014) do not define firm size in a continuous space as we do, may explain the difference. Ln(Domestic financing), meanwhile, is significant at the 5% level; it has the expected sign, but its statistical significance diminishes as more covariates are introduced in the model.

Column (3) incorporates the value of a firm's exports during its first year as an exporter, a factor drawn from Rauch and Watson's (2003) model of search, according to which relationships with lower-cost suppliers (who are almost always from less developed countries) are characterized by both relatively large initial orders and long durations. A number of empirical studies also suggest the importance of initial exports on trade duration (Besedeš and Prusa, 2006b; Brenton, Saborowski, and Von Uexkull, 2010; Fugazza and Molina, 2009; Albornoz, Pardo, Corcos, and Ornelas, 2012; Stribat, Record, and Nghardsaysone, 2013). Furthermore, Albornoz, Pardo, Corcos, and Ornelas (2012) show that initial exports at a high value indicate ability to earn profits abroad; Artopoulos, Friel, and Hallak (2011) argue that that ability requires knowledge of local consumer preferences, business practices, and institutional environments, an ability likely acquired through foreign networks and exporters' previous experiences.[20] In keeping with this, Table 2 shows that the effect of Ln(Initial exports) is positive and significant at the 1% level in all specifications.

Column (4) incorporates two industry-specific dummies that equal one for high-tech and medium-tech industries, respectively, and zero otherwise. To classify industries, we adopt a criterion similar to the one used by Esteve-Pérez, Mañez-Castillejo, Rochina, Barrachina, and

[20] Artopoulos, Friel, and Hallak (2011) find that knowledge advantage is critical to understanding export pioneering.

Sanchis-Llopis (2007). These authors argue that because firms in tech-intensive industries exert greater R&D efforts and supply more vertically differentiated products, they have larger price-cost margins and survive longer. Our results also show that both dummy variables are significant at the 1% (or 5%) level in all specifications.

Table 5. Probit Model with Random Effects *

	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Foreign financing)	-0.0837***	-0.0806***	-0.0852***	-0.0793***	-0.0779***	-0.0769***
	[0.0174]	[0.0169]	[0.0191]	[0.0183]	[0.0177]	[0.0171]
Ln(Export year)	-0.529***	-0.474***	-0.0930	-0.140	-0.173	-0.197
	[0.150]	[0.154]	[0.174]	[0.168]	[0.159]	[0.149]
Ln(Size)		-0.0365	-0.00561	-0.0167	-0.0175	-0.0159
		[0.0256]	[0.0346]	[0.0335]	[0.0326]	[0.0318]
Ln(Domestic financing)		-0.0293**	-0.0312**	-0.0304**	-0.0294**	-0.0279*
		[0.0121]	[0.0155]	[0.0150]	[0.0146]	[0.0143]
Ln(Initial exports)			-0.260***	-0.253***	-0.245***	-0.241***
			[0.0419]	[0.0403]	[0.0382]	[0.0357]
Medium technology				-0.277***	-0.261**	-0.232**
				[0.106]	[0.103]	[0.0999]
High technology				-0.196***	-0.180***	-0.163**
				[0.0692]	[0.0670]	[0.0648]
GDP growth					-2.113*	-1.302
					[1.124]	[1.127]
Mercosur						-0.164***
						[0.0561]
Constant	-0.408***	-0.287***	0.0939	0.212*	0.306**	0.356***
	[0.0574]	[0.0751]	[0.109]	[0.115]	[0.126]	[0.126]
Observations	7,120	7,120	7,120	7,120	7,120	7,120
Number of firms	3,265	3,265	3,265	3,265	3,265	3,265
rho	0.21	0.256	0.568	0.534	0.51	0.488
rho s.d.	0.2	0.185	0.107	0.113	0.113	0.111
Log likelihood	-3,595	-3,589	-3,472	-3,465	-3,463	-3,459
Likelihood-ratio test of rho = 0	0.172	0.100	0.000	0.000	0.000	0.000

Standard errors in brackets

*** Significant at 1%, ** at 5%, * at 10%.

Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

Notes: The dependent variable equals one if the firm ceases exporting and zero otherwise; Ln(Foreign financing) is the natural logarithm of one plus the dollar amount of foreign financing obtained by a firm; Ln(Export year) is the natural logarithm of a firm's export year; Ln(Size) is the natural logarithm of its number of employees; Ln(Domestic financing) is the natural logarithm of one plus the dollar amount of debt to domestic banks; Ln(Initial exports) is the natural logarithm of a firm's exports in its first year as an exporter; high and medium technology are equal to one for high-tech and medium-tech industries, respectively, and zero otherwise. GDP growth is the weighted average (by share in total exports for each year) of GDP growth rates in export destination countries; and Mercosur is a dummy variable equal to one if more than 50% of a firm's export value goes to Mercosur and zero otherwise.

Column (5) adds the weighted GDP growth of export-destination countries. While the inclusion of this variable is justified only for an IV model, the same reasoning holds true for the case of a probit model with random effects (for other studies with macroeconomic controls, see Besedeš and Blyde, 2010; Hess and Person, 2011; Fugazza and McLaren, 2014; Stribat, Record, and Nghardsaysone, 2013; Fu and Wu, 2014). Indeed, Column (5) shows that the effect of the GDP

growth variable has the expected sign; it is statistically significant at the 10% level.

Nonetheless, this result is reversed in Column (6) with the incorporation of the variable Mercosur at the value of one if more than 50% of a firm's export value goes to Mercosur and zero otherwise. The fact that Argentine exporters may find it easier to survive in Mercosur might imply that firms that sell mainly in the region are intrinsically different from others, e.g., their productivity may be lower, which would bias our results unless we control for differences. Column (6) shows that Mercosur is significant at the 1% level and renders GDP growth insignificant. This may be because Mercosur countries grew at relatively higher rates over the sample period.

Regarding the effect of foreign financing, Ln(Foreign financing) has the expected sign; it is significant at the 1% level in all specifications.

5.2. Linear Instrumental Variable Model (LIVM)

We incorporate the variables mentioned in Section 4, that is, variables determined at the exporting firm-source country level, to identify exporters that borrowed in Latin America and exporters that borrowed in countries with consistently different interest rates. This also allows us to account for the potential impact of macroeconomic shocks on both the GDP variable considered in Subsection 5.1 and a variable that identifies firms for which source countries are the same as export destinations. As mentioned above, considering variables set at the firm-source country level is both consistent with the theory and the most direct way to tackle a potential correlation between unobserved heterogeneity and the financial index, which is reassuring: since, by definition, we have an unbalanced panel and a relatively short average length of trade relationship, we do not have great enough degrees of freedom to incorporate firm-fixed effects.

The model is estimated in two stages: the first regresses Ln(Foreign Financing) against the financial index and other controls, and the second regresses the dependent variable of the previous subsection against the instrument and other controls. Significantly, of the covariates considered in the probit model, this subsection considers only the variable on GDP growth. Given that most covariates in Subsection 5.1 are correlated with the instrument or with the additional variables we incorporate in the LIVM, this ensures sufficient variation. Even more important, most of the covariates considered in Subsection 5.1 are endogenous. Introducing them in the LIVM model would, then, require that we include more instruments in the regression in order to preserve an equal number of instruments and endogenous variables. This strategy would not add much to our analysis, however, because our variable of interest is Ln(Foreign financing). Moreover, we are more confident in the ability of our one-instrument based strategy and, therefore, choose not to threaten it by incorporating more endogenous covariates.

Table 6 presents the results of the first stage. Column (1) shows that, when foreign financing is regressed only against the index, it is significant at the 1% level but does not have the expected

sign. Interestingly, this result is reversed as we introduce the variable identifying firms that borrowed in Latin America: in Columns (2)-(6), the coefficient on the index is statistically significant at the 1% level and has the expected sign.

Using the same specifications as in Table 6, Table 7 shows the results of the second stage. In Column (1), the economic interpretation of the coefficient on Ln(Foreign financing) is complicated by the fact that the index does not have the expected sign at the first stage. Starting in Column (2), then, we observe that the coefficient is negative, as expected, and significant at the 1% level. This result is robust to the introduction of the variable above mean interest rate in Column (3) and, interestingly, the value of the foreign financing coefficient remains stable.

More generally, the significance of the coefficient on foreign financing remains robust to the introduction of all variables in all specifications on Table 7. Hence, we conclude that foreign financing exerts a positive impact on export survival probabilities, potentially because it provides firms with otherwise unavailable external finance to pay recurrent exporting costs or, as speculated above, because it enables them to reduce their financing costs.

Table 6. Linear Instrumental Variable Model: First Stage

	(1)	(2)	(3)	(4)	(5)	(6)
Interest rate	10.57***	-4.513***	-4.585***	-4.301***	-4.532***	-4.260***
	[0.857]	[0.804]	[0.806]	[0.804]	[0.804]	[0.803]
Dummy LATAM foreign financing		2.423***	2.408***	2.211***	2.408***	2.218***
		[0.0496]	[0.0511]	[0.0585]	[0.0510]	[0.0584]
Dummy above mean interest rate			0.0594	0.0905*	0.0975**	0.126***
			[0.0480]	[0.0480]	[0.0483]	[0.0484]
Dummy export-foreign financing				0.455***		0.439***
				[0.0668]		[0.0668]
GDP growth					-5.472***	-5.197***
					[0.949]	[0.947]
Constant	0.522***	0.600***	0.565***	0.516***	0.801***	0.741***
	[0.0494]	[0.0428]	[0.0512]	[0.0516]	[0.0655]	[0.0659]
Observations	7,120	7,120	7,120	7,120	7,120	7,120
R-squared	0.021	0.267	0.267	0.271	0.270	0.275

Standard errors in brackets

*** Significant at 1%, ** at 5%, * at 10%.

Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

Notes: The dependent variable is the natural logarithm of one plus the dollar amount of foreign financing obtained by a firm; *Interest rate* is the index defined in Equations (5)-(8); LATAM foreign financing equals one if at least one fund supplier is in LATAM and zero otherwise; above mean interest rate equals one if the firm receives funds from at least one country whose time dimension collapsed money market interest rate mean is above the cross-section (time dimension collapsed) sample mean or if it did not receive foreign financing and zero otherwise; and export-foreign financing equals one if the firm's main financing origin country is also its main export destination and zero otherwise; GDP growth is the weighted average (by share in total exports for each year) of GDP growth rates in export destinations.

The lower section of Table 7 shows the results of different tests. According to the LM test reported in this Table, we can reject the null of under identification, i.e. the model is identified. Second, we run the Cragg-Donald test, which shows the bias that would be obtained if instruments were weak relative to the bias that would be obtained with an OLS, i.e., due to endogeneity (Stock

and Yogo, 2005). According to that test, we can reject the hypothesis that our bias is more than 10% greater than the bias of an OLS with a 0% risk of making an error of type I, i.e., at the 10% significance level. More precisely, the value for the Wald statistic in Table 4 is 28.17, greater than 18.37, the value required to reject the hypothesis at the 10% confidence level. If we run the version of the Stock and Yogo (2005) test that looks at the size of the Wald statistic, the tabulated value at the 5% confidence level is 26.87. Thus, we can also reject the null of weak instruments.

Table 7. Linear Instrumental Variable Model: Second Stage

	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Foreign financing)	-0.0409**	-0.164***	-0.283***	-0.297***	-0.284***	-0.298***
	[0.0170]	[0.0512]	[0.0617]	[0.0679]	[0.0626]	[0.0687]
Dummy LATAM foreign financing		0.209*	0.608***	0.597***	0.611***	0.600***
		[0.119]	[0.143]	[0.144]	[0.145]	[0.147]
Dummy above mean interest rate			-0.442***	-0.434***	-0.437***	-0.429***
			[0.0170]	[0.0181]	[0.0177]	[0.0191]
Dummy export-foreign financing				0.105***		0.104***
				[0.0403]		[0.0397]
GDP growth					-0.650	-0.663
					[0.482]	[0.499]
Constant	0.274***	0.345***	0.677***	0.673***	0.706***	0.703***
	[0.0186]	[0.0218]	[0.0270]	[0.0270]	[0.0436]	[0.0442]
Observations	7,120	7,120	7,120	7,120	7,120	7,120
Centered R^2	0.003	-0.406	-1.094	-1.229	-1.106	-1.24
Underidentification test (Kleibergen-Paap rk LM statistic)	0.000	0.000	0.000	0.000	0.000	0.000
Weak identification test (Cragg-Donald Wald F statistic)	152.2	31.53	32.38	28.59	31.78	28.17
Hansen J statistic (overidentification test of all instruments)	0.000	0.000	0.000	0.000	0.000	0.000
Endogeneity test of endogenous regressors	0.259	0.000	0.000	0.000	0.000	0.000

Standard errors in brackets
*** Significant at 1%, ** at 5%, * at 10%.
Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.
Notes: The dependent variable is one if the firm ceases exporting and zero otherwise; Ln(Foreign financing) is the natural logarithm of one plus the foreign financing obtained by a firm; LATAM foreign financing equals one if at least one fund supplier is in LATAM and zero otherwise; above mean interest rate equals one if the firm receives funds from at least one country whose time dimension collapsed money market interest rate mean is above the cross-section (time dimension collapsed) sample mean or if it did not receive foreign financing and zero otherwise; and export-foreign financing equals one if the firm's main financing origin country is also its main export destination and zero otherwise; GDP growth is the weighted average (by share in total exports for each year) of GDP growth rates in export destinations.

Regarding the quantitative results, the difference between the survival probability for a firm with no foreign financing and for a firm that has a level of foreign financing that is at the 75th level of the distribution is equal to 32% in the LIVM model.

As for comparison between the LIVM and the probit model note that the coefficient of foreign financing is statistically significant and has the expected sign in both cases. The quantitative results obtained with the two models are, however, not directly comparable and the LIMV has de drawback that probabilities are not expressed within the zero – one interval.

5.3. Robustness Checks

This subsection conducts two robustness checks. The first complements our analysis with a clog-log model. Using the same dependent variable and covariates as in the probit setup, Table A2.1 in Appendix 2 shows the results. In that table, the coefficient associated with foreign financing is significant at the 1% level in all specifications and it has the expected sign.

In the second robustness check, we use an alternative definition of export-foreign financing to render that variable equal to one more times, i.e., we are more severe in controlling for firms for which the source countries are frequent export destinations. In particular, Tables A2.2 and A2.3 in the appendix consider cases in which this variable is equal to one when the fund supplier is the same as either the first or the second most frequent export destination of the firm, or when that supplier is the same as the firm's first, second, or third largest export destination, respectively. By comparing these tables to Tables 6 and 7, we observe that the use of an alternative definition for export-foreign financing does not change the results.

6. Conclusions

On the basis of a rich dataset of Argentine exporters' financial information, this paper assesses the impact of foreign financing on export survival rates. Preliminary evidence is consistent with the fact that Argentine exporters used foreign financing to obtain external finance not available on the domestic market and to obtain that financing at lower cost. Similarly, the econometric methods traditionally used in the literature, such as the probit model with random effects and the clog-log, show a significant and positive association between foreign financing and higher export survival rates.

We complement our analysis with a linear instrumental variable model guided by a simple theory model. That model suggests that foreign financing raises export survival rates.

References

Ahn, J. (2011). "A theory of domestic and international trade finance." IMF Working Papers 11/262, International Monetary Fund.

Albornoz, F., Pardo, H., Corcos, G., and Ornelas, E. (2012). "Sequential exporting." Journal of International Economics, 88.

Amiti, A., and Wenstein, D. (2011). "Exports and financial shocks." The Quarterly Journal of Economics, Oxford University Press, vol. 126(4).

Antras, P., and Foley, C. (2015), "Poultry in motion: A study of international trade finance practices." Journal of Political Economy, 123(4).

Araujo, L., Mion, G., and Ornelas, E. (2016). "Institutions and Export Dynamics." Journal of International Economics, 98, 2-20

Artopoulos, A., Friel, D., and Hallak, J.C. (2011). "Lifting the domestic veil: the challenges of exporting differentiated goods across the development divide." NBER Working Paper 16947.

Bastos, M. F. R., Kamil, H., and Sutton, M. B. (2015). "Corporate financing trends and balance sheet risks in Latin America." International Monetary Fund.

Beck, T. (2002). "Financial development and international trade: Is there a link?" Journal of International Economics, Elsevier, vol. 57(1), pages 107-131, June.

Berman, N., and Héricourt, J. (2010). "Financial factors and the margins of trade: Evidence from cross-country firm-level data." Journal of Development Economics, 93(2), 206-217.

Bernard, A., Eaton, J., Jensen, J., and Kortum, S. (2003). "Plants and productivity in international trade." American Economic Review, vol 93.

Besedeš, T., and Blyde, J. (2010). "What drives export survival: An analysis of export duration in Latina America." mimeo.

Besedeš, T., and Prusa, T. (2006a). "Ins, outs and the duration of trade." Canadian Journal of Economics, Vol 30, N 1.

Besedeš, T., and Prusa, T. (2006b). "Product differentiation and duration of US import trade." Journal of International Economics, vol 70(2).

Besedeš, T., and Prusa, T. (2011). "The role of extensive and intensive margins and export growth." Journal of Development Economics, 96(2), 371-379.

Brenton, P., Pierola, M. D., and von Uexkull, E. (2009). "The life and death of trade flows: understanding the survival rates of developing-country exporters." Breaking into markets: Emerging lessons for export diversification, 127-44.

Brenton, P., Saborowski, C., and Von Uexkull, E. (2010). "What explains the low survival rate of developing country export flows?" The World Bank Economic Review, 24(3), 474-499.

Cadot, O., Iacovone, L., Pierola, M. D., and Rauch, F. (2013). "Success and failure of African exporters." Journal of Development Economics, 101, 284-296.

Castagnino T., D'Amato, L., and Sangiácomo, M. (2013). "How do firms in Argentina get financing to export?" ECB Working Paper N° 1601.

Eaton J., M. Eslava, C. J. Krizan, M. Kugler, and J. Tybout (2008). "A Search and Learning Model of Export Dynamics", unpublished mimeo.

Esteve-Pérez, S., Mañez-Castillejo, J. A., Rochina Barrachina, M. E., and Sanchis-Llopis, J.A (2007). "A survival analysis of manufacturing firms in export markets." Unpublished manuscript.

Esteve-Pérez, S., Requena-Silvente, F., and Pallardó-Lopez, V. J. (2013). "The duration of firm-destination export relationships: Evidence from Spain, 1997-2006." Economic Inquiry, vol. 51, January.

Fanelli, S., and Hallak, J. C. (2015). "Export survival with uncertainty and experimentation." Mimeo.

Feenstra R., Li, Z., and Yu, M. (2014). "Exports and credit constraints under incomplete information: Theory and evidence from China." The Review of Economics and Statistics, MIT Press, vol. 96(3), October

Forbes, K. J. (2007). "One cost of the Chilean capital controls: increased financial constraints for smaller traded firms." Journal of International Economics, 71(2), 294-323.

Fu, D., and Wu, Y. (2014), "Export survival pattern and its determinants: an empirical study of the Chinese manufacturing firms." Asian Pacific Economic Literature. Crawford School of Public Policy.

Fugazza, M., and McLaren, A. (2014). "Market access, export performance and survival: Evidence from Peruvian firms." Review of International Economics, 22(3), 599-624.

Fugazza, M., and Molina, A.C. (2009). "The determinants of trade survival." HEID Working Paper No05/2009. The Graduate Institute of International and Development Studies.

Gross T., and Verani, S. (2013). "Financing constraints, firm dynamics, and international trade." Finance and Economics Discussion Series Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C.

Hess, W., and Persson, M. (2012). "The duration of trade revisited." Empirical Economics, 43(3).

Hess, W., and Persson, M. (2011). "Exploring the duration of EU imports." Review of World Economics/Weltwirtschaftliches Vol. 147, No. 4 pp. 665-692.

Jaud, M., Kukenova, M., and Strieborny, M. (2015). "Financial development and sustainable exports: Evidence from firm-product data." The World Economy, 38.7, 1090-1114.

Kohn, D., Leibovici, F., and Szkup, M. (2016). "Financial frictions and new exporter dynamics." International Economic Review, v. 57, n. 2.

Manova, K. (2008). "Credit constraints, equity market liberalizations and international trade." Journal of International Economics, 76(1), 33-47.

Manova, K., (2013). "Credit constraints, heterogeneous firms and international trade." The Review of Economic Studies 80.

Manova, K., and Zhang, Z. (2009). “China’s exporters and importers: Firms, products and trade partners.” National Bureau of Economic Research, No. w15249.

Manova K., Wei, S., and Zhang, Z. (2011). “Firm exports and multinational activity under credit constraints.” Review of Economics and Statistics 97 (2015), p.574-588.

Melitz, M. (2003). “The impact of trade on intra-industry reallocations and aggregate industry productivity.” Econometrica, vol. 71.

Minne, R., and Zhu, S. C. (2011). “Credit constraints and firms export: Microeconomic evidence from Italy.” Journal of International Economics, vol. 83 (2).

Molina, D., and Roa, M. (2015). “The effect of credit on the export performance of Colombian exporters.” MPRA Paper 56137, University Library of Munich, Germany.

Muûls, M. (2008). “Exporters and credit constrain. A firm-level approach.” National Bank of Belgium.

Nitsch, V. (2009). “Die another day: Duration in German import trade.” Review of World Economics, 145(1), 133-154.

Olea, J. L. M., and Pflueger, C. (2013). “A robust test for weak instruments.” Journal of Business & Economic Statistics, 31(3), 358-369.

Paravisini, D., Rappoport, V., Schnabl, P. and Wolfenzon, D. (2015). “Dissecting the effect of credit supply on trade: Evidence from matched credit-export data.” The Review of Economic Studies 82(1), pp. 333-359.

Peek, J., and Rosengren, E. S. (2002). “Troubled banks, impaired foreign direct investment: The role of relative access to credit.” The American Economic Review, 92(3), 664-682.

Peek, J., Rosengren, E., and Tootell, G. M. B. (2003). “Identifying the macroeconomic effect of loan supply shocks.” Journal of Money, Credit and Banking, Vol. 35, No. 6, Part 1.

Rauch, J., and Watson, J. (2003). “Starting small in an unfamiliar environment.” International Journal of Industrial Organization, vol 21(7).

Staiger, D., and Stock, J. H. (1997). “Instrumental variables regression with weak instruments.” Econometrica, 65, 557–86.

Stock, J. H., and Yogo, M. (2005). “Testing for weak instruments in linear IV regression.” Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg, 80.

Svaleryd, H., and Vlachos, J. (2005). “Financial markets, the pattern of industrial specialization and comparative advantage: Evidence from OECD countries.” European Economic Review 49.

Stribat, L., Record, R., and Nghardsaysone, K. (2013). “Determinants of export survival in the Lao PDR.” Policy Research Working Paper 6301, The World Bank.

Volpe-Martincus, C., and Carballo, J. (2009). “Survival of new exporters in developing countries: Does it matter how they diversify?” IDB Working Paper Series N. 140, Inter-American Development Bank.

Appendix 1. Model Formal Definitions

Proposition 1. Under the assumptions stated in Subsection 2.3.1, there is a cutoff ability to deal with the foreign investor from country j ($j \in [1,2]$) that we call $\overline{\gamma_{ij}}$, below which exporters with less ability do not borrow in that country. If the aforementioned conditions are met and $\gamma_{ij} < \overline{\gamma_{ij}}$, then $\phi_{ij} = 0$.

Proposition 2. If the assumptions in 4.2.1 are true, then if firm i borrows from countries j and j' (j and $j' \in [1,2]$ and $j \neq j'$), it will, everything else being constant, be more successful in its dealing with the investor from j the larger the fraction of its debt is contracted in that investor's country. Let us call two values of firm i's ability to deal with the foreign investor from country j γ'_{ij} and γ''_{ij} such that $\gamma'_{ij} > \gamma''_{ij}$, and her ability to deal with the foreign investor from country j' $\gamma_{ij'}$. Thus, if the assumptions in 2.3.1 are true and $\gamma''_{ij} > \overline{\gamma_{ij}}$ and $\gamma_{ij'} > \overline{\gamma_{ij'}}$ so that the firm borrows in both countries when $\gamma_{ij} = \gamma''_{ij}$ and $\gamma_{ij'}$ remain constant, the fact that $\gamma'_{ij} > \gamma''_{ij}$ implies that $\phi'^{*}_{ij} > \phi''^{*}_{ij}$, where ϕ'^{*}_{ij} and ϕ''^{*}_{ij} are the solutions to the optimization problem in (1)-(1.3) when γ_{ij} equal γ'_{ij} and γ''_{ij}, respectively.

Propositions 1 and 2 state that exporters tend to borrow in countries where they find it easier to overcome asymmetric information constraints. In the model, there are characteristics of firms that determine its optimal debt portfolio. The following propositions can be derived from Proposition 1 (for the proofs, see the Appendix).

Proposition 3. Under the assumptions stated in Subsection 2.3.1, a rise in country j's interest rate increases the financial costs to firms that borrow in that country. If the aforementioned conditions are met and $\gamma_{ij} > \overline{\gamma_{ij}}$, then $\partial F_i^* / \partial r_j > 0$, where F_i^* is the expression that results from plugging the cost-minimizing values of ϕ_{i1} and ϕ_{i2} in F_i.

Proposition 4. Under the assumptions stated in Subsection 2.3.1, a rise in country j's interest rate induces some of the exporters to stop borrowing in it. Formally: if the aforementioned conditions are met, then $\partial\overline{\gamma_{if}}/\partial r_f > 0$.

Proposition 5. If the assumptions of 4.2.1 are satisfied, then a rise in country j's interest rate not only leads a firm to stop borrowing in that country but also increases that firm's financial costs. Formally: define ε as a positive number, j and j' ($j \neq j'$) as the two foreign countries, and $\overline{r_{ij}}$ as the minimum level of r_j under which the firm does not borrow in country j. If those conditions are met, then $F_{ij}(\overline{r_{ij}} - \varepsilon) + F_{ij'}(\overline{r_{ij}} - \varepsilon) < F_{ij'}(\overline{r_{ij}})$.

Proof of Proposition 1-2 and 4

Using the participation constraints shown in Equations (3.1) and (3.2) and imposing $\phi_{i2} = 1 - \phi_{i1}$, F_{i1} and F_{i2} can be expressed as:

$$F_{i1} = \frac{fe}{\lambda}(d\phi_{i1}(1+r_1)(1+\phi_{i1}) - (1-\lambda)\phi_{i1}\gamma_{i1}) \qquad (3.1')$$

$$F_{i2} = \frac{fe}{\lambda}(d(1-\phi_{i1})(1+r_2)(1+1-\phi_{i1}) - (1-\lambda)(1-\phi_{i1})\gamma_{i2}) \qquad (3.2')$$

Ignoring the inequality in Equation (3.3), the solution to the optimization problem yields:

$$\phi_{i1}^* = \frac{d(2+3r_2-r_1)-(1-\lambda)(\gamma_{i2}-\gamma_{i1})}{2d(2+r_2+r_1)} \qquad (A.1)$$

Given that the optimization problem is symmetric, we can generalize expression (A.1) as follows:

$$\phi_{ij}^* = \frac{d(2+3r_{j'}-r_j)-(1-\lambda)(\gamma_{ij'}-\gamma_{ij})}{2d(2+r_j+r_{j'})} \qquad (A.1')$$

Note that in this definition the coefficient of γ_{ij} equals $(1-\lambda)/(2d(2+r_j+r_{j'}))$ and is greater than zero, which implies that, for given levels of the remaining parameters, if $\gamma'_{ij} > \gamma''_{ij}$, then $\phi'^*_{ij} > \phi''^*_{ij}$, where ϕ'^*_{ij} and ϕ''^*_{ij} are the solutions associated with γ'_{ij} and γ''_{ij}, respectively. Moreover, we know that $\phi_{ij} > 0$ as long as:

$$\gamma_{ij} > \overline{\gamma_{ij}}(r_j) = \gamma_{ij'} - \frac{d(2+3r_{j'}-r_j)}{1-\lambda} \qquad (A.4)$$

Note as well that $\frac{\partial \overline{\gamma_{ij}}(r_j)}{\partial r_j} = \frac{d}{1-\lambda} > 0$ (A.5)

(A.4) and (A.5) prove Propositions 1 and 3.

Proof of Proposition 3 and 5

Consider the definitions of F_{ij} and $F_{ij'}$ given in Equations (3.1') and (3.2'), and the definition of $\overline{r_{ij}}(d, \lambda, r_{j'}, \gamma_{ij'})$ given in proposition 4 and write:

$$F_{ij}\left(\phi_{ij}^*(\lambda, \gamma_{ij}, \gamma_{ij'}, d, r_{j'}, \overline{r_{ij}} - \varepsilon), f_E, \lambda, \gamma_{ij}, d, \overline{r_{ij}} - \varepsilon\right) + F_{ij'}\left(\phi_{ij}^*(\lambda, \gamma_{ij}, \gamma_{ij'}, d, r_{j'}, \overline{r_{ij}} - \varepsilon), f_E, \lambda, \gamma_{ij'}, d, r_{j'}\right) < F_{ij}\left(0, f_E, \lambda, \gamma_{ij}, d, \overline{r_{ij}} - \varepsilon\right) + F_{ij'}\left(0, f_E, \lambda, \gamma_{ij'}, d, r_{j'}\right) \qquad (A.6)$$

This inequality follows from the facts that: (i) when r_j equals $\overline{r_{ij}} - \varepsilon$, the optimal level of ϕ_{ij} equals ϕ_{ij}^* and this level is, by definition, greater than zero; (ii) thus, by the principle of minimization. Consider now the following equality:

$$F_{ij}\left(0, f_E, \lambda, \gamma_{ij}, d, \overline{r_{ij}} - \varepsilon\right) + F_{ij'}\left(0, f_E, \lambda, \gamma_{ij'}, d, r_{j'}\right) = F_{ij'}\left(0, f_E, \lambda, \gamma_{ij'}, d, r_{j'}\right) =$$

$$F_{ij'}\left(\phi_{ij}^{*}\left(\lambda,\gamma_{ij},\gamma_{ij'},d,r_{j'},\overline{r_{ij}}\right),f_E,\lambda,\gamma_{ij'},d,r_{j'}\right) \quad \text{(A.7)}$$

The equality follows from the fact that when ϕ_{ij}^{*}, there is no foreign financing and, thus, $F_i\left(0,f_E,\lambda,\gamma_{ij'},d,r_{j'}\right)=F_{id}\left(0,f_E,\lambda,\gamma_{ij'},d,r_{j'}\right)$. As a result, an increase in r_j does not affect financial costs.

Combining (A.6) and (A.7), we can state:

$$F_{ij}\left(\phi_{ij}^{*}\left(\lambda,\gamma_{ij},\gamma_{ij'},d,r_{j'},\overline{r_{ij}}-\varepsilon\right),f_E,\lambda,\gamma_{ij},d,\overline{r_{ij}}-\varepsilon\right)+F_{ij'}\left(\phi_{ij}^{*}\left(\lambda,\gamma_{ij},\gamma_{ij'},d,r_{j},,\overline{r_{ij}}-\right.\right.$$
$$\left.\left.\varepsilon\right),f_E,\lambda,\gamma_{ij'},d,r_{j'}\right)<F_{ij'}\left(\phi_{ij}\left(\lambda,\gamma_{ij},\gamma_{ij'},d,r_{j'},\overline{r_{ij}}\right),f_E,\lambda,\gamma_{ij'},d,r_{j'}\right) \quad \text{(A.8)}$$

This proves Proposition 3.

To prove Proposition 5, replace the definition of ϕ_{ij} given in (A.1) in (1.1) and (1.2) and write:

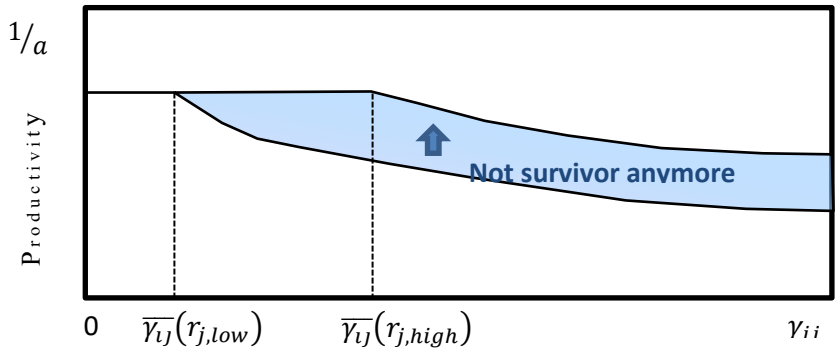
$$F_i=F_{if}+F_{id}=$$
$$\frac{f_e(12d^2-d^2r_{j'}^2-d^2r_j^2+2dr_{j'}\left(6d+7dr_j+\gamma_{ij'}-\lambda\gamma_{ij'}-3(1-\lambda)\gamma_{ij}\right)+2dr_j\left(6d-3(1-\lambda)\gamma_{ij'}+\gamma_{ij}-\lambda\gamma_{ij}\right)-(1-\lambda)(\gamma_{ij'}\left(4d+\gamma_{ij'}-\lambda\gamma_{ij'}\right)+2\left(2d-(1-\lambda)\gamma_{ij'}\right)\gamma_{ij}+(1-\lambda)\gamma_{ij}^2))}{4d\lambda(2+r_{j'}+r_j)}$$

Now take the following derivative

$$\partial F_i/\,\partial r_f$$
$$=\frac{f_e(2d+3dr_{j'}-dr_j-(1-\lambda)\gamma_{ij'}+\gamma_{ij}-\lambda\gamma_{ij})(6d+5dr_{j'}+dr_j-(1-\lambda)\gamma_{ij'}+\gamma_{ij}-\lambda\gamma_{ij})}{4d\lambda(2+r_{j'}+r_j)^2}$$

If $\gamma_{ij}>\overline{\gamma_{ij}}$, the expression shown above is positive. This proves Proposition 4.

Figure A1.1. Frontier of Export Survival



Appendix 2: Tables and Figures mentioned in Section 5

Table A2.1. Clog-log with frailty model

	(1)	(2)	(3)	(4)	(5)	(6)
			$e^{(\beta)}$			
Ln(Foreign financing)	0.895***	0.900***	0.901***	0.907***	0.908***	0.908***
	[0.0167]	[0.0165]	[0.0214]	[0.0202]	[0.0196]	[0.0191]
Ln(Export year)	0.381***	0.402***	0.682	0.638**	0.616**	0.602***
	[0.0692]	[0.0718]	[0.166]	[0.143]	[0.128]	[0.117]
Ln(Size)		0.958	0.995	0.982	0.980	0.982
		[0.0295]	[0.0416]	[0.0395]	[0.0387]	[0.0381]
Ln(Domestic financing)		0.963**	0.963*	0.964**	0.965**	0.966*
		[0.0146]	[0.0187]	[0.0181]	[0.0177]	[0.0175]
Ln(Initial exports)			0.737***	0.744***	0.750***	0.753***
			[0.0373]	[0.0344]	[0.0323]	[0.0304]
Medium technology				0.727**	0.740**	0.767**
				[0.0920]	[0.0913]	[0.0929]
High technology				0.790***	0.804***	0.820**
				[0.0642]	[0.0637]	[0.0635]
GDP growth					0.0684*	0.224
					[0.0966]	[0.316]
Mercosur						0.809***
						[0.0560]
Constant	0.437***	0.504***	0.710***	0.824	0.935	0.996
	[0.0455]	[0.0562]	[0.0877]	[0.104]	[0.132]	[0.141]
Observations	7,120	7,120	7,120	7,120	7,120	7,120
Number of firms	3,265	3,265	3,265	3,265	3,265	3,265
rho	0.043	0.075	0.462	0.415	0.392	0.374
rho s.d.	0.209	0.188	0.138	0.138	0.133	0.127
Log likelihood	-3,601	-3,594	-3,478	-3,472	-3,470	-3,465
Likelihood-ratio test of rho = 0	0.421	0.350	0.000	0.000	0.000	0.001

Standard errors in brackets
*** Significant at 1%, ** at 5%, * at 10%.

Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

Notes: The dependent variable equals one if the firm ceases exporting and zero otherwise; Ln(Foreign financing) is the natural logarithm of one plus the dollar amount of foreign financing obtained by a firm; Ln(Size) is the natural logarithm of its number of employees; Ln(Export year) is the natural logarithm of a firm's export year; Ln(Domestic financing) is the natural logarithm of one plus the dollar amount of debt to domestic banks; Ln(Initial exports) is the natural logarithm of a firm's exports in its first year as an exporter; high and medium technology are equal to one for high-tech and medium-tech industries, respectively, and zero otherwise. GDP growth is the weighted average (by share in total exports for each year) of GDP growth rates in export destination countries; and Mercosur is a dummy variable equal to one if more than 50% of a firm's export value goes to Mercosur and zero otherwise. Unobserved heterogeneity is assumed to follow a Normal distribution.

Table A2.2 Linear Instrumental Variable Model with Alternative Controls: Stage 1

	1st or 2nd country	1st, 2nd or 3rd country
Interest rate	-2.892***	-2.456***
	[0.740]	[0.733]
Dummy above mean interest rate	0.213***	0.217***
	[0.0445]	[0.0440]
Dummy LATAM foreign financing	1.565***	1.482***
	[0.0522]	[0.0521]
GDP growth	-3.586***	-3.273***
	[0.873]	[0.865]
Dummy export-foreign financing 2	2.376***	
	[0.0653]	
Dummy export-foreign financing 3		2.481***
		[0.0640]
Constant	0.494***	0.453***
	[0.0607]	[0.0602]
Observations	7,120	7,120
R-squared	0.385	0.397

Standard errors in brackets

*** Significant at 1%, ** at 5%, * at 10%.

Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

Notes: The dependent variable is the natural logarithm of one plus the dollar amount of foreign financing obtained by a firm; *Interest rate* is the index defined in Equations (5)-(8); above mean interest rate equals one if the firm receives funds from at least one country whose time dimension collapsed money market interest rate mean is above the cross-section (time dimension collapsed) sample mean or if the firm did not receive foreign financing and zero otherwise; LATAM foreign financing equals one if at least one fund supplier is in LATAM and zero otherwise; GDP growth is the weighted average (by share in total exports for each year) of GDP growth rates in export destinations; e*xport-foreign financing 2* equals one if a firm's first or second largest financial fund supplier is the same as its most frequent export destination and zero otherwise; and *export-foreign financing 3* equals one if a firm's first, second, or third largest financial fund supplier is the same as its most frequent export destination and zero otherwise.

Table A2.3 Linear Instrumental Variable Model with Alternative Controls: 2nd stage

	1st or 2nd country	1st, 2nd or 3rd country
Ln(Foreign financing)	-0.444***	-0.523***
	[0.128]	[0.170]
Dummy above mean interest rate	-0.371***	-0.352***
	[0.0340]	[0.0434]
Dummy LATAM foreign financing	0.624***	0.703***
	[0.192]	[0.244]
GDP growth	-0.692	-0.811
	[0.634]	[0.748]
Dummy export-foreign financing 2	1.048***	
	[0.307]	
Dummy export-foreign financing 3		1.295***
		[0.427]
Constant	0.698***	0.715***
	[0.0547]	[0.0670]
Observations	7,120	7,120
Centered R^2	-2.552	-3.568
Underidentification test (Kleibergen-Paap rk LM statistic)	0.000	0.001
Weak identification test (Cragg-Donald Wald F statistic)	15.30	11.24
Hansen J statistic (overidentification test of all instruments)	0.000	0.000
Endogeneity test of endogenous regressors	0.000	0.000

Standard errors in brackets

*** Significant at 1%, ** at 5%, * at 10%.

Sources: Tax Collection Agency, Customs Office, and Central Bank of Argentina.

Notes: The dependent variable is one if the firm ceases exporting and zero otherwise; Ln(Foreign financing) is the natural logarithm of one plus the foreign financing obtained by a firm; LATAM foreign financing equals one if at least one fund supplier is in LATAM and zero otherwise; above mean interest rate equals one if the firm receives funds from at least one country whose time dimension collapsed money market interest rate mean is above the cross-section (time dimension collapsed) sample mean or if the firm did not receive foreign financing and zero otherwise; e*xport-foreign financing 2* equals one if a firm's first or second largest financial fund supplier is the same as its most frequent export destination and zero otherwise; and *export-foreign financing 3* equals one if a firm's first, second, or third largest financial fund supplier is the same as its most frequent export destination and zero otherwise.

Previous volumes in this series

876 August 2020	Government banks, household debt, and economic downturns: The case of Brazil	Gabriel Garber, Atif Mian, Jacopo Ponticelli and Amir Sufi
875 August 2020	The Impact of credit risk mispricing on mortgage lending during the subprime boom	James A Kahn and Benjamin S Kay
874 August 2020	Demographic origins of the decline in labor's share	Andrew Glover and Jacob Short
873 July 2020	Effects of Fed policy rate forecasts on real yields and inflation expectations at the zero lower bound	Gabriele Galati and Richhild Moessner
872 July 2020	Effects of credit restrictions in the Netherlands and lessons for macroprudential policy	Gabriele Galati, Jan Kakes and Richhild Moessner
871 July 2020	The Matthew effect and modern finance: on the nexus between wealth inequality, financial development and financial technology	Jon Frost, Leonardo Gambacorta and Romina Gambacorta
870 July 2020	International spillovers of forward guidance shocks	Callum Jones, Mariano Kulish and Daniel M Rees
869 June 2020	How well-anchored are long-term inflation expectations	Richhild Moessner and Előd Takáts
868 June 2020	Debt De-risking	Jannic Cutura, Gianpaolo Parise and Andreas Schrimpf
867 June 2020	The effectiveness of macroprudential policies and capital controls against volatile capital inflows	Jon Frost, Hiro Ito and René van Stralen
866 May 2020	Model risk at central counterparties: Is skin-in-the-game a game changer?	Wenqian Huang and Előd Takáts
865 May 2020	The drivers of cyber risk	Iñaki Aldasoro, Leonardo Gambacorta, Paolo Giudici and Thomas Leach
864 May 2020	Global and domestic financial cycles: variations on a theme	Iñaki Aldasoro, Stefan Avdjiev, Claudio Borio and Piti Disyatat
863 May 2020	Pension contributions and tax-based incentives: evidence from the TCJA	Ahmed Ahmed and Anna Zabai
862 May 2020	On the instability of banking and other financial intermediation	Chao Gu, Cyril Monnet, Ed Nosal and Randall Wright

All volumes are available on our website www.bis.org.