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TRADE CREDIT CONTRACTS

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ABSTRACT

We employ a novel dataset on almost 30,000 trade credit contracts to describe the broad characteristics of the parties that contract together and the key contractual terms of these contracts. Whereas prior work has typically used information on only one side of the buyer-seller transaction, this paper utilizes information on both, allowing for the first analysis of buyer-seller pairs. An equally important distinction is that we have multiple contracts for the same buyer or supplier firms, rather than a firm-average response, allowing for the correction of time-invariant firm characteristics that might determine the choice of credit terms. We find that the largest and most creditworthy buyers receive contracts with the longest maturities from smaller suppliers, and that discounts for early payment tend to be offered to riskier buyers. (JEL G32)

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1. Introduction

Trade credit is an important source of external financing for firms of all sizes (Demirguc-Kunt and Maksimovic, 2001). For instance, suppliers often offer working capital financing to their buyers, some of whom may be small or credit constrained (McMillan and Woodruff, 1999; and Marotta, 2005). Trade credit has also been shown to act as a substitute for bank credit during periods of monetary tightening or financial crisis (see, for example, Calomiris et al., 1995; Choi and Kim, 2005; and Love et al., 2007).

Trade credit, however, is not used for financing purposes alone. Trade credit, it has been argued, is a way for a supplier to engage in price discrimination, giving favored or more powerful clients longer terms (see, for example, Wilner, 2000; Fisman and Raturi, 2004; Van Horen, 2005; and Giannetti, Burkart, and Ellingsen, 2011). Furthermore, trade credit may simply be customary in an industry, with customs driven by economic rationales such as allowing buyers time to assess the quality of the supplied goods (Lee and Stowe, 1993).

Studies have explored the supply and demand of trade credit around the world (for instance, Petersen and Rajan, 1997; Johnson, McMillan and Woodruff, 2002; Boissay and Gropp, 2007; and Fabbri and Klapper, 2009). Yet, in part due to the lack of detailed contract-level data on trade credit terms, little is known about how the contract terms of trade credit vary across buyer and supplier characteristics. For example, what is the typical contract period of trade credit? Which buyers receive longer net days (days before payment is due)? Which firms are offered early payment discounts? Equally important, past studies have not been able to investigate issues such as whether the relative bargaining power of buyers and suppliers matters because they have not had access to data on both sides of the contract.

This paper addresses these questions using a unique database that includes contract information for about 30,000 supplier transactions for 56 large buyers in the United States and Europe. The data includes detailed information on contract terms: the contract size (the amount in trade credit to spend in U.S. dollars), net days (days within which the buyer has to pay the amount owed), discount days (days within which the buyer has to pay to get the full discount), and the discount rate (the size of the discount if the amount is paid by the discount date).

What really sets our dataset apart from the earlier survey based work, however, is that our data has bilateral contract information, allowing us to control both for buyer and supplier firm characteristics and analyze both sides of the buyer-seller transaction, whereas earlier work only analyzed one side of the buyer-seller transaction. An equally important advantage with respect to previously used survey data is that we have multiple contracts for the same buyer and supplier firms, rather than a firm-average response. This allows us to include firm fixed effects in our empirical analysis, thereby correcting for time-invariant firm characteristics that might determine the choice of credit terms.

The limitations of our data set are that the number of buyers is small (a total of 56), which limits our analysis of buyer characteristics, and that we have relatively little information about the sellers in our sample. For example, we do not have information on the industry of the seller. Unfortunately, we have no way of getting more data. Also, because our buyers are mostly large firms we are less likely to pick up the financing motive as strongly as in the earlier literature (although we do have a mix of investment and non-investment grade buyers). The silver lining is that this allows us to focus on other non-financing motives.

We start by summarizing typical trade credit contracts terms, such as number of discount days, discount rate, and net days, and analyze how they relate to buyer and seller characteristics.

We then turn to analysis. Our primary conclusion is that no single motive is likely to account for all the patterns in even our limited data. Instead, a combination of motives appears to be at work.

Specifically, it seems hard to conclude that trade credit is primarily a cheap way for suppliers to provide buyers financing in our sample (most of our buyers are larger and better rated than our suppliers, and still get credit). Instead, non-financing motives seem to be operative. In particular, large, investment-grade buyers get long terms from small suppliers. While this is consistent with large buyers exercising market power, they do not seem to exercise it in the most effective way one might imagine – obtaining upfront price discounts from the small supplier rather than obtaining financing, which the supplier has no comparative advantage in providing. This suggests that another motive for extending trade credit is also at work: Relatively untrusted suppliers have to extend longer terms to buyers to guarantee product quality. However, this leaves suppliers exposed to riskier credits. This is where discounts help. Riskier buyers are offered discounts to repay early so that suppliers can continue offering product quality warranties even while containing the credit risk in their trade credit portfolio.

The paper continues as follows. In section 2 we review theories of trade credit, and we describe our data set in section 3. In section 4, we present the empirical results, and we conclude in section 5.

2. Theories of Trade Credit

Before we present the data, it might be useful to outline various theories of trade credit. Much of the work on trade credit has seen it as a *form of financing* that can overcome traditional impediments in financing. In particular, the seller may know more about, and have more clout over, the buyer than other arm's length financiers (see, for example, Smith, 1987; Brennan et al.,

1988; Petersen and Rajan, 1997; Biais and Gollier, 1997; and Burkart and Ellingsen, 2004). Therefore trade credit may be available when other forms of financing are not. Much of this literature argues that large, high credit quality suppliers have a comparative advantage in obtaining outside finance and pass on this advantage to small, credit constrained buyers (e.g., Boissay and Gropp, 2007). Similarly, large suppliers may act also as liquidity providers, insuring buyers against liquidity shocks that could endanger their survival (see, for example, Cunat, 2006). They may also be better able to extract value from the liquidation of assets in default, generating demand for trade credit from credit constrained buyers (Petersen and Rajan, 1997; and Fabbri and Menichini, 2010). Or, as in Burkart and Ellingsen (2004), receivables may be used as collateral for bank credit, improving the buyer and supplier's combined access to finance.

Nevertheless, previous studies also suggest that trade credit is not only used to finance credit constrained firms.[1] For instance, large, listed, multinational firms around the world, which are unlikely to face financing constraints in the market, have large volumes of accounts payable on their balance sheet (e.g., Demirguc-Kunt and Maksimovic, 2005). Globally, it is estimated that trade credit financed 90% of world merchandise trade in 2007, valued at about US$ 25 trillion dollars.[2]

Why might large, investment grade buyers choose to use trade credit financing? Perhaps their suppliers have even cheaper access to financing, and a comparative advantage in passing it on (see Ng et al., 1999). However, one of the advantages of seeing both sides of the contract in our data set is that we find many suppliers who extend credit are much smaller and less well rated than their buyers, and are unlikely to have access to cheaper financing.

Another rationale, which is relatively poorly documented in the literature because data on both sides of the contract has hitherto not been available, is that large buyers have the *market*

power to extract favorable contract terms from small suppliers, which reduce their overall borrowing costs (see, for example, the discussion in Fabbri and Klapper, 2009, and Giannetti, Burkart, and Ellingson, 2011). Why small suppliers may want to borrow at high cost in order to provide such cheap financing seems less clear – could they not simply offer more of a price discount up front, without incurring the deadweight costs of intermediation? One reason may be that a country's laws may not allow a vendor to offer different prices to different clients.[3] To the extent that price discrimination is prohibited, variations in trade credit terms also offer opportunities for sellers to offer better terms to more important buyers.

Another non-financial reason for the use of trade credit is for the supplier to *warranty product quality* to the buyer. To the extent that the buyer does not have to pay for a good until he has used or sold it satisfactorily, it allows him time to verify the quality of the good before deciding whether or not to make payment and accept the merchandise (see, for example, Lee and Stowe, 1993; Long et al., 1993; and Antras and Foley, 2011). The time that buyers need to verify quality may then determine the duration of trade credit. For instance, perishable goods bought by small suppliers may take a relatively short time to verify. In contrast, durable goods bought by cross-border large buyers, who take more time to distribute to their outlets, may require longer payment terms.[4]

Both the market power and warranty rationales have similar implications: small, lesser known suppliers should extend credit to large buyers. However, the market power rationale has another implication. To the extent that a buyer is more creditworthy than a supplier and enjoys lower financing costs, he should prefer to obtain a larger discount for early payment (effectively, a price discount) rather than longer term financing. If we find instead that discounts are targeted by suppliers elsewhere, it might suggest that the warranty rationale is also operative.

Finally, given non-financial reasons for extending trade credit, *financial risk management* might dictate at the margin what terms are set. For instance, suppliers may be more willing to trust large investment grade buyers with longer terms. Trade credit terms can also be set by suppliers as a screening mechanism to gauge buyer default risk (see, for example, Mian and Smith, 1992; and Frank and Maksimovic, 2005). Sellers can reduce payment risks through two-part payment terms, such as early payment discounts to incentivize buyers to pay early (e.g., Ng et al., 1999).

In sum then, we see three important factors driving trade credit: 1) As a way for suppliers with cheaper access to credit to finance buyers; 2) As a means for the buyer to exercise market power and obtain favorable price discrimination; and 3) As a warranty assuring buyers of product quality. Given these three factors, terms may also be influenced by the supplier's need to contain financial risks.

Our data set is unique in that we know some characteristics of the parties on either side of the contract. So we can take a closer look at these rationales for trade credit, focusing on how contract terms vary with characteristics of the parties to the contract. The limitations of our data set are that we do not have detailed characteristics on the firms, and we have no way of getting more data. Therefore our tests are reduced-form in nature, allowing us to document associations but not identify causality. Nevertheless, what we can tease out is intriguing.

3. Data, Summary Statistics, and Variance Decomposition Analysis

We use a novel database of trade credit contracts for nearly the universe of suppliers of 56 large buyers.[5] The data are provided by PrimeRevenue, an online network that links large,

global companies, their suppliers, and third-party financial institutions, via the Internet. PrimeRevenue provides software and an IT platform for buyers to post their invoices directly. Suppliers choose whether to be paid at the maturity of the contract or to have the contract "factored out" and be paid immediately at a discount. PrimeRevenue is a leading provider of such "open platform supply-chain finance (SCF)" solutions, allowing multiple banks to participate directly in a buyer's SCF program.

The buyers in our dataset are PrimeRevenue's clients. The data on the suppliers is collected from the buyers, who hold extensive information on their suppliers, including detailed information on their trade credit contracts. The suppliers sell mostly final goods (only 1% of contracts are from sellers that produce intermediate goods), indicating that the buyers are mostly at the end of the value chain.

Our data is a snapshot of outstanding receivables as of December 1, 2005. Importantly, this snapshot is before PrimeRevenue started factoring the receivables.[6] Also, PrimeRevenue allows firms to post whatever trade credit contract they choose, and does not limit the choice to a set of standardized options for firms. Buyers generally post invoices for all 'important' suppliers, which is estimated by PrimeRevenue to capture over 90% of total inputs to the buyer. Our database includes information for 29,019 contracts, the full set of contracts in PrimeRevenue at the time, which includes 56 large buyers and 24,140 suppliers. The data includes complete information on contract terms: the contract size, net days, discount days, discount, and currency in which the contract is denominated. Most buyers interact with most sellers only once, though there is a fraction of repeat buyers and sellers who have multiple buyers.

For buyers, we can control for firm size using buckets based on their total sales[7], location (North America or Europe), sector, and whether the buyer is investment grade. For suppliers, we

know their size (sales buckets) and whether the supplier is investment grade. Information is not provided on supplier location or sector, since 95% of buyers purchase inputs via local distribution centers to avoid any import duties, such as tariffs and taxes. Apart from missing information about net days for 832 out of 29,019 contracts, we have complete information on contract terms.

Empirical work on trade credit thus far has been hampered due to a lack of firm-level data on trade credit contract terms. Most studies have used the Federal Reserve's Survey of Small Business Finances (SSBF) database of U.S. firms, which has only limited data on credit terms and firm characteristics (e.g., Petersen and Rajan, 1997; and Giannetti et al., 2011). Ng et al. (1999), instead, uses survey level data on 950 listed U.S. firms to study the determinants and characteristics of trade credit contracts.

Our dataset differs from ones used in the earlier survey based work by Ng et al. (1999), Giannetti et al. (2011) and others in several important ways. First, we use data from actual trade credit contracts rather than data based on survey responses, thereby mitigating the usual misreporting concerns associated with survey based data. Importantly, our dataset consists of trade credit contracts signed, while papers using the National Survey of Small Business Finance (NSSBF) database use trade credit contracts offered. Our dataset also covers a broader set of industries that includes technology firms, allowing for an analysis of trade credit contract terms across a range of industries, and includes trade credit terms not only for U.S. firms but also for international firms, allowing for a comparison of trade credit terms across different jurisdictions. Moreover, our dataset covers suppliers of all sizes, and not just small firms as in the SSBF. This is an important difference because the credit terms offered by large firms could be very different than those by small firms.

We begin by summarizing the main characteristics of buyers, suppliers, and contracts. Panels A and B of Table 1 show summary statistics of buyer and supplier characteristics. First, the buyers in our sample are very large – 33 out of 56 (or 59%) of buyers have over US$ 10 billion in sales and only one buyer has less than US$ 2 billion in sales.

The buyers are also creditworthy as measured by whether or not they are investment grade: about 75% of buyers in the dataset are investment grade. That we have mostly large, investment-grade buyers will make it harder to find evidence in this dataset of a financing motive for trade credit. We should, therefore, treat our results with appropriate caution.

Buyers are active in a range of industries, with the majority in retail industries. The sectoral distribution of buyers is: 16% in auto manufacturing, 13% in diversified retail, 29% in diversified manufacturing, 7% in retail groceries, 16% in retail hard goods, 11% in retail soft goods, 5% in technology, 4% in food and beverages, and 2% in the utility sector. The data encompasses only one firm in the utility sector and two firms in the food and beverages sector. Approximately 77% of buyers are from North America (the U.S. or Canada) and 23% of buyers are from Europe.

In comparison to the buyers, our suppliers are relatively small: 56% of suppliers have less than US$ 100 million in sales and only 11% of suppliers have more than US$ 2 billion in sales. Creditworthiness is also an issue for many suppliers, given that almost two-thirds of suppliers are not investment grade (meaning their credit rating is below investment grade or they do not have a rating).

In Table 1, Panel C, we present summary statistics of contract characteristics. We have a wide distribution of contract amounts (contract size) varying from about US$ 400 dollars to over US$ 4 billion dollars, with a median of about US$ 3.5 million dollars.[8] Contracts in our sample

are generally very long in duration: the average net days is 59.2 and the median is 60 net days. About 75% of contracts in our sample have net days longer than 30 days, which is longer than the 'typical' contract of 30 days previously shown in the literature (Ng, Smith and Smith 1999), possibly because our buyers are relatively large. For example, 20% of contracts have net days of exactly 30 days, 28% have net days of exactly 60 days, and 17% have net days of exactly 75 days.

About 60% of contracts in our sample are denominated in U.S. dollars, followed by almost 40% in euros; this is in line with the distribution of contracts among buyers in North America and in Europe (59% and 41%, respectively, as shown in Table 1, Panel A).

In our sample, 13% of contracts (or 3,707 in total) offer early payment discounts.[9] We also examine the discount terms, including the discount and discount days (the number of days within which the buyer has to pay to obtain the discount). Almost two-thirds of discount days are 30 days or less, while 27% are between 30 and 60 days, and 9% are more than 60 days. Some terms seem very common; 20% of discount days are 10 days, 20% are 30 days, and 16% are 60 days. The most common spreads of net days less discount days are 1 day (34% of contracts with discounts), 30 days (29% of contracts), and 20 days (16% of contracts), with the majority (or 63%) of contracts having a spread of net days less discount days equal to or less than 20 days. The mean spread of net days less discount days equals 17 and the mean ratio of discount to net days is 63%.

That 30% of contracts have a spread of exactly one day might suggest that discounts can be used simply to encourage prompt payments, or as an implicit price discount, i.e. an alternative to a cut in list prices.[10] The mean and median discount rate is equal to 2%. Of contracts with

discounts, 36% have a discount equal to 1% or less, 56% have a discount of 2% or less but exceeding 1%, and the remaining 8% have a discount greater than 2%.

Trade credit appears expensive for most buyers. The effective interest rate, defined as the implied interest rate if the buyer does not pay on the discount date, foregoes the discount, and pays on the due date, is $\left(1/(1-\textit{discount rate})\right)^{360/(\textit{net days}-\textit{discount days})}-1$. For contracts with net days equal to discount days, we set the spread between net days and discount days to one to allow for the computation of an interest rate. Moreover, given the high interest rates that result for contracts with low spreads between net days and discount days, we truncate interest rates at 100%. The resulting average effective interest rate is high at 54%, though effective interest rates vary from a low of 2% to a high of 100%.

In Table 2, we show the distribution of contracts and buyers across buyer and supplier characteristics, indicating that the sample is well distributed across firms of different sizes and investment grade ratings. For example, while the majority of buyers are investment grade, there are still 14 (out of 56) firms that are not investment grade.

In Table 3 we present the distribution of contract terms by buyer and supplier characteristics. Larger buyers tend to make purchases with a wider range of contract size, including more frequent relatively small purchases of less than US$ 1 million in size. Across industries, auto manufacturing and retail hard goods have relatively larger average contract size, especially relative to technology, where almost 75% of contracts are less than US$ 1 million in size. We find no notable differences in contract size across buyer location or investment grade. In addition, large suppliers appear to make large sales, while whether a supplier is investment grade or not does not seem related to average contract size.

Contracts to the largest and most creditworthy buyers also entail longer maturities (net days). We find strong sectoral effects in the net days offered: 85% of contracts in retailing of soft goods have a maturity of 30 days or less, while other sectors have longer average maturities. Contracts to firms in Europe are on average longer than contracts in North America (although the sectoral distribution is relatively even across regions).

Next, we focus on the decision to extend early payment discounts (Table 4). The statistics refer to the subsample of contracts that offer an early payment discount. Overall, 34 out of the 56 buyers (or 63% of buyers) are offered at least one early payment discount. In general, the buyers receiving a discount are small and non-investment grade, while suppliers offering a discount tend to be larger and are roughly equally likely to be investment or non-investment grade. Suppliers are also most likely to offer discounts to buyers that retail in hard goods. 22 buyers are never offered discounts (including all buyers in the food and beverages, technology, and utility sectors). In the empirical analysis of this paper we therefore also check how the results look if we drop the firms who never report discounts.

Discounts do not appear strongly related to buyer or supplier characteristics, with the exception that higher discounts (>2%) are more common in the auto industry and among grocery firms. Discount days, the number of days the buyer has to pay and receive a discount, appears strongly related to buyer size: 78% of firms with less than US$ 10 billion in total sales have discount days of 30 or less, while only about 64% of firms larger than US$ 10 billion in size receive a short discount window. The mean of net days is 60 days for contracts without discounts and 44 days for contracts with discounts, suggesting that suppliers offer trade discounts in association with shorter net days.

Importantly, our database also allows for both supplier and buyer fixed effects. About 25% of suppliers (or 7,273 suppliers) sell to multiple buyers. Of these, 3,126 suppliers sell to 2 buyers and 4,147 suppliers sell to 3 or more buyers. In addition, 16% of suppliers (or 4,557 suppliers) have more than one contract with the same buyer. Specifically, 2,685 suppliers have exactly 2 contracts with a buyer, and 1,872 suppliers have 3 or more contracts with a buyer. In general, we find variation in net days and the decision to extend an early payment discount across contracts of a single supplier.

The summary statistics and correlation matrix of the main regression variables are presented in Tables 5 and 6. We find that the correlation between supplier investment grade and supplier large size is not high at 0.11, and that the correlation between buyer investment grade and buyer large size is close to zero (these calculations treat unrated firms as non-investment grade firms because the data do not allow us to distinguish between non-investment grade and unrated). These low correlations reduce concerns about potential multi-collinearity problems in our regressions.

Next, we conduct a variance decomposition analysis of our main outcome variables of interest: log of net days, the discount dummy (equal to one if a discount is offered), and the effective interest rate. In earlier work, Ng et al. (1999) argue that most of the determinants of trade credit contracts are sector driven. The variance decomposition results presented in Table 7, Panel A confirm this: net days, discounts, and interest rates are mainly driven by buyer industry characteristics.

Of course, the supplier characteristics we have are coarse, and do not include the supplier industry. Because the suppliers are smaller and hence likely to be more narrowly focused, their industry is likely to carry more information about trade credit terms. One way to explore the

effect of inclusion of detailed supplier characteristics is to include supplier fixed effects. This will allow us to check whether credit terms of a given seller vary across buyers. Specifically, we compute the contribution of buyer characteristics in explaining the variance of contract characteristics that remain after controlling for supplier fixed effects, for the sellers with multiple contracts. The results are in Table 7, Panel B.

They show that buyer characteristics explain only a small fraction of the variation in net days and interest rates once the variation in credit terms from supplier characteristics has been fully accounted for, indicating that the credit terms offered by a given seller do not vary much across buyers (and that the narrower seller's industry probably subsumes much of the variation in the buyer's industry). However, buyer industry characteristics remain an important determinant of the variation in discounts and interest rates of a given seller across buyers, even after controlling for supplier fixed effects. The results suggest that a seller may offer discounts selectively across buyers, even if other terms like the duration of credit may be largely determined by the seller's characteristics. This willingness to be selective in discounts will be important in our explanation of its purpose.

4. Characteristics of Contracting Parties and Regression Analysis

Let us now examine the determinants of contract terms more explicitly, starting first with the explicit duration of contracts, that is, net days.

4.1 Net days

In Figure 1, we plot the average net days for different sets of supplier-buyer characteristics. Figures 1a to 1d suggest that large, investment grade buyers get longer net days

from smaller suppliers. To verify this, we turn to regressions, with log net days as the dependent variable.

We include supplier and buyer characteristics as explanatory variables. We include an indicator if the buyer is large (above $ 10 billion in sales), as well as an indicator if the buyer has an investment grade rating. Similarly, we include an indicator if the supplier is large (above $ 2 billion in sales), an indicator if the supplier is medium sized (between $ 100 million and $ 2 billion in sales), as well as an indicator if the supplier is investment grade. We also include indicators for the buyer's industry.

Our first results are shown in Table 8. The first two columns cluster standard errors by buyer, while the next two columns include buyer fixed effects, and the last two columns include supplier fixed effects. Note that the supplier fixed-effects regressions are identified on the basis of those sellers that sell to more than one buyer, which in our case account for 25% of the sample of contracts. The second column in each of these pairs excludes credit contracts with discounts, so as to correct for the possibility that net days on two-part contracts vary systematically from those of simple contracts without discounts. However, the estimates excluding contracts with a discount do not seem to be qualitatively different.

Our industry classifications are very broad. Nevertheless, we find buyers in industries with substantial turnover and where goods are more likely to be perishable (groceries, soft goods), tend to have shorter net days. This is consistent with trade credit as a warranty of quality. Utilities also tend to have lower net days, which would be consistent with trade credit as a warranty if utilities primarily buy fuel, whose quality is easily assessed.[11]

Consistent with Figure 1, we find that longer net days are offered to significantly larger, investment grade buyers (Table 8, Columns 1 and 2). The magnitude of these effects is sizeable.

For example, from the estimates in Column 2, a buyer who is large gets 9.8 longer days than the mean of 59 days. Similarly, a buyer who is investment grade gets 7.5 longer days than the mean net days.

We also find that net days are shorter for buyers located in North America (the majority of which are located in the United States) relative to buyers located in Europe. One potential explanation for this result is that sales in Europe are often cross-border in which case buyers may demand longer days to protect against damaged goods and avoid having to challenge suppliers in foreign courts.

When we include buyer fixed effects (Table 8, Columns 3 and 4), we find that longer net days are significantly more likely to be extended by smaller suppliers and by investment grade suppliers, again consistent with Figure 1. When we include supplier fixed effects (thus focusing on the subsample of suppliers with multiple contracts within or across buyers), we continue to find that larger and investment grade buyers get longer net days (Table 8, Columns 5 and 6). For robustness, we also performed additional regressions (not reported) on the restricted sample of suppliers with multiple contracts but without fixed effects. These regressions reveal that the differences in estimates between the regressions with supplier fixed effects (Columns 5 and 6) and the regressions without fixed effects (Columns 1 and 2) can be attributed to the inclusion of supplier fixed effects (and not simple the different sampling).

The evidence thus far is consistent with trade credit as a way to warranty product quality: the easier verifiability of the quality of supplies to buyers running high turnover businesses with perishable inputs would justify the short duration credit extended to these businesses, while the long time period before cross-border buyers get to use shipped goods justifies the longer terms extended to them.[12]

That investment grade suppliers, who presumably have greater access to finance, extend longer net days is consistent with the financing explanation. However much of the evidence cannot be reconciled with the financing explanation. We have seen that large, investment grade buyers get longer net days, while the financing argument would suggest that smaller, higher credit risk buyers should get longer term financing. Also small suppliers tend to offer longer term credit, which again is inconsistent with the financing story. These results may be more consistent with the market power rationale for trade credit: large, investment grade buyers would typically have more power over small suppliers and be able to demand better terms from them. They are also consistent with the warranty rationale: small suppliers may be relatively unknown, and have to offer longer term credit to persuade buyers to take their products.

Finally, given some underlying rationale for extending credit (such as its value as a warranty of product quality) the evidence is also consistent with a risk management explanation. Suppliers are willing to trust larger investment grade buyers with longer-term credit because they are less likely to default.

4.2 Buyer-supplier pairs

Perhaps we can shed more light on the alternative explanations for trade credit by looking more closely at buyer-supplier pairs more carefully, correcting for buyer fixed effects. The financing explanation would suggest that large investment grade suppliers should extend longer terms to small non-investment grade buyers than should small non-investment grade suppliers. The bargaining power explanation would suggest that small suppliers should extend longer terms than would large suppliers, especially to large buyers. To the extent that the primary factor driving trade credit is its use as a warranty of quality, and to the extent that larger buyers take

longer to use a product and test its quality, while small suppliers have a greater need to warranty their product quality, this is another reason why small suppliers should extend longer term credit to large buyers. Finally, whatever the reason suppliers extend credit, small non-investment grade suppliers have the least ability to sustain credit losses, and would have the greatest preference for mitigating risk by reducing the length of credit, especially to small, non-investment grade buyers. Of course, these theories need not be mutually exclusive.

In Table 9, we explore these possibilities by including buyer fixed effects, and various interaction effects in the regression explaining log net days. In column 1, we include interactions between the supplier's size and the buyer's rating. Large and medium-sized suppliers offer significantly shorter terms than small suppliers (the omitted category) to non-investment grade buyers, while their terms are longer, but still less than those offered by small suppliers, for investment grade buyers. Thus small suppliers offer relatively the longest duration credit, especially to low credit quality buyers.

In column 2, we see that medium-sized suppliers are significantly less likely than small suppliers to extend credit to small buyers, while large-sized suppliers are significantly less likely than small suppliers to extend credit to large buyers. Small suppliers seem therefore to extend longer credit than larger suppliers, no matter what the size or investment rating of the buyer.

In column 3, we see that investment grade suppliers offer shorter terms to non-investment grade buyers than do non-investment grade suppliers, while they offer longer terms to investment grade buyers than do non-investment grade suppliers. Again, it seems that non-investment grade suppliers are forced to provide longer terms to less creditworthy buyers.

In sum, small suppliers offer the longest terms, which is consistent with them being squeezed by more powerful buyers for more credit, or with them having to post a stronger

performance bond. That small, non-investment grade suppliers offer relatively more credit to non-investment grade buyers than to investment grade buyers suggests they are forced to extend credit to risky buyers, even when suppliers with greater access to finance are not.

Not all the evidence goes against the financing explanation though. When the supplier is investment grade and therefore has greater access to financing, it seems to be willing to lend longer, except to non-investment grade buyers. For instance, investment grade suppliers do lend longer to investment grade buyers than do non-investment grade suppliers (column 3). Also, investment grade suppliers offer longer terms to small buyers than do non-investment grade suppliers, while the differences narrow for larger buyers (column 4).

In column 5, we include all the explanatory variables in the previous columns, and while the coefficient estimates of the interaction terms are typically smaller, the signs are unchanged.

We have to recognize the dangers of drawing overly strong conclusions, given that our buyers are, for the most part, billion dollar companies. This is likely to be a sample where the financing motive for trade credit is least likely to be operative. Nevertheless, it is telling that our strongest finding runs against the grain of the financing theory: Even after correcting for buyer fixed effects, small suppliers extend the longest credit, even to small, non-investment grade buyers. Perhaps then, our sample allows us to highlight the non-financial motives for trade credit; the need to offer better terms to powerful buyers, and the need to signal product quality.

Interestingly, though, given a non-financial motive to extend credit, credit is naturally longest when the cost of giving it is low – when the buyer is investment grade and the supplier is investment grade.

4.3 Discounts

To throw further light on the motivations behind trade credit, we examine the sample of contracts that include an early payment discount. The view that discounts are used as a way to reduce buyer default risk would suggest that smaller and non-investment grade buyers, where default risk tends to be higher, would more likely receive discounts. To the extent that it is easier for large rated suppliers to diversify or otherwise absorb default risk, this view would also suggest that small unrated suppliers are more likely to extend discounts.

Discounts also allow us to shed more light on the bargaining power explanations. If trade credit is a means for large powerful buyers to effectively extract better prices, we should also see the following: Because it is costly for small unrated suppliers to extend long term trade credit, and because longer term credit is of least value to large rated buyers, who can get financing elsewhere, we should see the large buyers translate their bargaining power into shorter terms and a discount for early payment.

Finally, to the extent that longer trade credit is a way for the supplier to guarantee product quality, we should see small young suppliers, who might suffer the greatest distrust of the quality of their product, most reluctant to offer discounts for early payment. Thus the data on early payment discounts might shed light on the relative merits of the non-financing explanations.

We start by charting the average number of contracts with discounts for suppliers and buyers of different characteristics. We only consider the 34 buyers who receive at least one discount.[13] The results are reported in Figure 2.

Suppliers offer discounts for early payment more frequently to small buyers (Figure 2a and 2c) as well as to non-investment grade buyers (Figure 2b and 2d), consistent with the use of discounts as a way to mitigate the risk of default. Unlike the predictions of the bargaining power theory, however, small suppliers are least likely to offer early discounts to large buyers. Instead,

they seem to conserve discounts and offer relatively more to small and non-investment grade buyers (Figures 2a and 2c). A similar pattern can be seen for non-investment grade suppliers: discounts are targeted at riskier buyers.

These findings suggest a more nuanced view of trade credit and the separate role of contractual features such as net days and the discount. It may be that the primary rationale for trade credit in our sample is to give buyers the time to ascertain product quality, which is why the duration from small unrated suppliers is the longest. At the same time, the cost of offering this warranty is highest for small suppliers, especially when they offer it to unrated small buyers. As a result, they offer discounts to those buyers to manage the risks down.

So while large rated buyers may have bargaining power, they seem to exercise it by demanding longer "trial" credit periods before they pay.[14] It may seem inefficient for the small supplier to extend credit to the large rated buyer. But given that it has to extend credit for non-financial reasons, it may be constrained efficient for it to use scarce cash resources for selectively-targeted discounts that persuade lower credit quality buyers to pay early, thus maintaining a high overall quality of its credit portfolio.

We turn next to regression analysis. In Table 10, we present logit regressions of determinants of early payment discounts for the subsample of contracts that offer early payment discounts. The dependent variable takes value 1 if the contract includes a discount (two-part contract), and 0 otherwise. We focus on the regressions for buyers who have at least one discount (columns 2, 3, and 5), though for completeness, we also present regression results for the complete sample of buyers (in columns 1 and 4).

Let us focus first on the regression estimates with supplier fixed effects in column 5. Large buyers get significantly fewer contracts with discounts, and investment grade buyers are

also less likely to get discounts for early payment. Discounts also tend to be industry-specific, with discounts being more common for buyers in the groceries sector, where goods tend to be perishable. Turning next to the estimates with buyer fixed effects in column 3, we find that large and medium-sized suppliers give significantly fewer discounts than small suppliers.

That early payment discounts are more common from small suppliers is consistent with the market power hypothesis, except that these discounts go more to small and non-investment grade buyers**.** The finding is more consistent with the risk management view that stipulates that smaller suppliers are more likely to offer discounts to risky buyers as a way to encourage early payment and prevent default because it is more difficult for these firms to absorb and diversify default risk.[15]

4.4 Discount terms

Finally, we analyze the determinants of discount terms for the subsample of contracts that offer early payment discounts and for which we have complete information on discount terms (including discount period, discount rate, and net days). Specifically, we analyze the effective interest rate of the trade credit contract. The regression results are presented in Table 11 and are based on the subsample of contracts that offer early payment discounts. Columns 1 to 3 present results when we regress our buyer and supplier characteristics on the natural logarithm of the effective interest rate, defined as $\left(1/(1-\textit{discount rate})\right)^{360/(\textit{net days}-\textit{discount days})}-1$. We use the natural logarithm of this variable in the regression to reduce the impact of outliers.

As mentioned earlier, a surprisingly large fraction of contracts (over 30%) with early payment discounts have a spread between net days and discount days of exactly one day, suggesting that discounts are used to encourage prompt payments. Contracts with net days equal

to discount days are automatically dropped from the regressions in columns 1 to 3 (because the denominator in the formula of interest rates is equal to zero). These contracts are of particular interest because they most represent the types who are encouraged to pay on time. In Columns 4 to 6, we therefore also present regression results with the effective interest rate computed after setting the spread between net days and discount days equal to one for contracts with net days equal to discount days. It turns out that including these additional contracts in this way does not materially affect the results.

Discount terms appear to be dependent on industry norms. For instance, buyers of soft goods and groceries tend to receive the highest effective rates on two-part contracts, according to the regression in column 1 where standard errors as clustered at the buyer level. One reason why suppliers might be especially interested in encouraging risky buyers in this industry to pay up might be because of the perishable nature of the underlying good. Without much ability to take back a shipment for non-payment, suppliers might have an unsecured claim that they would like repaid as soon as possible.

In unreported regressions, we generally find similar patterns across discount terms (including the discount period and discount rate) in the sense that the coefficients on the various firm determinants have the same sign in most specifications, suggesting that the different discount terms serve similar purposes and that firms do not systematically trade off various terms against each other. This is consistent with the findings by Ng et al. (1999).

5. Concluding Remarks

The bilateral, multi-contract nature of our dataset is a valuable improvement on (generally survey based) datasets that have previously been used to study the determinants of

credit terms used in trade credit. This multi-contract structure of our dataset allows us to abstract from unobserved buyer and supplier firm characteristics, something previous empirical work has not been able to do.

We find that the largest and most creditworthy buyers receive contracts with the longest maturities, as measured by net days, from smaller suppliers. This is consistent with a market power explanation (smaller suppliers are squeezed more by large buyers) as well as the view that credit may be a means for small suppliers to warranty quality to their large buyers. However, if the buyer's bargaining power is the sole rationale for trade credit, it is puzzling that the large rated buyers do not swap the credit (which the supplier can ill afford and the buyer does not need) for a discount. Instead, it is the small unrated buyer who typically gets the discount.

All this suggests that there are multiple, not mutually exclusive, rationales for extending trade credit. While the duration of trade credit may reflect the relative bargaining power of the buyer vis a vis the supplier, the former may be reluctant to take a discount instead because trade credit serves as a warranty of product quality that is lost when the buyer is offered and takes a discount. Nevertheless, trade credit discounts may still be offered to the riskiest buyers in order to reduce the overall risk of the supplier's credit portfolio, and achieve an optimal mix of warranty and risk.

Clearly, more work is needed to put these conjectures on firmer footing. For instance, while our data on both sides of the contract allows us to put the bargaining power hypothesis on firmer footing, we need better data to determine the relative importance of the bargaining power and warranty rationales. Nevertheless, our work provides more evidence that the motivations for trade credit are both intriguing and suggestive of the richness of financial contracting.

Footnotes

[1] In fact, Schiff and Lieber (1974) argue that risk management and inventory management decisions are often taken separately from financing decisions and by different units of the firm, and that consequently trade credit cannot be solely explained on financing grounds.

[2] "World Bank urged to lift trade credit finance," *Financial Times*, November 11, 2008.

[3] For example, the Clayton Act in the United States prohibits price discrimination across customers for the same good.

[4] Of course, a supplier who is in a repeated relationship with a buyer may have incentives to deliver quality. Even so, trade credit could save on transactions costs, with the buyer paying only for what meets the quality hurdle (or the time specified for sales as in consignment sales).

[5] Because purchasing history is proprietary information, we do not know the identity of buyers in our sample. However, as discussed in this section, PrimeRevenue provided us with buyer characteristics (such as size, sector, and location) and informed us that almost all buyers in our sample are Global Fortune 500 companies.

[6] Unfortunately, we were unable to obtain repeated cross-sections or panels of data from Prime Revenue, because these are proprietary data. We obtained a single snapshot of data for the year 2005, prior to Prime Revenue starting factoring the receivables in 2006.

[7] Buyer and supplier size buckets based on total sales are (in U.S. dollars): less than $0.1 billion; $0.1-2 billion; $2-7 billion; $7-10 billion; larger than $10 billion.

[8] The largest contract in our dataset is for a large, diversified U.S. retailer.

[9] This is a comparable figure to that obtained using SSBF survey data on U.S. firms, indicating that 20% of firms that use trade credit are offered an early payment discount from their suppliers.

[10] Anecdotally, large buyers do not pay late fees to their suppliers.

[11] We should be cautious about over-interpreting the effect found for the utility sector because it is based on observations from only one firm.

[12] It could also be argued that buyers may have to raise the money needed to pay for shipped goods by selling them, so they need to be financed until that happens. However, this would not explain why the largest buyers, who presumably have the easiest access to financing, get the longest term credit.

[13] Our main results are robust to the inclusion of the remaining buyers that do not receive discounts in the model that includes supplier fixed effects and adjusts standard errors for clustering at the buyer level. Buyers who never receive discounts are dropped from the model that includes buyer fixed effects.

[14] Antras and Foley (2011) study contracts for one U.S. poultry exporter and find similar evidence that trade contracts are extended to protect buyers in the case that a seller does not deliver goods as specified in the contract.

[15] We could also examine buyer-seller pairs as in Table 9, but the smaller number of observations on discounts renders much of the analysis statistically inconclusive.

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Table 1
Buyer and Seller Characteristics

This table reports summary statistics of buyer, supplier, and contract characteristics. Sample consists of 29,019 trade credit contracts between 56 large buyers and 24,140 suppliers. Early payment discounts are offered on 3,717 of these contracts. The effective interest rate variable is winsorized at 100% and computed after setting the spread between net days and discount days to one for contracts with net days equal to discount days. Panel A reports summary statistics for buyer characteristics, panel B for supplier characteristics, and panel C for contract characteristics.

Panel A: Buyer Characteristics (Percentages)

	Number of Buyers	% of buyers	Number Contracts	% of Contracts	Total Amount ($ billion)	% of total amount
Size >$10 billion	33	59	24,298	84	612	89
Size $0.1–10 billion	23	41	4,721	16	79	11
Industry auto	9	16	1,615	6	75.8	11
Industry diversified retail	7	13	9,749	34	193	28
Industry diversified mfg	16	29	3,824	13	74.3	11
Industry grocery	4	7	1,630	6	88.5	13
Industry hard goods retail	9	16	3,146	11	164	24
Industry soft goods retail	6	11	2,362	8	42.1	6
Industry technology	3	5	5,306	18	24.2	4
Industry food & beverages	2	4	682	2	26.7	4
Industry utility	1	2	705	2	2.47	0
Location: Europe	13	23	12,029	41	241	35
Location: North America	43	77	16,990	59	450	65
Investment Grade: No	14	25	4,008	14	107	16
Investment Grade: Yes	42	75	25,011	86	583	84

Panel B: Supplier Characteristics (Percentages)

	Number of Suppliers	% of Suppliers	Number Contracts	% of Contracts	Total Amount ($ billion)	% of total amount
Size >$2 billion	2,727	11	5,772	20	531	77
Size $0.1–2 billion	7,821	32	9,549	33	142	21
Size <$0.1 billion	13,590	56	13,698	47	17.9	3
Investment Grade: No	16,391	68	18,655	65	319	46
Investment Grade: Yes	7,713	32	10,043	35	372	54

Panel C: Contract Characteristics

	N	Mean	Median	Min	Max	Std Dev
Contract amount (US$ million)	29,019	23.8	3.47	.0004	6,520.0	111.0
Net Days	29,019	59.2	60	1	120	26.1
Discount Offered (Yes/No)	29,019	0.13	0	0	1	0.33
Discount Days	3,462	30.43	30	1	180	20.09
Discount Rate (%)	3,707	2	2	.02	11.5	0.09
Ratio of Discount to Net Days	2,634	0.63	0.6	0.02	1	0.28
Effective Interest Rate	2,624	54%	31%	2%	100%	38%

Table 2
Buyer and Seller Cross-Tabulations

This table reports cross-tabulations of count statistics of buyer and supplier characteristics (Panel A) and within buyer characteristics (Panel B). Sample consists of 29,019 trade credit contracts between 56 large buyers and 24,140 suppliers. Not investment grade also includes unrated firms.

Panel A: Buyer vs. Supplier Characteristics (number of observations)

	Supplier Size			Supplier Investment Grade		
	Small	Medium	Large	No	Yes	Total
Buyer Size						
Small/Medium	1,608	2,166	947	3,471	1,250	4,721
Large	12,090	7,383	4,825	15,505	8,793	24,298
Buyer Investment Grade						
No	1,204	1,729	1,075	2,667	1,341	4,008
Yes	12,494	7,820	4,697	16,309	8,702	25,011
Total	13,698	9,549	5,772	18,976	10,043	29,019

Panel B: Buyer Characteristics (number of buyers)

	Buyer size		
	Small /Medium	Large	Total
Buyer Investment Grade			
No	6	8	14
Yes	17	25	42
Total	23	33	56

Table 3
Distribution of Buyer and Seller Characteristics, by Contract Characteristics (Percentages)

This table reports the distribution (in percentages) of trade credit contract terms by buyer and supplier characteristics. Sample consists of 29,019 trade credit contracts between 56 large buyers and 24,140 suppliers. NA denotes North America.

	Contract Amount (%)				Net Days (%)				Location	
	< $1 mln	$1-4 mln	$4-15 mln	> $15 mln	0-30	31-60	61-90	91+	Europe	NA
Buyer Characteristics:										
Size >$10 billion	32	23	20	25	20	38	29	13	46	54
Size $0.1–10 billion	5	35	33	26	52	40	8	0	18	82
Industry auto	0	15	28	57	20	53	20	7	59	41
Industry diversified retail	23	37	22	17	10	13	50	26	84	16
Industry diversified mfg	6	29	36	29	47	34	17	1	0	100
Industry grocery	11	25	18	47	42	54	3	0	84	16
Industry hard goods retail	0	15	29	57	21	52	24	4	3	97
Industry soft goods retail	26	23	22	29	85	14	1	1	0	100
Industry technology	74	9	10	7	8	88	3	0	0	100
Industry food & beverage	28	34	21	17	27	30	12	31	100	0
Industry utility	73	18	6	4	54	9	36	0	100	0
Location: Europe	26	33	20	20	11	19	46	23	100	0
Location: North America	29	19	23	29	37	53	10	1	0	100
Investment Grade: No	20	20	28	32	68	29	2	0	7	93
Investment Grade: Yes	29	26	21	24	18	39	28	12	50	50
Supplier Characteristics:										
Size: >$2 billion	5	11	18	65	33	39	21	8	30	70
Size: $0.1-2 billion	5	9	48	38	34	32	24	11	39	61
Size: <$0.1 billion	53	41	6	0	18	43	27	12	48	52
Investment Grade: No	28	26	23	23	27	40	24	10	43	57
Investment Grade: Yes	27	22	21	30	23	37	27	12	41	59

Table 4
Distribution of Buyer and Seller Characteristics, by Discount Characteristics (Percentages)

This table reports the distribution of trade credit contract terms (in percentages) by buyer and supplier characteristics for the subsample of 3,717 contracts that offer an early payment discount. Statistics are not reported for the technology, food & beverages, and utility industries, as no buyers in these industries are offered discounts.

	Full Sample	Subsample of Contracts that Offer an Early Payment Discount						
		Discount Rate (%)			Discount Days (%)			Discount to Net
	Discount (%)	0-1%	1-2%	> 2%	0-30	31-60	61+	Days Ratio (%)
Buyer Characteristics:								
Size >$10 billion	10	35	58	7	64	33	3	64
Size $0.1- 10 billion	26	37	52	11	78	21	2	60
Industry auto	19	21	50	29	100	0	0	35
Industry diversified retail	5	34	66	0	94	5	1	43
Industry diversified mfg	13	67	30	3	95	4	1	44
Industry grocery	25	31	48	22	84	15	0	87
Industry hard goods retail	58	35	60	5	54	42	4	68
Industry soft goods retail	8	5	86	9	25	75	0	95
Location: Europe	4	19	44	37	70	28	2	80
Location: North America	19	38	58	4	67	30	3	61
Investment Grade: No	17	42	57	1	93	6	1	53
Investment Grade: Yes	12	34	56	10	57	32	2	66
Supplier Characteristics:								
Size >$2 billion	27	34	58	7	66	31	3	65
Size $0.1-2 billion	17	38	54	8	67	30	2	63
Size <$0.1 billion	4	32	58	11	80	19	1	57
Investment Grade: No	13	37	55	9	69	29	2	63
Investment Grade: Yes	12	33	59	7	67	30	3	64

Table 5
Summary Statistics of Regression Variables

This table reports summary statistics of the main regression variables. Sample consists of 29,019 trade credit contracts between 56 large buyers and 24,140 suppliers. Early payment discounts are offered on 3,717 of these contracts. Summary statistics on buyer-specific variables are computed at the buyer level, and summary statistics on supplier-specific variables are computed at the supplier level.

Variable	Obs	Mean	Std. Dev.	Min	Max
Complete sample:					
Log net days	28,187	3.947	0.614	0	5.481
Discount dummy	29,019	0.128	0.334	0	1
Subsample of contracts with early payment discount:					
Discount days	3,462	30.433	20.09	1	180
Discount rate	3,707	0.017	0.008	0.000	0.115
Discount days/Net days	2,634	0.630	0.282	0.017	1
Effective rate	2,584	0.533	0.381	0.017	1
Buyer characteristics:					
Buyer large size	56	0.589	0.496	0	1
Buyer small size	56	0.411	0.496	0	1
Buyer investment grade	56	0.750	0.437	0	1
Buyer North America	56	0.768	0.426	0	1
Industry auto	56	0.161	0.371	0	1
Industry diversified retail	56	0.125	0.334	0	1
Industry diversified mfg	56	0.286	0.456	0	1
Industry grocery	56	0.071	0.260	0	1
Industry hard goods retail	56	0.150	0.354	0	1
Industry soft goods retail	56	0.100	0.296	0	1
Industry technology	56	0.054	0.227	0	1
Industry food and beverages	56	0.036	0.187	0	1
Industry utility	56	0.018	0.134	0	1
Supplier characteristics:					
Supplier large size	24,140	0.113	0.316	0	1
Supplier medium size	24,140	0.324	0.468	0	1
Supplier small size	24,140	0.563	0.496	0	1
Supplier investment grade	24,140	0.320	0.466	0	1

Table 6
Correlation Matrix of Regression Variables

This table reports correlations between the main regression variables. Panel A presents correlations between the explanatory and dependent variables. Panel B presents correlations between the explanatory variables. Sample consists of 29,019 trade credit contracts between 56 large buyers and 24,140 suppliers. Early payment discounts are offered on 3,717 of these contracts. Correlations between buyer characteristics are computed at the buyer level, correlations between supplier characteristics are computed at the supplier level, and correlations between buyer-supplier characteristics are computed at the buyer-supplier level, after aggregating contracts at the appropriate level. Asterisks indicate significance at 1%.

Panel A: Correlations between credit terms, buyer characteristics, and supplier characteristics

	Full Sample		Subsample w/Discount	
	Log net days	Discount dummy	Discount days/net days	Effective rate
Buyer large size	0.26*	-0.18*	0.09*	0.01
Buyer small size	-0.26*	0.18*	-0.09*	-0.02
Buyer investment grade	0.29*	-0.05*	0.20*	0.15*
Buyer North America	-0.37*	0.22*	-0.18*	-0.26*
Industry auto	0.00	0.04*	-0.17*	-0.12*
Industry diversified retail	0.35*	-0.17*	-0.33*	-0.27*
Industry diversified mfg	-0.13*	0.00	-0.32*	-0.26*
Industry grocery	-0.17*	0.09*	0.35*	0.44*
Industry hard goods retail	-0.01	0.47*	0.15*	-0.03
Industry soft goods retail	-0.25*	-0.04*	0.33*	0.34*
Industry technology	-0.02*	-0.18*	n.a.	n.a.
Industry food and beverage	0.05*	-0.06*	n.a.	n.a.
Industry utility	-0.07*	-0.06*	n.a.	n.a.
Supplier large size	-0.11*	0.21*	0.06*	0.08*
Supplier medium size	-0.10*	0.08*	0.00	-0.05
Supplier small size	0.18*	-0.25*	-0.08*	-0.04
Supplier investment grade	0.03*	-0.02*	0.02	0.02

Panel B: Correlations between buyer and supplier characteristics

	Buyer large size	Buyer investment grade	Buyer North America	Industry auto	Industry diversified retail	Industry diversified mfg	Industry grocery	Industry hard goods retail	Industry soft goods retail	Industry technology	Industry food and beverage	Industry utility	Supplier large size	Supplier medium size
Buyer investment grade	0.02													
Buyer North America	-0.12	-0.12												
Industry auto	-0.03	-0.20	-0.10											
Industry diversified retail	0.10	0.09	-0.18	-0.17										
Industry diversified mfg	-0.28	0.00	0.35*	-0.28	-0.24									
Industry grocery	0.23	-0.00	-0.34	-0.12	-0.10	-0.18								
Industry hard goods retail	-0.06	0.13	0.11	-0.19	-0.16	-0.27	-0.12							
Industry soft goods retail	0.04	0.06	0.19	-0.15	-0.13	-0.22	-0.09	-0.10						
Industry technology	0.20	-0.05	0.13	-0.10	-0.09	-0.15	-0.07	-0.10	-0.08					
Industry food and beverage	-0.03	-0.11	-0.35	-0.08	-0.07	-0.12	-0.05	-0.08	-0.07	-0.05				
Industry utility	0.11	0.08	-0.25	-0.06	-0.05	-0.09	-0.04	-0.06	-0.05	-0.03	-0.03			
Supplier large size	-0.02	-0.07*	0.09*	0.11*	-0.10*	0.02*	0.11*	0.21*	-0.02*	-0.14*	-0.00	-0.05*		
Supplier medium size	-0.14*	-0.10*	0.06*	0.11*	-0.06*	0.14*	0.02	0.12*	0.05*	-0.21*	-0.02	-0.08*	-0.25*	
Supplier investment grade	0.08*	0.01	-0.04*	0.02*	0.03*	-0.04*	-0.02*	0.00	-0.05*	0.04*	-0.03*	0.01	0.11*	-0.05*

Table 7
Variance Decomposition Analysis

This table shows the results of an ANOVA analysis of variance of the log ofnet days, discount dummy, and effective interest rate variables. Specifically, we report the contribution of buyer and supplier characteristics in explaining the variance of contract characteristics. Panel A includes supplier specific variables, while panel B shows results of an ANOVA analysis of variance for the subset of contracts from suppliers with multiple buyers when including supplier fixed effects.

Panel A: Full sample

Dependent variable: Log of net days	Degrees of freedom	Partial sum of squares	F-stat	p-value	Contribution to sum of squares (%)
Buyer's size	1	127.94	509.71	0.000	3.60
Buyer's sub-industry	8	1145.83	570.64	0.000	32.28
Buyer's location	3	458.36	608.72	0.000	12.91
Buyer's investment grade	1	117.80	469.34	0.000	3.32
Supplier's size	2	61.83	123.17	0.000	1.74
Supplier's investment grade	1	1.36	5.42	0.020	0.04
Number of obs = 28,187					
Adj R-squared = 0.334					

Dependent variable: Discount dummy	Degrees of freedom	Partial sum of squares	F-stat	p-value	Contribution to sum of squares (%)
Buyer's size	1	9.08	123.38	0.264	0.82
Buyer's sub-industry	8	738.17	1253.48	0.000	66.74
Buyer's location	3	178.13	806.64	0.000	16.11
Buyer's investment grade	1	0.00	0.00	0.980	0.00
Supplier's size	2	0.45	3.04	0.048	0.04
Supplier's investment grade	1	0.21	2.84	0.092	0.02
Number of obs = 29,019					
Adj R-squared = 0.341					

Dependent variable: Effective interest rate	Degrees of freedom	Partial sum of squares	F-stat	p-value	Contribution to sum of squares (%)
Buyer's size	1	3.18	37.97	0.000	1.93
Buyer's sub-industry	5	131.15	312.76	0.000	79.42
Buyer's location	2	9.27	55.25	0.000	5.61
Buyer's investment grade	1	5.36	63.93	0.000	3.25
Supplier's size	2	1.80	10.75	0.000	1.09
Supplier's investment grade	1	0.00	0.05	0.820	0.00
Number of obs = 2,624					
Adj R-squared = 0.427					

Panel B: Supplier fixed effects

Dependent variable: Log of net days	Degrees of freedom	Partial sum of squares	F-stat	p-value	Contribution to sum of squares (%)
Buyer's size	1	16.25	62.14	0.000	0.67
Buyer's sub-industry	8	73.93	35.35	0.000	3.07
Buyer's location	3	35.03	44.66	0.000	1.45
Buyer's investment grade	1	18.24	69.77	0.000	0.76
Supplier fixed effect	2266	1371.56	2.32	0.000	56.89
Number of obs = 6,448					
Adj R-squared = 0.519					

Dependent variable: Discount dummy	Degrees of freedom	Partial sum of squares	F-stat	p-value	Contribution to sum of squares (%)
Buyer's size	1	4.76	67.82	0.450	0.44
Buyer's sub-industry	8	46.82	83.31	0.000	4.31
Buyer's location	3	18.39	87.26	0.000	1.69
Buyer's investment grade	1	0.56	8.05	0.005	0.05
Supplier fixed effect	2393	483.93	2.88	0.000	44.57
Number of obs = 7,273					
Adj R-squared = 0.642					

Dependent variable: Effective interest rate	Degrees of freedom	Partial sum of squares	F-stat	p-value	Contribution to sum of squares (%)
Buyer's size	1	0.01	0.09	0.769	0.00
Buyer's sub-industry	5	9.96	33.14	0.000	8.40
Buyer's location	2	2.66	22.13	0.000	2.24
Buyer's investment grade	1	2.57	42.73	0.000	2.17
Supplier fixed effect	539	52.44	1.62	0.000	44.22
Number of obs = 1,049					
Adj R-squared = 0.576					

Table 8
Net Days

Dependent variable is the logarithm of net days on the contract. Standard errors in regressions (1) and (2) are corrected for clustering at the buyer level. Regressions (3) and (4) include buyer fixed effects. Regressions (5) and (6) include supplier fixed effects and are estimated based on the subsample of suppliers that have multiple contracts. Regressions (2), (4) and (6) include only trade credit contracts with no discounts. Standard errors are reported between brackets. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable: Log net days	Buyer clustered		Buyer FE		Supplier FE	
		Without discount		Without discount		Without discount
	(1)	(2)	(3)	(4)	(5)	(6)
Buyer large size	0.387***	0.388***			0.225***	0.172***
	(0.102)	(0.110)			(0.025)	(0.031)
Buyer investment grade	0.238**	0.293***			0.226***	0.280***
	(0.105)	(0.113)			(0.025)	(0.030)
Buyer North America	-0.488***	-0.556***			-0.443***	-0.499***
	(0.168)	(0.184)			(0.043)	(0.054)
Industry diversified retail	-0.071	-0.136			0.036	-0.067
	(0.127)	(0.155)			(0.060)	(0.071)
Industry diversified mfg	0.095	0.124			0.181***	0.169***
	(0.166)	(0.186)			(0.052)	(0.060)
Industry grocery	-0.763***	-0.760***			-0.534***	-0.535***
	(0.136)	(0.163)			(0.069)	(0.084)
Industry hard goods retail	0.134	0.110			0.067	-0.001
	(0.150)	(0.166)			(0.061)	(0.073)
Industry soft goods retail	-0.262*	-0.230			-0.125	-0.103
	(0.143)	(0.161)			(0.086)	(0.097)
Industry technology	-0.048	-0.044			-0.237***	-0.287***
	(0.304)	(0.321)			(0.062)	(0.069)
Industry food and beverage	-0.148	-0.200			0.100	0.043
	(0.143)	(0.158)			(0.131)	(0.141)
Industry utility	-0.805***	-0.872***			-0.552***	-0.661***
	(0.122)	(0.156)			(0.119)	(0.128)
Supplier small size	0.149	0.145	0.059***	0.068***		
	(0.126)	(0.138)	(0.008)	(0.008)		
Supplier medium size	0.009	-0.011	0.018**	0.022***		
	(0.022)	(0.022)	(0.007)	(0.008)		
Supplier investment grade	0.008	0.006	0.017***	0.017***		
	(0.016)	(0.017)	(0.005)	(0.005)		
Number of buyers	56	56	56	56	56	56
Number of suppliers	24,006	22,028	24,006	22,028	2,267	2,051
Number of observations	28,187	25,298	28,187	25,298	6,448	5,321
R-squared	0.336	0.334	0.036	0.030	0.274	0.284

Table 9
Heterogeneous Effects of Buyer and Supplier Characteristics

In columns (1)-(3), the dependent variable is log net days and regression estimates are based on an OLS model with buyer fixed effects. In columns (4)-(6), the dependent variable is a dummy variable that take a value of one if the trade credit contract includes a discount (two-part contract), and zero otherwise, and regression estimates are based on a logit model with buyer fixed effects. All columns include buyer fixed effects. Standard errors are reported between brackets. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable: Log net days	(1)	(2)	(3)	(4)	(5)
Supplier large size	-0.128***	0.007	-0.058***	-0.061***	-0.056**
	(0.020)	(0.018)	(0.008)	(0.008)	(0.026)
Supplier medium size	-0.060***	-0.048***	-0.042***	-0.042***	-0.070***
	(0.017)	(0.015)	(0.006)	(0.006)	(0.022)
Supplier invst grade	0.017***	0.016***	-0.028**	0.047***	-0.006
	(0.005)	(0.005)	(0.013)	(0.014)	(0.019)
Supplier large size * Buyer invst grade	0.082***				0.072***
	(0.022)				(0.022)
Supplier medium size * Buyer invst grade	0.020				0.020
	(0.019)				(0.019)
Supplier large size * Buyer large size		-0.084***			-0.079***
		(0.019)			(0.021)
Supplier medium size * Buyer large size		0.009			0.012
		(0.016)			(0.017)
Supplier invst grade * Buyer invst grade			0.053***		0.038**
			(0.014)		(0.015)
Supplier invst grade * Buyer large size				-0.035**	-0.012
				(0.014)	(0.015)
No. of buyers	56	56	56	56	56
No. of observations	28,187	28,187	28,187	28,187	28,187
R-squared	0.003	0.004	0.003	0.003	0.004

Table 10
Discounts

Dependent variable is a dummy variable that take a value of one if the trade credit contract includes a discount (two-part contract), and zero otherwise. Regression estimates are based on a logit model. Standard errors in regressions (1) through (2) are corrected for clustering at the buyer level. Regression (3) includes buyer fixed effects (note that by definition, this sample is equivalent to the sample of buyers who have at least one discount). Regressions (4) and (5) include supplier fixed effects and are estimated based on the subsample of suppliers that have multiple contracts. Regressions (2) and (5) only include buyers who have at least one discount. Several industries do not have firms with discounts and are dropped from estimation. Standard errors are reported between brackets. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Dependent variable: Discount	Buyer clustered		Buyer FE	Supplier FE	
		Buyers who have at least one discount			Buyers who have at least one discount
	(1)	(2)	(3)	(4)	(5)
Buyer large size	-1.587**	-0.738		-1.673***	-1.313***
	(0.698)	(0.504)		(0.179)	(0.199)
Buyer investment grade	-0.546	-0.568		-0.779***	-0.835***
	(0.681)	(0.684)		(0.174)	(0.214)
Buyer North America	1.753	0.839		3.365***	3.667***
	(1.270)	(1.079)		(0.386)	(0.527)
Industry diversified retail	0.929	-0.790		2.504***	0.647
	(1.428)	(1.042)		(0.419)	(0.516)
Industry diversified mfg	-0.005	-1.706*		-0.148	-1.442***
	(1.097)	(0.947)		(0.336)	(0.464)
Industry grocery	3.189*	-0.152		5.632***	3.373***
	(1.657)	(1.129)		(0.559)	(0.710)
Industry hard goods retail	2.937***	0.472		3.838***	1.644***
	(0.963)	(1.061)		(0.387)	(0.484)
Industry soft goods retail	-0.068	-1.364		0.647	-0.466
	(1.130)	(1.033)		(0.753)	(0.862)
Supplier small size	-1.215***	-0.601	0.225**		
	(0.344)	(0.419)	(0.095)		
Supplier medium size	-0.466***	-0.409**	-0.098		
	(0.158)	(0.175)	(0.066)		
Supplier investment grade	-0.280***	-0.099	-0.065		
	(0.093)	(0.107)	(0.064)		
Number of buyers	56	34	34	56	34
Number of suppliers	24,140	7,927	7,927	399	305
Number of observations	29,019	10,604	10,604	2,067	1,433
Pseudo R-squared	0.336	0.118	0.002	0.295	0.150

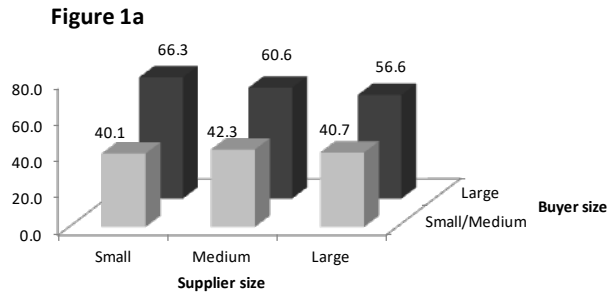
Table 11
Interest Rates

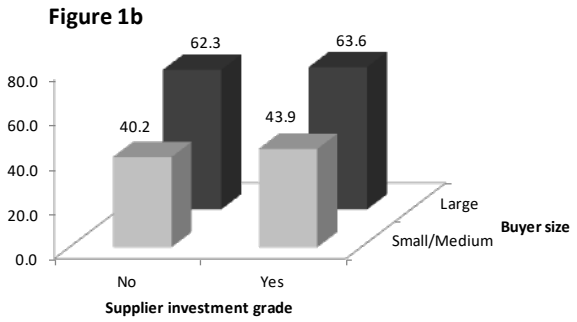
Dependent variable is the natural logarithm of the effective interest rate on the trade credit contract, with the effective interest rate computed as $\left(1/(1-\textit{discount rate})\right)^{360/(\textit{net days}-\textit{discount days})}-1$. In columns 4-6, the effective interest rate is computed by setting the spread between net days and discount days to one for contracts with net days equal to discount days (these contracts are dropped from the regressions in columns 1-3). We winsorize interest rates at 100% before taking logs. Standard errors in regression (1) and (4) are corrected for clustering at the buyer level. Regressions (2) and (5) include buyer fixed effects (note that by definition, this sample is equivalent to the sample of buyers excluding discounts). Regressions (3) and (6) include supplier fixed effects and are estimated based on the subsample of suppliers that have multiple contracts. Several industries do not have firms with discounts and are dropped from the regressions. The regressions also exclude contracts with missing discount or net days information from the regressions. Standard errors are reported between brackets. ***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

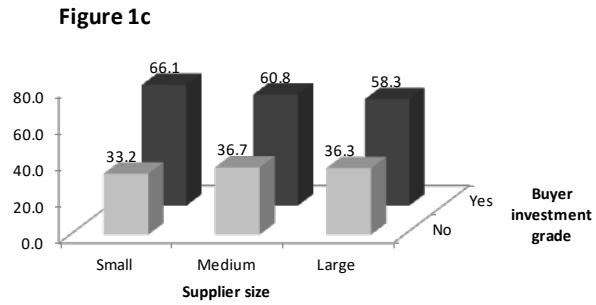
Dependent variable:	Effective interest rate			Effective interest rate with spread set to one if net days equals discount days		
	Buyer clustered	Buyer FE	Supplier FE	Buyer clustered	Buyer FE	Supplier FE
	(1)	(2)	(3)	(1)	(2)	(3)
Buyer large size	-0.177		0.043	-0.174		0.076
	(0.473)		(0.093)	(0.461)		(0.092)
Buyer investment grade	0.396*		0.666***	0.397*		0.676***
	(0.205)		(0.105)	(0.203)		(0.105)
Buyer North America	0.622***		0.806***	0.622***		0.811***
	(0.202)		(0.240)	(0.201)		(0.241)
Industry diversified retail	0.190		-0.241	0.190		-0.230
	(0.311)		(0.309)	(0.309)		(0.310)
Industry diversified mfg	-0.211		-0.177	-0.210		-0.157
	(0.375)		(0.277)	(0.372)		(0.279)
Industry grocery	1.643***		0.972***	1.643***		0.982***
	(0.303)		(0.320)	(0.301)		(0.321)
Industry hard goods retail	0.171		-0.667**	0.206		-0.655**
	(0.464)		(0.305)	(0.458)		(0.305)
Industry soft goods retail	1.078***		0.620	1.083***		0.626
	(0.352)		(0.535)	(0.343)		(0.537)
Supplier small size	0.099	-0.089**		0.101	-0.084**	
	(0.137)	(0.036)		(0.134)	(0.037)	
Supplier medium size	-0.069*	-0.062***		-0.067*	-0.054**	
	(0.036)	(0.024)		(0.037)	(0.024)	
Supplier investment grade	0.035	0.036		0.033	0.037	
	(0.064)	(0.024)		(0.061)	(0.024)	
Number of buyers	34	34	28	34	34	28
Number of suppliers	2,080	2,080	531	2,115	2,115	540
Number of observations	2,584	2,584	1,035	2,624	2,624	1,049
R-squared	0.353	0.007	0.216	0.347	0.005	0.213

Figure 1
Net Days for Suppliers and Buyers of Different Size and Ratings

Figures 1a through 1d report the average net days for different subgroups of supplier-buyer pairs based on supplier size, supplier creditworthiness, buyer size, and buyer creditworthiness.







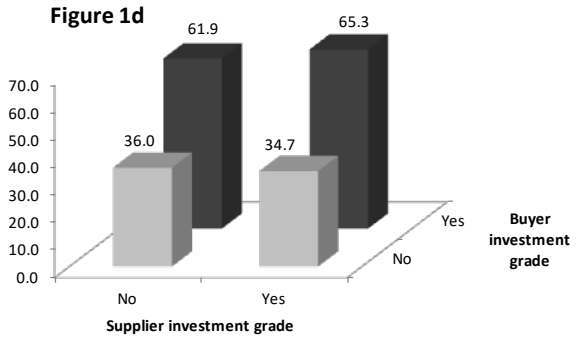


Figure 2
Discount Frequency for Suppliers and Buyers of Different Size and Ratings

Figures 2a through 2d report the fraction of contracts that receive discounts for different subgroups of supplier-buyer pairs based on supplier size, supplier creditworthiness, buyer size, and buyer creditworthiness.

Figure 2a

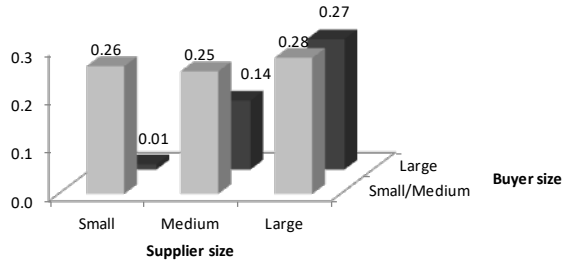


Figure 2b

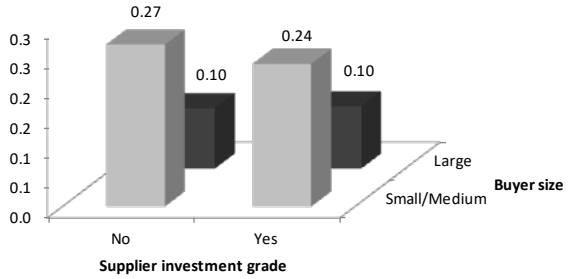


Figure 2c

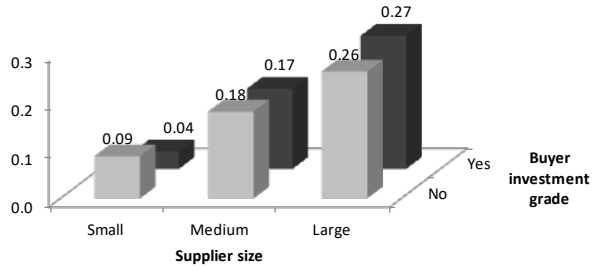


Figure 2d