Trade Credit and Relationships*

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Abstract

Exploiting transaction-level international trade data, this paper documents that long-term firm-to-firm relationships facilitate the use of trade credit, with the strength of this effect varying with firm size, firms' payment delays, and multinational affiliate status. Effects also depend on the strength of contract enforcement across countries and the complexity of products traded. Because trade credit can reduce the overall need to borrow from the financial sector, long-term relationships may reduce firms' credit demand. The destruction of trade relationships, for example, through trade conflicts, may hence increase firms' leverage.

Keywords: trade credit, relationships, learning, financing costs, risk

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1. Introduction

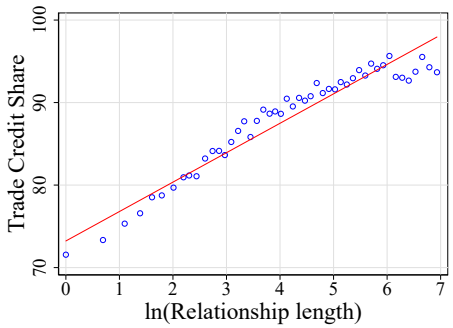
It is well-established that trade credit is a key source of short-term finance (Petersen and Rajan, 1997). Although a fruitful literature has studied the determinants and consequences of trade credit, an understudied dimension is the role of firm-to-firm relationships. A large fraction of transactions in the economy occurs within these relationships. However, due to data limitations, little is known about how these relationships shape the choice of payment terms. A key question is whether long-term trade relationships facilitate the use of trade credit and how this affects the financing needs of firms.

To answer these questions, we assemble a large dataset that covers the universe of Colombian imports with information on payment terms and the identity of both exporters and importers at the transaction level. Using these unique data, we show that trade credit use increases with relationship length, on average, across the universe of firms, countries, and products. In addition, we uncover a sizable heterogeneity in the speed of trade credit adoption with relationship length. Specifically, effects vary with importer and exporter size, with importers' late payment status on their accounts payable, and with importers' related-party status, all of which support the view that enforcement and learning are key forces generating the link between trade credit and relationship length.

The paper starts by documenting a striking positive relationship between trade credit use and relationship length (illustrated in Figure 1). The longer a Colombian firm imports from a foreign supplier, the more likely that supplier will provide trade credit to the Colombian importer.

Exploiting the rich information contained in the transaction-level data, we generate additional facts that help us zoom in on the mechanisms behind this striking pattern. First, while firms switch their payment terms within a relationship from cash in advance to trade credit quite frequently, they rarely switch in the opposite direction. Second, trade credit use increases rapidly at the beginning of relationships and tends to level off as relationships age. Third, we show that the effect of relationship length on trade credit use varies across both importing and exporting firms. To analyze importer heterogeneity, we combine the trade transactions data with balance sheet information on the Colombian importing firms. We find that trade credit use

Figure 1. Trade Credit Increases with Relationship Length



Notes: The figure shows a binscatter plot between the trade credit share and log relationship length for Colombian imports. Relationship length is measured by the number of transactions between a Colombian importing firm and a foreign supplier. Relationship length is censored at ln(relationship) = 7, i.e., at 1096 interactions within a relationship.

increases more with relationship length if the importer is small, has overdue accounts payable, or does not belong to a multinational company, consistent with the idea that perceived importer risk reduces trade credit early on in relationships. To also analyze exporter heterogeneity, we match the Colombian imports data with information on the size of foreign exporters in one specific source country (Chile). The matched firm-to-firm trade data reveal that trade credit use increases less with relationship length if the exporter is small. This finding is consistent with the idea that exporters perceived as riskier have to provide trade credit from the start because importers are unwilling to pay them in advance. Finally, we show that the length of the relationship affects the payment choice more for imports from source countries with stronger contract enforcement and for trade in complex products that are harder to enforce in courts.

Our empirical findings are consistent with theoretical frameworks that feature the following two elements. First, a friction that declines with relationship length - like the enforcement friction with learning modeled in Antràs and Foley (2015). Second, a friction that makes trade credit preferable to cash in advance that is independent of relationship age - like the financing cost advantage model in Garcia-Marin et al. (forthcoming). Of course, other mechanisms that generate a preference for trade credit independent of

learning would also be able to explain the patterns we uncover.

Learning matters in these models because there are two types of firms, reliable and unreliable, and because each payment term gives rise to diversion risk: An importer may not pay after receiving goods on trade credit, and an exporter may not deliver after getting paid cash in advance. Through repeated interactions, firms learn about the type of their trading partner. As firms learn, the importance of diversion risk declines and any other advantage of trade credit starts to dominate. Consequently, a sizable fraction of new relationships relies on cash in advance. In contrast, transactions within old firm-to-firm relationships will be mainly based on trade credit, as shown in Figure 1. If trade credit has a financing cost advantage over cash in advance (Garcia-Marin et al., forthcoming), then the model implies a new benefit of long-term trade relationships: the ability to save on financing costs by employing the most efficient payment term, trade credit.

Literature. The analysis speaks to two strands of the literature: research studying international trade finance and trade credit, and work on relationships and learning.

The paper extends the empirical literature on payment choice in international trade (see, e.g., Ahn, 2014; Hoefele et al., 2016; Niepmann and Schmidt-Eisenlohr, 2017; Demir and Javorcik, 2018; Garcia-Marin et al., forthcoming). Closest to our paper is Antràs and Foley (2015), who study a single large U.S. exporter and find that the firm's sales shifted toward trade credit over time. In a more recent paper, Kohn et al. (2024) confirm our earlier results on relationships and trade credit with more aggregate Chilean data, document additional patterns on trade values and relationship survival, and study trade dynamics in a quantitative model with importer default only. More broadly, the paper adds to the work on trade and financial frictions (see e.g. Ahn et al., 2011; Amiti and Weinstein, 2011; Chor and Manova, 2012; Manova, 2013; Paravisini et al., 2015; Niepmann and Schmidt-Eisenlohr, 2017; Demir et al., 2017; Leibovici, 2021; Crozet et al., 2022; Paravisini et al., 2023; Federico et al., forthcoming).

Our paper adds to the earlier work on payment terms in three dimensions. First, it goes beyond the single-firm study for the United States and documents that trade credit use increases with relationship age for the universe of Colombian import transactions. Second, it shows that these dynamics differ systematically with importer and exporter size, importers' late payment status, multinational status, as well as contract enforcement across countries

and product characteristics. Third, it decomposes the learning dynamics into importer-level, exporter-level and relationship-level effects, uncovering the key importance of relationship-level learning.

The paper speaks to earlier theoretical work on domestic trade credit that studies other ways through which relationships may interact with trade credit. Wilner (2000) develops a model where long-term relationships make trade credit desirable, because they improve outcomes for debtors during renegotiations. Cuñat (2007) develops a related idea, arguing that suppliers may provide liquidity insurance to buyers within longer-term trade credit relationships. More recently, Hardy et al. (2022) study the insurance properties of trade credit in a model of supply chains, showing that trade credit can have a role as a macroeconomic stabilizer. While our paper has an international focus, the idea that older relationships facilitate trade transactions by reducing diversion risk should also be relevant for domestic trade credit provision. For reviews of the wider literature on domestic trade credit see, for example, Petersen and Rajan (1997), Cuñat and García-Appendini (2012), and Giannetti (2024).

There is an increasing understanding that firm-to-firm relationships are central to international trade.[1] This paper adds to this literature by looking at trade credit use within Colombian import relationships at the firm-pair level. The analysis suggests an additional benefit of long-term relationships: the ability to reduce borrowing from banks by using trade credit. This adds to earlier work that showed that long-term relationships trade more, have higher survival rates, are more resilient during crises (Monarch and Schmidt-Eisenlohr, 2023), are better able to share risk in the presence of exchange-rate shocks (Heise, forthcoming), and can overcome enforcement frictions (Macchiavello and Morjaria, 2015).

The remainder of the paper is organized as follows. Section 2 discusses channels that can link relationship length and trade credit use. Section 3 describes the data. Section 4 discusses the empirical specifications. Section 5 presents the empirical results. Finally, Section 6 concludes.

[1] For a survey, see Bernard and Moxnes (2018).

2. Trade Credit and Relationships: Discussion of Potential Channels

This section discusses the basic tradeoffs between cash in advance and trade credit and how they may be affected by relationships.

Overview of Payment Terms. The literature on international payment terms starting with Schmidt-Eisenlohr (2013) and Antràs and Foley (2015) typically focuses on three options: cash in advance, trade credit and letters of credit. The main difference across these payment terms is who bears the risk and who finances a transaction. With cash in advance, the importer finances the transaction and bears the risk of non-delivery (or the risk of receiving goods of inferior quality). With trade credit, the exporter finances the transaction and bears the risk of non-payment (or late payment). With a letter of credit, banks intermediate the transaction, making payouts conditional on documentary compliance, thereby reducing or eliminating the risk of the transaction.

The baseline model of trade finance (Schmidt-Eisenlohr, 2013) explains firm choices between these options as primarily driven by differences in enforcement and financing costs across countries. More recent contributions have also considered the role of product and firm heterogeneity, respectively (see, e.g. Hoefele et al. (2016); de Nicola et al. (2026)). The basic prediction of the model is that stronger enforcement in the exporting country makes cash in advance more attractive as it lowers the likelihood of exporter default, whereas stronger enforcement in the importing country facilitates trade credit as it increases the probability of payment by the importer. In addition, all else equal, the trading partner with the lower interest rates should finance the transaction.

Dynamics of Trade Credit Use. This paper is interested in the dynamics of trade credit use over time. Antràs and Foley (2015) develop a model where trade credit use increases over time within a relationship, consistent with our findings. In the model, an exporter initially sells to a buyer on cash in advance terms, because the exporter does not want to bear the non-payment risk. Over time, the exporter learns the type of the importer and switches to trade credit once the expected risk of non-payment has declined sufficiently.

Generating this prediction in their framework requires two strong assumptions. First, only importers can default on their obligations, whereas exporters never default. Assuming that exporters never default makes cash

in advance very attractive, as this payment term now bears no risk for the importer. To make firms ever pick trade credit hence requires a second strong assumption: the interest rate for importers has to be strictly higher than that for exporters. Antràs and Foley (2015) studied the case of a large U.S. food exporter selling to many smaller buyers. Hence, in their empirical setting, these two assumptions are defensible. However, our paper is concerned with the universe of trade transactions for Colombia, making it implausible that there is no exporter default and that importers always face higher borrowing costs than exporters.[2]

How can the Antràs and Foley (2015) model be adjusted to relax these two strong assumptions mentioned above? To answer this question, first consider a model where default is two-sided, that is, both the exporter and the importer can default on the contract. If these two risks are symmetric and learning has the same speed, then one would not expect any dynamics in the payment terms over time. To generate dynamics therefore requires an additional friction in the model that gives an advantage to trade credit. Importantly, that advantage has to be active even after learning has resolved all risk. Mechanisms that could generate such an advantage for trade credit could be related to price discrimination amid competition or financial costs (Demir and Javorcik, 2018; Giannetti et al., 2021; Garcia-Marin et al., forthcoming).

Firm, Country and Product Characteristics. A key element for explaining the dynamics of trade credit use within a relationship over time in both Antràs and Foley (2015) and the working paper version, Benguria et al. (2023), is that firms learn about the reliability of their trading partners. The learning framework can generate predictions on heterogeneous effects across firms, countries and products. Specifically, learning should have a stronger dynamic effect, the less reliable the trading partner and the more there is hence to learn. With trade credit, learning is about the probability that the importer will pay. Therefore, if the importer is riskier, learning will benefit trade credit relatively more. In contrast, with cash in advance, learning is about the probability that the exporter will deliver. Hence, if the exporter is riskier, learning will benefit cash in advance relatively more.

[2]Of note, recent calibrations of the Antràs and Foley (2015) model to the case of Chile required very large differences in interest rates to match the payment shares in the data (see Kohn et al. (2024)).

This intuition expands to country and product characteristics as well. For countries with weaker contract enforcement, there is more to gain from learning than for countries where institutions prevent firms from deviating from contracts. Related to this, contract enforcement should be more difficult for products that are more complex and where verifying quality is more difficult in a court. Thus, learning should be particularly valuable for more complex products.

To sum up, the framework we outlined gives rise to the following predictions: (i) trade credit use increases with relationship age; (ii) the effect of relationship age on trade credit use is stronger if the importer is riskier or the importing country has weaker enforcement; (iii) the effect of relationship age on trade credit use is weaker if the exporter is riskier or the exporting country has weaker enforcement; (iv) the effect of relationship age on trade credit use is stronger for more complex products.

3. Data

Our primary dataset is transaction-level import data from Colombia for 2005 to 2019. A key advantage of the Colombian data is that it provides firm identifiers for both Colombian importers and foreign exporters, which allows studying relationships at the importer-exporter level. This information is crucial for testing how payment choices change as relationships evolve. For part of the analysis, we combine this information with balance sheet data on Colombian importers. In addition, we use transaction–level export data from Chile for 2007 to 2015. We match the Chilean data to the Colombian data and study the role of firm characteristics of both Colombian importers and Chilean exporters in the matched sample.

Colombian Import Transactions. Data for Colombian imports are collected by the Colombian customs agency, DIAN (*Dirección de Impuestos y Aduanas Nacionales*), and records the universe of international transactions entering the country. For each transaction, the data provide information on the importer's name and tax ID and the name and address of the exporting firm in the source country. Importantly, the identifying variables for importers and exporters are recorded consistently across years, allowing us to track these firms uniquely over the sample period. For each transaction, the data details the transaction date, the 10-digit HS code to which the product belongs, the FOB value of the merchandise, and the financing mode of the import

transaction. In particular, the data contain information allowing us to determine if the transaction was paid post–shipment (trade credit), with cash in advance, a letter of credit, or other payment terms.

We create a consistent identifier for foreign exporters to Colombia following Benguria (2021, 2022). This procedure follows the method used by the U.S. Census Bureau to identify foreign suppliers in US imports as described by Kamal and Monarch (2018). Specifically, a foreign exporter ID is constructed as a string combining a two–digit ISO country code, the first three characters of the city in which the exporter is located, the first three characters in the first word of the exporter's name, the first three characters in the second word of the exporter's name, and the first four characters in the first number found on the street address of the exporter.[3]

We aggregate the data such that each observation corresponds to a Colombian importer, foreign exporter, HS10 product, and day. We refer to these observations as transactions. We exclude from the sample transactions that do not involve a payment, as well as transactions in which the payment term variable does not unambiguously correspond to trade credit, cash in advance, or letter of credit. For example, 4.6 percent of transactions involve no payment ("*Importación que no genera pago al exterior*"), and 3.7 percent of transactions have a mixture of payment terms ("*Combinación de alguna de las anteriores formas de pago*"). For a full list of excluded categories and their shares, see Appendix Table A.1. The sample used in the analysis has about 22.5 million transactions and represents 86 percent of transactions that involve a payment.

Colombian Balance Sheet Data. We also use annual balance sheet data from Colombia's company regulator, *Superintendencia de Sociedades* that is available for 2007 to 2019. All firms above a threshold based on revenue or assets are required to file balance sheet data.[4] We match the balance sheet data to the import data using the tax ID numbers available in both datasets. Balance sheet information is available for 25.4 percent of all importers in the customs data, and 61.5 percent of importers with more than 1 million dollars

[3]This procedure is implemented after removing punctuation marks from names and addresses and standardizing common prefixes and suffixes such as "inc", "llc", etc.

[4]Specifically, firms are required to file when they have annual revenue or total assets above 30 thousand times the monthly minimum wage. For example, with 2015 values, this threshold is approximately 7.5 million US dollars.

in imports over the entire period. Because larger importers account for more transactions, importers with available balance sheet data account for 71.7 percent of import transactions. In our analysis, we focus on two variables that are available in the balance sheet data. First, total revenues to proxy for firm size, which is available for 2007 to 2019. Second, a variable that indicates whether a firm has overdue accounts payable, which is available for 2016 to 2019. Table 1 presents summary statistics on these variables. Average annual revenues per firm over the sample are 49,150 million Colombian Peso (about 15 million U.S. dollars using the end of 2019 exchange rate), and the average share of firms with overdue accounts payable is 29 percent.

Table 1. Firm-Level Summary Statistics in the Sample with Balance Sheet Data

	Period	Mean	Std. Dev.	Obs.
	(1)	(2)	(3)	(4)
Revenue (Col. Peso million)	2007-2019	49,150.7	242,519.1	94,811
Revenue (Col. Peso million)	2016-2019	74,433.7	316,728.9	24,821
Overdue	2016-2019	0.29	0.45	24,821

Notes: The table reports summary statistics computed across firm-year observations for the variables used in the sample of Colombian imports merged to balance sheet data for 2007-2019 or 2016-2019.

Chilean Export Transactions. Transaction-level export data for Chile are provided by the Chilean National Customs Service and cover the years 2007 to 2015. For each export transaction, the dataset details the identity of the exporting firm, the destination country, the 8-digit HS code to which the product belongs, the date of the transaction, and the FOB value of the merchandise. We aggregate these data to construct the total exports of each exporting firm in each year. We use this information in our analysis of the matched Chile-Colombia data discussed next.

Matched Chile-Colombia Trade Data. We match the Colombian imports and Chile exports data, which allows us to construct a size measure (total world imports or exports) that is consistent across Colombian importers and Chilean exporters. For context, note that Chile exported US$ 848 million to Colombia in 2019. Chile was Colombia's 14th most important source country. We match both datasets based on the names of the Chilean exporters as shown in

the Colombian imports data and the Chilean exports data as follows.[5] First, we use a fuzzy string matching algorithm. We then manually inspect all the matches. For matches with a low similarity score, or matches that were found to be wrong, we find their matches manually. The matched sample captures 97.4 percent of total Colombian imports from Chile in our main data set and 94.1 percent of the firm-to-firm relationships between Colombia and Chile.[6] This accounts for 97.3 percent of transactions. The matched sample runs from 2007 to 2015.

Other Data. To construct the multinational affiliate status, we use S&P's Capital IQ to obtain a list of all firms in Colombia that are affiliates of multinational companies headquartered abroad. We match these firms to the Colombian customs data based on their names, using a record linking algorithm and manually inspecting the results.

4. Empirical Approach

This section presents the empirical methodology to test the link between trade credit and relationship length.

4.1. Relationship Definition

We define a relationship as all imports of a Colombian firm from the same foreign exporting firm. Our analysis is run on a sample starting in 2007 and ending in 2019. However, in order to compute relationship length more accurately, we use data starting in 2005.

4.2. Trade Credit and Relationship Length

We begin by testing if the use of trade credit increases in the length of a trading relationship. Considering our baseline sample of Colombian imports,

[5]Note that firms in these two countries are required to use their official name in their customs declarations and we in fact see that firms' names are entered in a very homogeneous way both within and across datasets.

[6]There are several reasons for which we did not expect to perfectly match the two data sets. First, we take a conservative approach such that if we are not entirely sure that the names in both datasets correspond to the same firm, we exclude them. Second, exports of Chilean firms could go to free trade zones in Colombia, or could be warehoused for further shipping to third countries, and we exclude these cases from the analysis.

the main regression exploits within-relationship variation and takes the form

$$\rho_{iept} \quad = \quad \alpha_1 \ \ln(\text{Rel. Length})_{iet} + \psi_{iep} + \nu_{iept}, \tag{1}$$

where ρ_{iept} is a dummy variable that equals one if a transaction between Colombian importer i and foreign exporter e in product p on day t is settled with trade credit and zero otherwise. Rel. Length$_{iet}$ captures the length of a relationship. It is calculated as the cumulative number of transactions between importer i and exporter e through date t. Specification (1) controls for importer–exporter–product fixed effects (ψ_{iep}). In alternative specifications, we also include importer-year and/or exporter–year fixed effects.

Interactions with Firm, Country, and Product Characteristics. Next, we test if learning interacts with diversion risk. For this, we modify specification (1), adding an interaction between the length of the relationship and proxies for importer (and exporter) diversion risk

$$\begin{aligned}\rho_{iept} = {} & \alpha_1 \ln(\text{Rel. Length})_{iet} \times (\text{Diversion Risk})_{it} + \alpha_2 (\text{Diversion Risk})_{it} \\ & + \alpha_3 \ln(\text{Rel. Length})_{iet} \times (\text{Diversion Risk})_{et} + \alpha_4 (\text{Diversion Risk})_{et} \\ & + \alpha_5 \ln(\text{Rel. Length})_{iet} + \psi_{iep} + \nu_{iept}\end{aligned} \tag{2}$$

where $(\text{Diversion Risk})_{it}$ and $(\text{Diversion Risk})_{et}$ proxy for importer and exporter diversion risk, respectively.[7] On the importer side, which is the main focus of our analysis, we use three different proxies for diversion risk. Two of the firm variables, larger firm size and being a multinational affiliate, imply lower diversion risk, whereas being overdue on accounts payable implies higher diversion risk. On the exporter side, we use only firm size, again assuming that diversion risk decreases with this variable. If the role of diversion risk decreases with relationship age, then we should find $\alpha_1 > 0$ and $\alpha_3 < 0$. The effect of learning on trade credit use should be stronger if there is high importer diversion risk and weaker if there is high exporter diversion risk.

5. Results

This section presents our empirical results. We start by providing descriptive evidence on the use of trade credit and other payment terms. We

[7] We also test for the role of heterogeneity in diversion risk at the country and product level.

then provide econometric evidence on the link between relationship length and payment terms, as well as results on trade credit and the interaction between relationship length and firm, country, and product characteristics.

5.1. Descriptive Evidence

We begin by comparing the shares of different payment terms in the overall sample. Trade credit is the dominant payment term. About 88.7% of import transactions in Colombia are paid with trade credit, followed by cash in advance (9.8%) and letters of credit (1.5%) in the main sample (Table 2, panel A).[8] Payment term shares across different subsamples and additional summary statistics are reported in Table 2 (panels B and C).

[8]Recall that, as mentioned in Section 3, we exclude from our sample payment terms that do not fall under these three categories, so here we report percentages out of the total of the sum of these three categories.

Table 2. Transaction-Level Summary Statistics

	Mean	Std. Dev.
	(1)	(2)
Panel A: 2007-2019; Full Sample		
Trade Credit Dummy	0.887	0.317
Cash in Advance Dummy	0.098	0.298
Letter of Credit Dummy	0.015	0.122
Ln (Relationship Length)	5.4	2.9
Import Value (US$ 1000)	20.1	248.3
Observations: 22,536,620		
Panel B: 2007-2019; Sample with Balance Sheet Data		
Trade Credit Dummy	0.902	0.298
Cash in Advance Dummy	0.080	0.271
Letter of Credit Dummy	0.019	0.135
Ln (Relationship Length)	6.0	2.9
Import Value (US$ 1000)	21.2	155.3
Observations: 15,585,460		
Panel C: 2016-2019; Sample with Balance Sheet Data		
Trade Credit Dummy	0.921	0.270
Cash in Advance Dummy	0.068	0.252
Letter of Credit Dummy	0.011	0.105
Ln (Relationship Length)	6.5	2.9
Import Value (US$ 1000)	19.6	125.5
Observations: 5,186,583		

Notes: The table reports transaction-level summary statistics. Panel A corresponds to the universe of Colombian imports over 2007-2019. Panel B corresponds to the sample of Colombian imports that is merged to balance sheet data for 2007-2019. Panel C corresponds to the sample of Colombian imports that is merged to balance sheet data for 2016-2019.

Table 3 reports the frequency of each payment term for different points over the life cycle of a relationship. Trade credit shares for the first transaction are lowest and then rise over the life of a relationship. The first transaction in a relationship is paid with trade credit most of the time (73.2%), followed by cash in advance (24.9%). The use of trade credit increases to 78.5% and 81.7% in the fifth and tenth transactions of a relationship, respectively. From the eleventh transaction onward, the trade credit share reaches 90.9%, which is 17.7 percentage points higher than the trade credit share in the first transaction. Most of this increase in the trade credit share comes at the

expense of cash in advance, whose share drops by 17.2 percentage points to reach 7.7%.

Table 3. Payment Terms and Relationship Length

	Trade Credit	Cash in Advance	Letter of Credit
First transaction	73.2	24.9	2.0
Fifth transaction	78.5	19.5	2.0
Tenth transaction	81.7	16.5	1.8
Eleventh transaction and beyond	90.9	7.7	1.4

Notes: The table shows, for the universe of Colombian imports over 2007-2019, the percentage of transactions financed through trade credit terms (column 1), cash in advance terms (column 2), and letter of credit terms (column 3) in the first, fifth, tenth transaction in a relationship, as well as the average for all transactions from the eleventh onward.

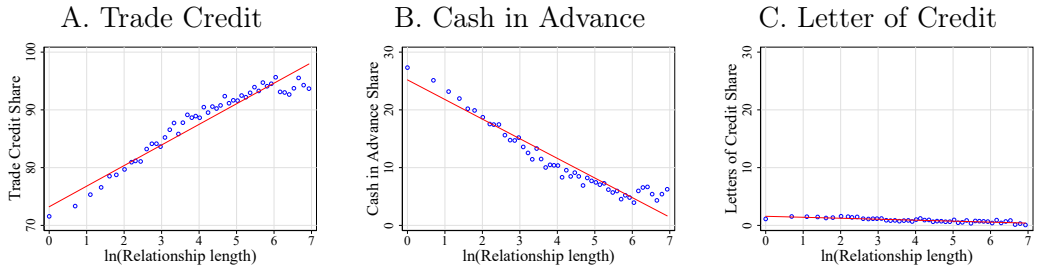
Figure 2 provides further evidence on the link between payment terms and relationship length. It shows a binscatter plot for the logarithm of relationship length —defined as the log cumulative number of transactions occurring from the beginning of a relationship– and the average use of the three main payment terms. Chart A on the left shows that the use of trade credit increases almost monotonically with the length of the relationship. Chart B in the middle shows that the opposite is true for the share of transactions paid cash in advance. Finally, Chart C on the right shows that the share of letters of credit also decreases with relationship length, but to a much lesser extent than cash in advance.

We can also compute transition probabilities between payment terms in consecutive transactions within a relationship (see Table 4). For relationships that use cash in advance, it is common to transition to trade credit in the next transaction. In contrast, switches in the opposite direction, from trade credit to cash in advance, are very rare. We find that 7.7% of relationships that utilize cash in advance switch to trade credit for the next transaction, while only 0.8% of relationships that use trade credit switch to cash in advance.

This asymmetric pattern, where many more relationships switch toward trade credit than toward other payment terms, is consistent with the financing cost advantage of trade credit in Garcia-Marin et al. (forthcoming) discussed in Section 2: as the enforcement friction wanes with relationship length and learning, the advantage of trade credit in terms of financing costs

starts to dominate, generating switches from cash in advance to trade credit but not in the opposite direction.

Figure 2. Trade Credit Share and Relationship Length



Notes: The figure plots, for the universe of Colombian imports over 2007-2019, the frequency of each of the three main payment terms for 50 bins of the measure of relationship length (defined as the cumulative number of transactions occurring from the beginning of the relationship). Relationship length is censored at ln(relationship) = 7, i.e., at 1096 interactions within a relationship.

Table 4. Transitions Between Payment Forms

	Payment term in $t+1$:		
	Trade Credit	Cash in Advance	Letter of Credit
Payment term in t:			
Trade Credit	99.1	0.8	0.1
Cash in Advance	7.7	92.1	0.2
Letter of Credit	7.9	1.1	91.0

Notes: The table shows, for the universe of Colombian imports over 2007-2019, transition probabilities in payment terms within relationships. Consider any two consecutive transactions within a relationship labeled t and $t+1$. Each cell shows the fraction of consecutive transactions that transition from the payment term shown in the corresponding row to the payment term shown in the corresponding column.

5.2. Main Results on Relationship Length

Baseline Results. Table 5 presents the results that test for an increase in trade credit use with relationship length by estimating equation (1). Because we multiply the trade-credit indicator by 100, the coefficient estimates

in Table 5 can be interpreted as percentage-point changes in the probability that a transaction is financed with trade credit. Column 1 includes importer-exporter-product fixed effects, while columns 2 and 3 sequentially add importer-year and exporter-year fixed effects to control for importer and exporter specific time-varying shocks. Across all specifications, the coefficient on relationship length is positive and statistically significant. Based on column 3, a one standard deviation increase in log relationship length is associated with a 1.3 percentage point increase in the probability of using trade credit.

One concern is that the results in columns 1 to 3 may be affected by survival bias. This would bias results if, for example, short-lived relationships were less likely to rely on trade credit than longer-lasting relationships. To address this concern, column 4 re-estimates the specification in column 3 using a sample of the first twenty transactions in relationships with at least twenty trades. This sample – which we denote as 'balanced' – is not subject to survival bias because, by definition, all relations survive the entire sample period. The fact that the coefficient in column 4 is positive and has a similar magnitude as the one in column 3, where the full sample is used, suggests that survival bias does not drive our results.

Non-Linear Effects. We can also estimate equation (1) replacing the continuous measure of relationship length by categorical variables to allow for a more flexible relationship between trade credit use and relationship length. We are particularly interested in documenting whether payment terms change more frequently early on in a relationship, as this would provide strong support to a learning interpretation. Results are presented graphically in Figure 3. The fixed effects used are the same as those in column 1 of Table 5 and the sample is restricted to the first 40 interactions in a relationship. The figure shows a steep increase in the use of trade credit at the beginning of the relationship, with the slope flattening out as the relationship progresses. This path is consistent with Bayesian learning, where learning is faster early in a relationship and then slows down. If the speed of learning declines in the number of transactions, firms should switch more toward trade credit at the beginning of a relationship. The effect is quantitatively meaningful. Based on the estimates underlying Figure 3, the trade credit share rises by 2 percentage points between the first and the tenth transaction.

Table 5. Relationship Length and Trade Credit

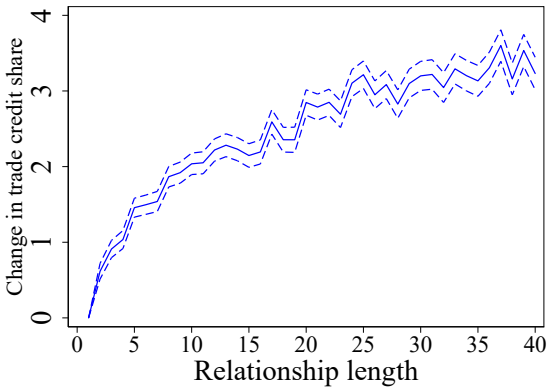
	(1)	(2)	(3)	(4)
ln(Relationship Length)	0.353***	0.603***	0.454***	0.620***
	(0.024)	(0.016)	(0.014)	(0.047)
Period	2007-2019	2007-2019	2007-2019	2007-2019
Balanced Sample	No	No	No	Yes
Importer-Exporter-HS10 FE	Yes	Yes	Yes	Yes
Importer-Year FE	No	Yes	Yes	Yes
Exporter-Year FE	No	No	Yes	Yes
Observations	18,930,693	18,898,566	18,697,801	1,298,536

Notes: The table reports the coefficient estimates from equation (1). In each regression, the dependent variable is (100 ×) a dummy variable equal to one for transactions financed with trade credit and zero otherwise. The independent variable is relationship length, measured as the log of the cumulative count of transactions within a relationship. The sample in columns 1 through 3 considers all observations, while the sample in column 4 comprises the first twenty transactions in relationships with at least twenty trades ("Balanced"). Standard errors (in parentheses) are clustered at the exporter-importer-product level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level.

5.3. Firm Characteristics and Relationship Length

To test the link between learning, diversion risk and trade credit, we next estimate equation (2) that interacts relationship length with a proxy of diversion risk. As discussed earlier, we use three proxies for an importing firm's diversion risk. First, the firm's size, measured by either total (world) imports or total revenue, under the assumption that diversion risk declines in firm size, which is motivated by the observation that larger firms are more visible and tend to have more trading partners, both of which should increase reputation costs from diversion. Second, we use a dummy variable equal to one for firms with overdue accounts payable. If a firm has overdue accounts payable this should be visible to foreign suppliers, given that this information is publicly available and likely features in commercial credit reports. Both variables are measured in the year corresponding to the transaction. Third, we compare firms that we identify as being part of a multinational with other firms. We expect diversion risk to be notably higher for trade between unrelated parties.

Figure 3. Within–Relationships Dynamics



Notes: The figure shows the estimated within-relationship trajectory for trade credit share in the sample of Colombian importers. We define relationships as importer-exporter combinations. The trajectories correspond to the estimated linear regression coefficients of a specification between the trade credit share and categorical variables taking the value one for different transaction counts within a relationship. The dotted lines represent 90 percent confidence intervals.

Importer Size. Table 6 presents the results on importer size. Consistent with the theoretical prediction, we find that the effect of relationship length on trade credit is smaller when there is less diversion risk (larger firms). In columns 1 and 2, the size of the Colombian importer is measured using total (world) imports, while in columns 3 and 4 we use total revenues. Total revenues are obtained from the balance sheet data, which reduces the sample size. In columns 2 and 4, adding importer-year fixed effects absorbs time-varying firm-level shocks. The results are quite similar across all four columns. Based on the coefficient estimate in column 4, for a firm at the 10th percentile of firm size, a one standard deviation increase in relationship length increases trade credit use by 0.9 percentage points more compared to a firm at the 90th percentile of firm size.

Overdue Status. Table 7 presents results for the importer overdue accounts payable dummy, which is available for 2016 to 2019. In column 1, we show that the baseline result on relationship length holds in this shorter subsample. In column 2 we introduce the interaction between the relationship length and overdue accounts payable. The results indicate that the effect of relationship

Table 6. Relationship Length, Importer Size and Trade Credit

	(1)	(2)	(3)	(4)
ln(Relationship Length)	2.037***	1.658***	2.823***	1.597***
	(0.153)	(0.103)	(0.263)	(0.180)
ln(Importer Size) × ln(Relationship Length)	-0.108***	-0.076***	-0.141***	-0.063***
	(0.010)	(0.006)	(0.015)	(0.010)
ln(Importer Size)	1.338***		1.590***	
	(0.064)		(0.114)	
Period	2007-2019	2007-2019	2007-2019	2007-2019
Measure of Importer Size	World Imports	World Imports	Revenue	Revenue
Importer-Exporter-HS10 FE	Yes	Yes	Yes	Yes
Importer-Year FE	No	Yes	No	Yes
Exporter-Year FE	No	Yes	No	Yes
Observations	18,930,693	18,697,801	14,261,025	14,117,305

Notes: The table reports the coefficient estimates from equation (2) for Colombian import data. In each regression, the dependent variable is (100 ×) a dummy variable equal to one for transactions financed with trade credit and zero otherwise. The independent variables are relationship length, measured as the log of the cumulative count of transactions within a relationship, and importer size, measured as total imports from the world in the current year or total revenue in the current year. Standard errors (in parentheses) are clustered at the exporter-importer-product level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level.

length on trade credit is larger when trading with importing firms with higher diversion risk. Finally, in column 3 we include interactions of relationship length with importer size and importer overdue status simultaneously. Results remain highly significant and of similar size for both variables, which implies that these two measures each independently affect the interplay between relationship length and trade credit use.

Multinational Status. Next, we exploit information on the multinational status of Colombian importers. Before estimating this relationship, we look at some baseline numbers. In our data, 97% of import transactions of firms that we identify as subsidiaries of a foreign multinational use trade credit. This contrasts with a trade credit share of 87% among all other Colombian importers. As shown in Table 8, the econometric evidence aligns well with our expectations. There is a large negative coefficient on the interaction between the multinational dummy and relationship length, which implies that relationship length is much less important for the payment choice of multinationals. In columns 2 and 3 we focus on the 2016 to 2019 period, and show that this effect is robust to controlling for the interaction between relationship length

Table 7. Relationship Length, Overdue Accounts Payable, and Trade Credit

	(1)	(2)	(3)
ln(Relationship Length)	1.669***	0.495***	2.238***
	(0.342)	(0.035)	(0.370)
ln(Importer Size) × ln(Relationship Length)	-0.059***		-0.094***
	(0.018)		(0.020)
Overdue × ln(Relationship Length)		0.210***	0.278***
		(0.058)	(0.063)
Period	2016-2019	2016-2019	2016-2019
Importer-Exporter-HS10 FE	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes
Exporter-Year FE	Yes	Yes	Yes
Observations	4,829,556	4,740,938	4,739,051

Notes: The table reports the coefficient estimates from equation (2) for Colombian import data. In each regression, the dependent variable is (100 ×) a dummy variable equal to one for transactions financed with trade credit and zero otherwise. The independent variables are relationship length, measured as the log of the cumulative count of transactions within a relationship; importer size, measured as total revenue in the current year; and a dummy variable equal to one for importers with overdue accounts payable in the current year. Standard errors (in parentheses) are clustered at the exporter-importer-product level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level.

and the two other importer characteristics discussed earlier.

Matched Colombia-Chile Data and Exporter Size. We next move to the matched dataset of Colombian importers and Chilean exporters to study the role of exporter size. Results are shown in Table 9. In column 1, we document that our baseline result on relationship length holds for the shorter subperiod from 2007 to 2015. In column 2, we introduce importer size and its interaction with relationship length, with results in line with those reported earlier in Table 6. In column 3, we introduce exporter size and its interaction with relationship length. In line with the intuition discussed in Section 2, we see the opposite sign on the interaction between exporter size and relationship length than what we had found for importer size. That is, because larger exporters have less diversion risk, learning is less helpful for cash in advance. And, as a consequence, trade credit becomes relatively more attractive with relationship age when exporters are large. Of note, the coefficient estimates on the firm size interactions are of about equal magnitude for exporters and

Table 8. Relationship Length, Multinational Status, and Trade Credit

	(1)	(2)	(3)
ln(Relationship Length)	0.485***	0.657***	2.169***
	(0.015)	(0.028)	(0.370)
MN × ln(Relationship Length)	-0.306***	-0.578***	-0.443***
	(0.025)	(0.040)	(0.053)
ln(Importer Size) × ln(Relationship Length)			-0.089***
			(0.020)
Overdue × ln(Relationship Length)			0.275***
			(0.063)
Period	2007-2019	2016-2019	2016-2019
Importer-Exporter-HS10 FE	Yes	Yes	Yes
Importer-Year FE	Yes	Yes	Yes
Exporter-Year FE	Yes	Yes	Yes
Observations	18,697,801	6,333,366	4,739,051

Notes: The table reports the coefficient estimates from equation (2) for Colombian import data. In each regression, the dependent variable is (100 ×) a dummy variable equal to one for transactions financed with trade credit and zero otherwise. The independent variables are relationship length, measured as the log of the cumulative count of transactions within a relationship; importer size, measured as total revenue in the current year; a dummy variable equal to one for importers with overdue accounts payable in the current year, and a dummy variable equal to one for firms with multinational status. Standard errors (in parentheses) are clustered at the exporter-importer-product level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level.

importers, which suggests that firm heterogeneity is equally important on both sides of the trade transaction. Results become even more pronounced when including both size interactions in the same specification (column 4) and are robust to including importer-year and exporter-year fixed effects (column 5).

5.4. Additional Results and Robustness

In the following, we discuss additional evidence exploiting heterogeneity in contract enforcement across source countries, and analyze the role of product complexity. Furthermore, we show that trade credit dynamics and learning indeed take place at the exporter-importer level and not only at more aggregate levels and that results remain similar when using alternative measures of relationship length.

Table 9. Relationship Length, Importer and Exporter Size, and Trade Credit

	(1)	(2)	(3)	(4)	(5)
ln(Relationship Length)	0.885***	2.919***	-2.131**	-0.199	-0.476
	(0.192)	(0.966)	(1.087)	(1.138)	(1.743)
ln(Importer Size) × ln(Relationship Length)		-0.136**		-0.225***	-0.176*
		(0.061)		(0.071)	(0.107)
ln(Importer Size)		-0.046		0.430	
		(0.332)		(0.377)	
ln(Exporter Size) × ln(Relationship Length)			0.179***	0.260***	0.246*
			(0.067)	(0.078)	(0.136)
ln(Exporter Size)			-1.116***	-1.516***	
			(0.372)	(0.434)	
Period	2007-2015	2007-2015	2007-2015	2007-2015	2007-2015
Importer-Exporter-HS10 FE	Yes	Yes	Yes	Yes	Yes
Importer-Year FE	No	No	No	No	Yes
Exporter-Year FE	No	No	No	No	Yes
Observations	113,580	113,580	110,896	110,896	109,346

Notes: The table reports the coefficient estimates from equation (2) for matched Colombian import - Chilean export data. In each regression, the dependent variable is (100 ×) a dummy variable equal to one for transactions financed with trade credit and zero otherwise. The independent variables are relationship length, measured as the log of the cumulative count of transactions within a relationship; importer size, measured as total imports from the world in the current year, and exporter size, measured as total exports to the world in the current year. Standard errors (in parentheses) are clustered at the exporter-importer-product level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level.

Relationship Length and Country Risk. Table 10 presents results from regressions where we interact relationship length with the Rule of Law measure from the World Bank's *World Governance Indicators*. The effect of relationship length on the probability of trade credit use increases with source country rule of law, and hence decreases with exporter diversion risk. Column 2 of Table 10 shows that this finding is robust to controlling for the source country's lending rate, the source country's (log) GDP per capita, and the interactions of these two variables with relationship length.

Relationship Length and Product Complexity. Plausibly, the effect of learning on the use of trade credit is stronger for more complex products. We test this prediction by measuring product complexity by the degree of vertical differentiation (i.e., the length of quality ladders) as defined and measured in

Khandelwal (2010).[9] Column 3 of Table 10 presents results on this prediction, where relationship length is interacted with this measure of the length of quality ladders. Consistent with our expectations, the effect of relationship length on trade credit is stronger for more vertically differentiated products.

Table 10. Relationship Length, Country Risk, and Product Complexity

	(1)	(2)	(3)
ln(Relationship Length)	0.345***	0.532***	0.337***
	(0.028)	(0.027)	(0.025)
ln(Relationship Length) × (Rule of Law)	0.562***	1.137***	
	(0.030)	(0.071)	
ln(Relationship Length) × (Quality Ladder Length)			0.102***
			(0.024)
Period	2007-2019	2007-2019	2007-2019
Importer-Exporter-HS10 FE	Yes	Yes	Yes
Observations	11,554,976	11,554,976	17,347,309

Notes: The table reports the coefficient estimates from equation (2). In each regression, the dependent variable is (100 ×) a dummy variable equal to one for transactions financed with trade credit and zero otherwise. In columns 1 and 2, the independent variables are relationship length, measured as the log of the cumulative count of transactions within a relationship; rule of law, and their interaction. In column 2, we also include the source country's lending rate and its interaction with relationship length as well as the source country's (log) GDP per capita and its interaction with relationship length. In column 3, the independent variables are relationship length, quality ladder length, and their interaction. All country-level and product-level variables are standardized to have mean 0 and standard deviation 1. Standard errors (in parentheses) are clustered at the exporter-importer-product level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level.

Importer Experience, Exporter Experience, and Relationship Length. So far, we have established that payment terms depend on the length of a relationship between an importer and an exporter. The payment terms could, however, also depend on the experience of an importer sourcing from a cer-

[9]The idea is that in industries with vertically differentiated goods, there is more scope for a breach of contract, because product quality is difficult to verify in courts. With cash in advance, the exporter may reduce the quality of the goods shipped, while, with trade credit, the importer may dispute the quality of the goods received and withhold payment.

tain country (regardless of which exporting firm it trades with) or on how long a firm has been an importer, regardless of where it imports from. Additionally, the foreign exporter's experience selling to Colombia could affect the payment terms. In Table 11, we estimate regressions similar to equation (1), adding to the right-hand side the log cumulative number of transactions of an importer ("importer experience"), the log cumulative number of transactions of an importer with a given source country ("country-specific importer experience"), and the log cumulative number of transactions of an exporter with Colombia ("exporter experience"). The results indicate that our findings on the importance of relationship length are robust to controlling for learning dynamics at a more aggregate level.

Table 11. Importer Experience, Exporter Experience, and Relationship Length

	(1)	(2)
ln(Relationship Length)	0.536***	0.655***
	(0.036)	(0.103)
ln(Importer Experience)	-0.787***	-0.345
	(0.073)	(0.236)
ln(Country–Specific Importer Experience)	0.918**	0.864***
	(0.068)	(0.205)
ln(Exporter Experience)	-0.293***	-0.334***
	(0.038)	(0.112)
Period	2007-2019	2007-2019
Balanced Sample	No	Yes
Importer-Exporter-HS10 FE	Yes	Yes
Importer-Year FE	Yes	Yes
Exporter-Year FE	Yes	Yes
Observations	18,697,801	1,298,536

Notes: This table shows the results of a transaction–level regression in which the dependent variable is (100 ×) a dummy variable equal to one for transactions financed with trade credit and zero otherwise. The right-hand side includes measures of relationship length, importer experience, and exporter experience. Standard errors (in parentheses) are clustered at the exporter-importer-product level. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level.

Alternative Measures of Relationship Length. In our main analysis, we define the length of a relationship as the number of transactions between firms.

Alternatively, we can define the length of a relationship as the cumulative value of sales that have taken place within a relationship or as the number of days that have passed since the first transaction within a relationship. As shown in Table 12, results are not sensitive to the way in which we define the length of a relationship.

Table 12. Robustness: Alternative Relationship Length Measures

	(1)	(2)	(3)	(4)
ln(Cumulative FOB Sales)	0.377***	0.375***		
	(0.023)	(0.013)		
ln(# Days since first trade)			0.378***	0.399***
			(0.022)	(0.016)
Period	2007-2019	2007-2019	2007-2019	2007-2019
Importer-Exporter-HS10 FE	Yes	Yes	Yes	Yes
Importer-Year FE	No	Yes	No	Yes
Exporter-Year FE	No	Yes	No	Yes
Observations	18,930,647	18,697,755	17,987,133	17,827,346

Notes: The table replicates columns 1 and 3 in Table 5 using two alternative relationship length measures: Cumulative FOB sales (columns 1 and 2) and days since the first trade in the relationship (columns 3 and 4). In all regressions, the dependent variable is (100 $\times$) a dummy variable equal to one for transactions financed with trade credit and zero otherwise. Standard errors (in parentheses) are clustered at the exporter-importer-product level. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level.

6. Concluding Remarks

Exploiting Colombian and Chilean transaction-level international trade data, this paper documents new facts about trade credit use: Trade credit use increases with firm-to-firm relationship length, an effect that is stronger if the importer is smaller, is late on its accounts payable and is not part of a multinational group and if the exporter is larger. In addition, the length of the relationship affects the payment choice more for imports from source countries with stronger contract enforcement and for trade in products with more scope for quality differentiation.

These findings are consistent with trade finance models that have two features. First, a friction, like diversion risk, that declines with relationship age. Second, a friction that gives a preference to trade credit that is independent of relationship age, like the financing cost advantage in Garcia-Marin et al. (forthcoming). Our findings thus suggest an important role of firm-to-firm relationships for firms' finances: by facilitating the use of trade credit in cross-border transactions, long-term relationships may reduce gross borrowing needs, and thereby reduce firms' leverage. This, in turn, would likely also reduce a firm's overall financing costs.

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A. Additional Table

Table A.1. Classification of Payment Terms in Colombian Imports Data

Our classification	Category in Colombian data	Share of transactions (%)
Cash in advance		
	Pagos anticipados (Payment in advance)	8.1
Letters of credit		
	Carta de crédito sobre el exterior (Foreign letter of credit)	1.2
Trade credit (open account)		
	Giro directo (Direct payment)	67.8
	Financiación directa del proveedor (Direct financing by foreign supplier)	5.0
Excluded		
	Mecanismo de compensación o cuenta de compensación en el exterior (Compensation mechanism or foreign compensation account)	5.8
	Financiación del intermediario del mercado cambiario (Financing from the foreign exchange market intermediary)	0.2
	Crédito externo de mediano y largo plazo (Long or medium term foreign credit)	0.1
	Arrendamiento financiero leasing (Leasing)	0.0
	Inversión extranjera directa (Foreign direct investment)	3.4
	Combinación de alguna de las anteriores formas de pago (Combination of any of the previous categories)	3.7
	Importación que no genera pago al exterior (Imports that do not require foreign payment)	4.6

Notes: The table shows our classification of the original payment term categories in Colombian import data, and the share of transactions in each category during the sample period.