Does Competition Encourage Cooperation? Evidence from Trade Credit Relationships

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Abstract

The economics literature has traditionally argued that competition negatively affects incentives to establish long-term, cooperative relationships. We provide a model to illustrate that the opposite result may hold in relationships where both parties must make up-front, non-contractible investments, a situation that often characterizes the establishment of surplus-increasing relationships. We provide evidence for this hypothesis in the context of the establishment of trade credit relationships, using data on the supply relationships of firms in five African countries. Because the data include several observations per firm, we are able to utilize firm fixed-effects, thus netting out unobserved firm characteristics that may have been driving results in earlier studies. (JEL Codes: L12, L14)

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Traditionally, economists have argued that competition is likely to reduce incentives to establish long-term, cooperative relationships. For example, in the labor literature, Becker (1975) and others have argued that competition reduces incentives for firms to efficiently train their workers, since workers can threaten to leave the firm after receiving 'general' training. More recently, research examining the effects of credit market competition has suggested that competition may adversely affect the establishment of mutually beneficial relationships between lenders and specific creditors. Petersen and Rajan (1995) argue that this is because when a firm is young, the potential future cashflows of the firm may be high relative to current cashflows. In this case, a lender in a competitive credit market will not charge an 'efficient' interest rate, since the lender will not be able to capture the benefits from a young firm's high profitability in future periods. A monopolist, on the other hand, will retain the firm as a captive customer in later rounds, and will thus have appropriate incentives to lend to the firm in earlier periods. An analogous argument underlies the explanation of Kranton and Swami (1999) for the deleterious effect that legal reforms in India had on village moneylenders. Similarly, in the provision of trade credit, it has been argued that monopoly power may be beneficial, since monopolistic suppliers have the power to cut off the supply of goods to clients that fail to repay their loans: this provides a strong incentive for repayment.

These arguments, while compatible with traditional economic reasoning, are apparently inconsistent with claims often made by managers about actual relational contracts. For example, during a recent series of firm-level surveys in several Sub-Saharan African countries, we asked owners and managers why they provided goods on credit. By far, the most common response was that if the buyer were not provided with trade credit, he would threaten to make his purchases from an alternative supplier.

Embedded in this response is the implication that competition may actually *encourage* firms to invest in cooperative relationships that lead to the provision of trade credit. We are therefore led to ask what the data actually tell us on this issue; furthermore, if it is true that competition *is* positively associated with credit provision, this begs the further question of why firms should choose to compete based on 'relationship building,' rather than lowering price.

In this paper, we provide evidence that greater competition *is* associated with higher rates of credit provision, and give an economic explanation for the 'conventional wisdom' that increased competition may induce greater cooperation between firms, in the form of trade credit. The intuition is that, very often, the establishment of a cooperative relationship involves up-front investments by both parties that must precede the increase in joint surplus created by the relationship. As a result, once the relationship has been established, there are switching costs associated with changing suppliers, which effectively 'locks in' buyers to particular relationships. Thus, competitive firms may compete based on 'relationship' provision (rather than price), since investments in relationships will allow for the establishment of market power – and the extraction of rents – after the relationship has been developed.

The issue then is why competitive firms should be *more* likely to invest in these relationships than monopolistic firms. This seems puzzling at first, since a monopolist may capture all rents ex post, and therefore always has an incentive to make surplus-increasing investments. There is a hold up problem, though: the buyer, aware of the fact that the monopolist will extract all rents after investments have been made, is unwilling to sink *its* investment, and hence the relationship is never established. So, the availability

of an outside option in the form of a new supplier (and the threat of switching) is also essential, if *both* parties are to invest.

In the empirical section that is the primary focus of this paper, we test the predictions of this model in the context of trade credit provision. Using data on supplier relationships from five African countries, we test for the effect of product market competition on the decision to provide trade credit. Consistent with the model, and contrary to traditional economic reasoning, we find a strong, robust, and positive relationship between competition and credit provision. Our econometric results are particularly convincing, because of the richness of our data. Other studies that have looked at the determinants of trade credit have used firm-level data in the estimation. This is problematic, since any cross-sectional estimations using firm-level data will be vulnerable to biases resulting from unobserved firm 'quality' that is correlated with credit worthiness. In this paper, since we have several observations per firm, we are able to utilize firm fixed-effects, thus netting out unobserved firm characteristics that may have been driving results in earlier studies.

We further provide some evidence in support of the 'lock in' hypothesis, with regressions showing that the higher likelihood of competitive firms obtaining credit occurs primarily in relationships that have existed for several years, and have therefore had time to allow for trust to develop. Also, we find that, among competitive relationships, those where a firm makes the bulk of its purchases from a single supplier are more likely to result in the provision of credit (once again, we argue that this observation stems from lock in).

This paper is related to a number of literatures in economics. Most obviously, we build on previous work in the area of relational contracting, which often uses trade credit

access as a proxy for interfirm trust. Recent significant contributions to this literature include Fafchamps (2000), and particularly McMillan and Woodruff (1999). The latter paper looks systematically at the determinants of credit access among small firms in Vietnam; among their main reported findings is evidence that competitive suppliers are *less* likely to provide goods on credit, a result that is the opposite of those contained in this paper. We will reconcile these apparently contradictory findings in a later section.

More generally, this paper contributes to the still rather sparse literature on interactions between financial markets (and financing constraints) and product markets that is beginning to receive some attention. For example, recent work by Chevalier and Scharfstein (1996) and Chevalier (1995) looks at pricing decisions by supermarkets as they relate to capital structure and liquidity constraints. In some sense, in this paper we look at the converse situation, examining how competition in product markets may impact financing conditions

The rest of this paper proceeds as follows: In Section 1, we provide a simple model of relationship development and quality provision to focus on the assumptions and structure of the lock-in theory. Section 2 discusses in greater detail why we might expect suppliers in competitive markets to use trade credit in particular to lock in customers, and examines some of the implications of our framework. The data used in this paper are described in Section 3. In Section 4, we provide our empirical results, as well as a discussion of potential omitted variable bias. Since our results seem to contradict those of several recent papers, we also provide a reconciliation of these differing results in this section. Finally, we conclude in Section 5 with some implications of our results.

1. A Model of Costly Quality Provision

Consider a market with N buyers and, for simplicity, either a single seller (monopoly) or two sellers ('competition').[1] Each buyer purchases either a single unit of output, or chooses not to purchase anything at all. This good may be of high or low quality, and the buyer derives utility V_H and V_L from each type of good respectively ($V_H > V_L$). Now, in keeping with the spirit of the discussion in the introduction, before a high-quality good may be provided, the seller and buyer must first make initial investments I_S and I_B respectively. Subsequently, the low quality good may be produced at a cost of C_L, and the high-quality good may be produced at a cost of C_H (conditional on the initial investments having already been made). Thus, each transaction yields a surplus of $S_i = V_i - C_i$, where $i \in (L,H)$ is the type of transaction. We assume that $(S_H - S_L)/r > I_S + I_C$, where r is the discount rate, so that it is jointly beneficial for investment in high-quality production to take place. In the context of this 'production function', the agents play the following game:

1. The buyer chooses a seller.
2. Each party has an opportunity to make a non-contractible investment; if both parties invest, the buyer may obtain goods of quality H from this supplier in all subsequent periods.
3. The seller offers divisions of the surplus generated by each type of product: $D_i = \{A_i, S_i - A_i\}$, where the first term A_i is the value obtained by the seller from the transaction, and once again, $i \in (L,H)$ is the type of transaction.

[1] In the simple framework utilized here, the results generalize easily to many sellers.

4. The buyer may purchase a high-quality good from the seller that it has chosen to be matched with; a low quality good may be purchased on the 'spot market' from either seller.

It is readily apparent that, in this context, investment will never take place if the seller is a monopolist: the buyer knows that having made his investment, the (monopoly) seller will extract all ex post surplus, so the buyer never makes the initial investment. By contrast, in the competitive case, an abundance of equilibria may be supported. Certainly, there are equilibria in the competitive case that involve no cooperation: for example, if buyers expect that in every period, both sellers will offer $D_H = \{S_H - S_L, S_L\}$ and $D_L = \{0 , S_L\}$, i.e., just enough to prevent switching in that round, then there is never any incentive to invest, and the economy is stuck in a low quality equilibrium.

However, we claim that competition also allows for equilibria involving investment and the sharing of the additional rents generated by these (socially efficient) investments, subject to certain conditions. One set of strategies that supports a high quality equilibrium is given by a slight variant on the so-called loyalty-boycott strategy (ours will be a 'rehabilitative' loyalty-boycott strategy) under which the buyer is 'loyal' to its seller, as long as the seller plays the equilibrium strategy, and reacts to any deviation by boycotting, whereby the buyer will never buy from the most recent seller to deviate from equilibrium strategies.[2] The basic point underlying the equilibrium is that the establishment of relationship-specific capital (and hence lock-in) creates an incentive for

[2] This 'rehabilitation' is necessary, so as to always allow the buyer to have an outside option with a payoff above the spot market level. Otherwise, the buyer, having got to the point where he wanted to boycott all sellers for deviations, would only have S_L per period as his continuation payoff, which could not support investment with the last seller. Hence, cooperation would unravel. A more 'vindictive' equilibrium can be

the seller to invest, while the possibility of establishing a relationship with a new seller gives the buyer a strong enough bargaining position to extract rents above S_L.

To be more precise, a set of strategies that supports a high quality equilibrium is given by the following:

In the first round, for all buyers and sellers:

1. Buyer randomly matches himself with a seller.
2. Both parties choose to invest.
3. Seller announces divisions $D_L = \{0 , S_L\}$, $D_H = \{A_H , S_H - A_H\}$, where A_H may take on any value such that $\max\{rI_S , r(S_H - S_L)\} \leq A_H \leq S_H - S_L - rI_B$, but is fixed for the entire game.
4. Buyer chooses high quality as long as his share of the high-quality division is larger than any division offered for the low quality good by any seller. Otherwise, pick highest low-quality offer.

In subsequent rounds:

1. Buyer stays with the same seller, as long as no deviation from equilibrium offers took place in the previous round. Otherwise, switch sellers.
2. Both parties invest, if investments have not already taken place.

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sustained if there is entry of at least one new seller (in expectation) in each period, thereby generating a new outside option for investment.

3. If seller was most recent 'cheater', make 'opportunistic' offer $D_L = \{0 , S_L\}$; $D_H = \{S_H - S_L , S_L\}$. If not most recent cheater, offer $D_L = \{0 , S_L\}$, $D_H = \{A_H , S_H - A_H\}$, where A_H is defined above.
4. Buyer chooses high quality as long as his share of the high-quality division is larger than any division offered for the low quality good by any seller. Otherwise, pick highest low-quality offer.

Proof that this is a subgame perfect equilibrium is straightforward: the (annualized) additional surplus generated by investments, $S_H - (S_L + r(I_S + I_B))$, is split between buyer and seller, with each party also receiving a return to cover her investment and opportunity costs ($rI_S \leq A_H \leq S_H - S_L - rI_B$), and is large enough that the seller does not have any incentive to cheat ($r(S_H - S_L)\} \leq A_H$). If, at any point, the seller deviates from equilibrium offers, any future transaction with that seller will involve an opportunistic offer $S_H - S_L$ (until another deviation takes place) so that the buyer is better off switching suppliers, making a new investment, and generating relationship rents with the other seller. In the case where both sellers have deviated in the past (and hence no new investments are required for the provision of high quality), it is similarly credible for the buyer to threaten to switch in reaction to any deviations.

It is important to be clear about what is driving the results in this model: if investment is only required by the seller in order to generate high quality, then a monopolist will always invest an extract the additional rents through higher prices. Moreover, these investments must be non-contractible, as otherwise the monopolist would simply pay her customer to make the investment.

2. Competition and Investments in Credit Provision

In the literature on supplier credit, the relationship-destroying element of competition has traditionally been emphasized – since buyers in competitive markets can switch suppliers, firms may reneged on debt payments to one supplier, and move on to making purchasers from another.

This simplistic description ignores the initial relationship-specific investments that must precede the provision of supplier credit, which sets up a situation characterized by the model in the previous section. As several recent theoretical papers have shown, in the presence of 'non-cooperative types', relationships will often be characterized by the gradual build-up of trust (see, for example, Ghosh & Ray, 1996). In the context of trading relationships, this suggests that the provision of credit will develop slowly, only as the supplier comes to learn more about the buyer and his 'type'. This makes it potentially very costly to switch suppliers, since credit will only be provided after this initial investment in relationship building has been made with the new supplier.

It is certainly possible that other types of relationship-specific investments – such as making special quality adjustments and learning more about the precise needs of a customer – could similarly be used to gain market power: our model in the previous section is very general. We would argue, however, that credit is special in several ways. Most importantly, the monopoly power derived from credit relationships may be intensified by adverse selection among firms searching for new suppliers, since suppliers will be more likely to allow lapses in relationships with firms that are poor credit risks to begin with. This would similarly make it difficult for suppliers to try to lure buyers away

from their competitors – presumably, 'low-quality' buyers would be the first to be 'let go' by their current suppliers.

Finally, much of the burden of up-front investment required to establish a credit relationship will be borne by the buyer: effort is required to convince a supplier that credit should be forthcoming, by soliciting referrals, opening up one's accounts and operations so as to increase transparency, and so forth. Many of the firms that we interviewed did not keep any formal accounts at all, and among those that did, many cited the need to access credit, either from a bank, or from a supplier, as a primary motivating factor. As we saw in the previous section, these up-front investments by buyers are crucial in deriving the lock-in result.

This story yields several corollary predictions. Suppose that, as hypothesized in this paper, it is true that credit will only be provided in competitive markets after the establishment of trust, i.e., after an initial period of learning. Then, among very young relationships, we should not see a higher rate of credit provision in more competitive industries. The greater likelihood of obtaining credit should only occur in older relationships, where trust has been established.

Another, somewhat more subtle, prediction of the framework outlined above relates to the percentage of a firm's inputs that are sourced from a given supplier. Obviously, to the extent that goods are simply purchased in a spot market type of environment, we do not expect 'lock in' to occur. In other words, firms that source the same input from many suppliers are unlikely to rely heavily on any particular relationship. Thus, we expect lock in to be correlated with the extent to which a firm relies on a single supplier (or very small number of suppliers) for a given input.

3. Data

The data used in this paper come from surveys administered by the Regional Program on Enterprise Development (RPED) at the World Bank during 1992-95, to five former British colonies in Sub-Saharan Africa (Ghana, Kenya, Tanzania, Zambia, and Zimbabwe). Three rounds of the survey were conducted in each country; where possible, the same firms were visited in each round. The survey instrument covered a wide variety of topics including: basic statistics on the firms' operations; the history of the firms and their owners; use of technology; competition and competitors (only in the later rounds); labor; financing and contractual relations; conflict resolution; regulation; infrastructure; and use of business support services.

The firms were chosen to reflect a size-weighted representative sample, by industry, of the universe of firms in each country. Because of the difficulty in assessing levels of industrial activity in these African countries, it is far from certain that the sample is truly representative, but it is not clear that this substantively affects the interpretation of our results.

Whenever one uses data from developing countries, concerns arise regarding data quality. While we are very sympathetic to these apprehensions in general, we believe that they are minimal with regard to the analyses in this paper. Most importantly, errors generally arise from misreporting or mismeasurement of accounting data, such as sales; capital; expenses. All critical regressions below do not require these data as controls, largely because of our fixed effects specifications. In fact, almost all of our results are derived using only very simple, survey-based variables that are relatively straightforward for the survey respondents to estimate. Deliberate misreporting, while also often a concern, is unlikely to be driving our results. First of all, the survey was carried out by

an independent organization (as opposed to the government), so there was less incentive for managers to mislead or withhold information. Furthermore, it is unclear why misreporting would be systematically correlated with any of the variables that we use.

The data are drawn primarily from the Finance section of the first round of the survey, which included information on the firm's relationships with up to three of its primary suppliers. It could potentially have been very useful to utilize time series variation in the data, to further analyze our conjectures. Unfortunately, virtually all questions related to trade credit were dropped from later rounds of the survey, so we are forced to rely exclusively on the first round data.

We considered the following variables to be relevant for our analyses:

The data contain information on the firm's relationships with the primary supplier of each of its three most important inputs. Thus, there are up to three observations per firm. Obviously, of crucial interest for this paper is the form of payment that was required by the supplier. Three options were available in the survey: credit; cash; and advance payment. Virtually all relationships were characterized by credit or cash transactions. Responses to this survey question were used to construct the dummy variable CREDIT, that takes on a value of one if purchases with a particular supplier were largely credit based. This will be the dependent variable in most of what follows.

To proxy for the extent of product market competition, we utilize responses to the question, "Is this the only possible supplier available for this raw material or input?" These responses were used to construct a variable that essentially reflects whether the

supplier has monopoly power: COMPETITION, takes on a value of one if there is more than one supplier available to provide the materials purchased.

There are several relationship-level characteristics that likely affect credit access, and may be correlated with supplier market structure, and hence must be included as controls. Particularly important is the length of relationship with the supplier; if, as suggested above, trust (required for credit provision) is a gradual process, length of relationship will be an important determinant of credit provision. We included as a control LENGTH, the reported length of the relationship with a given supplier, in years. Generally, we might expect the omission of this variable to bias our results *towards* zero, for the following reason: to the extent that switching among suppliers is easier when there exist multiple suppliers, we expect the average length of relationship to be shorter in this situation. Hence, to the extent that COMPETITION were to proxy for LENGTH, the bias would be downward. This is consistent with the data, where their raw correlation between LENGTH and COMPETITION is -0.2.[3]

Frequency of interaction may also be an important predictor of credit access: frequent transactions will put a supplier in a better position to retaliate quickly for non-payment, suggesting a positive relationship between credit provision and frequency of purchase. From a demand perspective, there will be less need for credit between parties that transact frequently, which argues for a negative relationship. Overall, the predicted effect is ambiguous. Frequency of interaction could potentially be correlated with market structure as well: competitive suppliers may be prevalent in areas with heavy industrial

[3] In the simplest specification, including only COMPETITION and firm fixed effects, the coefficient on COMPETITION is only slightly smaller than in the results given below, and is still significant at the 1 percent level.

activity, where frequent interaction would also be possible.[4] We define FREQUENCY as the frequency with which purchases were made from a given supplier. These values range from daily (FREQUENCY =6) to yearly (FREQUENCY=0). Firms were given the option of responding that the frequency of interaction was "Occasional" – we omit observations where this rather non-specific response was given.

Finally, there is a substantial literature relating social ties to credit provision. In particular, Fafchamps (2000) has argued that ethnic networks may therefore be an important determinant of credit provision. To control for this effect, we included the variable ETHNIC, a dummy variable that takes on a value of one if both the firm and its supplier were Asian, or both were European. This variable is not available for Ghanaian firms.

Since we will be using a firm fixed-affects specification in most regressions, firm-level characteristics are of secondary importance. However, for the purposes of comparison with previous work, we included some firm-level regressions, and therefore require a number of additional covariates.

The primary concern in firm-level regressions is controlling for firm quality and reputation, which is surely correlated with credit access. The proxies for reputation/quality that we use are the following:

SIZE - Following on previous work using the RPED data, we use total employment (given by (full-time workers) + 0.5*(part-time workers)) as a measure of firm size.

OVERDRAFT- dummy variable; takes on a value of one if the firm has access to overdraft facilities.

AGE – firm's age.

[4] The reality is that FREQUENCY and COMPETITION are remarkably uncorrelated ($\rho = 0.0000$).

Additional controls that are commonly employed included ethnicity and gender dummies; hence, we include the following:

ASIAN – dummy variable that takes on a value of one if the firm's owner is of Asian descent. This variable is not available for Ghanaian firms. Ethnic networks, as described above, may be an important consideration in credit provision.

EURO – dummy variable that takes on a value of one if the firm's owner is of European descent. This variable is not available for Ghanaian firms.

GENDER – dummy variable equal to one if the firm's owner is female. To the extent that women are excluded from social networks, this may be an important determinant of credit access.

Finally, since subsidiaries of larger firms may obtain goods on credit from their parent companies, or may have the parent company act as guarantor, we include SUBSIDIARY, a dummy variable denoting whether the firm is a subsidiary of a conglomerate.

Industry dummies are also included where appropriate. The sectors covered by the survey include: Food Processing; Textiles and Clothing; Wood and Furniture; and Metal Products.

The original sample included data on 1045 firms; of these, 19 did not report any information on their supplier relationships, and were thus dropped from the sample. The remaining 1026 firms included data on a total of 2494 supplier relationships. Relationship-level observations were dropped where information on the length of the relationship (174) or the competitiveness of the supplier market (9) was missing (number of observations dropped in parentheses; deletions done sequentially). This yielded a

sample of 960 firms with 2311 relationships. For the random effects regressions, SIZE was not available for some firms, thereby reducing the sample in these regressions to 2202 observations. Basic summary statistics for the firms are listed in Table 1a.

Now, firms for which there is no variation in credit access are problematic for any within-firm binary choice regressions. We follow Chamberlain (1986), in running conditional logit regressions, which automatically excludes firms without variation in CREDIT. Thus, these regressions will be limited to a subsample of observations consisting of 188 firms with 527 relationships. Summary statistics of this smaller sample are listed in Table 1b. While there are obvious systematic differences between the two groups of firms, we are relatively unconcerned with sample selection, because of our fixed effects.

4. Results

Specification

For ease of interpretation, linear regression models with heteroskedasticity-corrected errors are often used in estimating binary choice models. However, given some of the complications associated with short-panel fixed effect models, this simplified approach could lead to biased coefficients. In the analyses that follow, we will utilize two different models: random effects logit, and conditional fixed effect logit (as developed by Chamberlain, 1980). As already mentioned above, the sample size will be considerably smaller for the fixed effect specifications.

We begin with the random effects model. As always, there is considerable concern that the random effect will be correlated with some relationship-level covariates that reflect firm 'quality'. We include standard firm-level controls (described above in the data section). Also, we include the means of the various relationship-level variables, an approach suggested by Chamberlain (1984). These means will pick up some of the dependence that the random effect may have on these relationship-level variables. For example, it may be that firms which generally form long-term relationships also tend to be trustworthy and reliable. This could potentially bias upward the coefficient on LENGTH. Similar problems might also arise with other relationship-level variables.

Thus, we consider the following specification:

$$P(CREDIT_{si} = 1) = \Lambda(\beta_1 * LENGTH_{si} + \beta_2 * COMPETITION_{si} + \beta_3 * FREQUENCY_{si} + \beta_3 * ETHNIC_{si} + \beta_5 * \text{avg}(LENGTH)_i + \beta_6 * \text{avg}(COMPETITION)_i + \beta_7 * \text{avg}(FREQUENCY)_i + \beta_8 * \text{avg}(ETHNIC)_i + \beta_9 * \log(SIZE_i) + \beta_{10} * OVERDRAFT_i, + \beta_{11} * AGE_i, + \beta_{12} * EURO_i, + \beta_{13} * ASIAN_i, + \boldsymbol{IND_i}, + \boldsymbol{COUNT_i} + \eta_i + \varepsilon_{si})$$

where i is a firm index and s is a relationship index; $\boldsymbol{IND_i}$ is a vector of industry dummies and $\boldsymbol{COUNT_i}$ is a vector of country dummies; $\Lambda(.)$ is the logistic function; η_i is a firm-specific random effect, and ε_{si} is the error term.

The results are listed in Table 2. The coefficient on the variable of primary interest in this paper, *COMPETITION*, is positive, and generally significant at 5 percent or higher. The coefficient's size, 0.9, implies that for a firm with 'average' characteristics, the probability of obtaining credit increases from 40 to 60 percent in switching from a monopolistic to a competitive supplier market (holding buyer characteristics constant).

Thus, among our sample of African firms, there is strong evidence in support of our claim that product market competition may encourage the formation of cooperative relationships, in the form of trade credit provision. This is a very large effect, analogous to the difference in credit access between a new relationship and a relationship that has existed for more than 20 years already (see below). So, competition seems to go a long way in inducing firms to provide credit.

Note that the coefficient on avg(*COMPETITION*) is occasionally negative, though not significant. There are numerous reasons that could account for this, relating to unobserved heterogeneity across firms, which highlights the importance of having within firm variation. To take just one example, firms in more densely packed industrial areas may be more likely to have competitive suppliers. Such areas may also have more effective legal enforcement or informational diffusion mechanisms leading to implicit enforcement, both of which could facilitate the provision of credit. To flip the argument around, firms with monopolistic suppliers may be in isolated areas, where enforcement is easier due to the relatively small size of the business community. Hence the ambiguous observed relationship between avg(*COMPETITION*) and *CREDIT*.[5]

The other coefficients are, for the most part, as expected, and several are of interest in further illustrating the importance of utilizing within firm variation. Among the relationship specific variables: the coefficient on *LENGTH* is positive, and generally significant, consistent with the idea that there is a gradual build-up of trust that precedes the provision of credit.

[5] Not surprisingly, therefore, if the data are collapsed into a single observation per firm, and the regressions run using a simple cross-section with avg(*CREDIT*) as the dependent variable, the effect of competition appears to be insignificant.

Interestingly, in the regressions that include *FREQUENCY*, its coefficient is positive, and marginally significant, while the coefficient on avg(*FREQUENCY*) is negative. One interpretation of these results is the following: frequent interaction should make it easier to 'punish' non-payment, and should thus promote the provision of credit (hence the positive coefficient on *FREQUENCY*). On the other hand, firms that interact frequently with their suppliers are more likely to be credit constrained, and hence poor credit risks (thus the negative coefficient on avg(*FREQUENCY*). So, a naive cross-sectional regression would yield a zero coefficient on *FREQUENCY*. The coefficient on *ETHNIC*, which directly measures the presence of ethnic network effects, is positive and marginally significant.

Among the firm-level variables, firm size, a good proxy for a company's reliability and reputation, is large and significant. The coefficient on *OVERDRAFT* is also positive and strongly significant. While it might be tempting to interpret this as representing a complementarity between formal (bank) and informal (trade credit) financing, this would not be appropriate – access to overdraft facilities is probably a signal of (unobserved) firm quality, which might also account for a firm's trade credit access.

AGE is relatively small in size and significance, which is somewhat surprising – the age of an establishment should be a reasonably good proxy for its reliability in repaying its debts (though perhaps it does not add any information after controlling for *LENGTH*). Finally, consistent with previous work in this area (see, for example, Fafchamps, 2000), the coefficients on the two 'ethnic' dummies are also positive, and the Asian dummy is significant. While this has generally been interpreted as resulting from ethnic networks that facilitate contract enforcement, it may also be driven by unobserved heterogeneity across ethnic groups (see Fisman, 1999).

While we have tried to control for unobserved quality that might be correlated with our relationship-specific regressors, and have included firm-level averages as regressors, omitted variable bias is always a potential problem with the random effects models. For this reason, all of our preceding regressions were repeated using Chamberlain's (1980) conditional fixed-effects model. Because the maximum likelihood estimation in this case is conditional on the total number of suppliers from which a firm receives goods on credit, all observations for which there is no within firm variation in *CREDIT* will drop out of the maximum likelihood expression.[6] This significantly reduces the sample size (188 firms with 527 relationships). Our fixed-effects specification is as follows:

$$P(CREDIT_{si} = 1) = \Lambda(\beta_1 * LENGTH_{si}, + \beta_2 * COMPETITION_{si}, + \beta_3 * FREQUENCY_{si}, + \beta_4 * ETHNIC_{si} + \alpha_i)$$

The results are listed in Table 3; the coefficients are very similar to those obtained with the random effects model, suggesting that the firm-level means do a reasonable job of controlling for unobserved quality as it may be correlated with relationship-level regressors. The variable of primary interest, *COMPETITION*, is positive, and is significant at 1 percent in the basic regression; its size is remarkably unaffected by the inclusion of additional controls, though it significance diminishes somewhat as the sample size is reduced.[7] Note that the size of the coefficient on *COMPETITION* is very

[6] Intuitively, a firm that receives credit from all of its suppliers would require an infinite fixed effect; one that receives no credit would require a fixed effect of negative infinity. See, for example, Greene (2000) for a brief discussion.

[7] To the extent that the coefficient changes across regressions, this is actually due to changes in the sample, rather than the inclusion of additional controls.

similar to its size in the random effects regressions. The other coefficients are also very similar to their counterparts in the random effects regressions.

Additional Evidence of 'Lock-in'

In the previous section, we made some additional predictions that should hold if the supplier lock-in hypothesis were true. First, we claimed that lock-in should lead to greater provision of credit in competitive markets only after an initial period of trust development. A prediction stemming from this observation is that competition should matter more among older relationships, i.e., the interaction term *LENGTH*COMPETITION* should be positive. Results in support of this prediction are listed in Table 4; note, however, that the interaction term's coefficient in the fixed effects regression is not significant at conventional levels. The coefficient on the uninteracted *COMPETITION* term is only slightly greater than zero, implying that for new relationships (i.e., *LENGTH* = 0), the probability of obtaining credit is virtually identical for both competitive and monopolistic suppliers.

Additionally, we predicted that, restricting ourselves to the subsample of competitive suppliers, those supplying inputs that were purchased from many different suppliers simultaneously should be less likely to receive credit, since these relationships may be characterized more as spot market transactions. To examine this hypothesis, we further define *PERCENTAGE* as the percentage of a given input that comes from the supplier listed in the data. Values of *PERCENTAGE* for suppliers in competitive industries range from 10 to 100 (obviously, by definition, *PERCENTAGE* is 100 for monopolists).

Table 5 reports the relationship between *PERCENTAGE* and *CREDIT*. In the first column, the coefficient on *PERCENTAGE* is slightly positive, though not significant. To allow for a more flexible specification, we add a squared term in the second column. The data seem to strongly prefer this specification, and exhibit apparently very strong diminishing returns. The effect of *PERCENTAGE* is positive over the entire relevant range, diminishing to close to zero, as reliance approaches 100 percent.

Robustness: Supplier Heterogeneity & Consistency Across Countries

While our firm fixed-effects have credibly controlled for within-firm heterogeneity, it is at least plausible that unobserved heterogeneity across suppliers may be driving the results. Unfortunately, we have relatively little information on the firms' suppliers. Additional variables that were available include: whether the supplier is public or private; the supplier's familial relation to the firm's owner; whether the supplier is foreign or domestic. The addition of these variables did not alter the results on any of the variables in Table 2 or 3, and were not included in the table because of the further reduction in sample size that results from their addition.

Of particular concern is the fact that we do not control for the supplier's size, which would almost certainly be correlated with the decision to provide credit. Not surprisingly, large firms are more likely to provide credit to their customers (see, for example, Fafchamps, 1997). Moreover, using data on competition from the second round of the RPED surveys, we find a positive correlation between monopoly power and firm size (i.e., large firms are more likely to be monopolists). If this is the case, then all else equal, a monopolist should be more likely to provide credit, simply by virtue of its greater size. Hence, the omission of this variable probably biases our results *towards*

zero. We can, to some limited degree, examine this possibility with the available data. In particular, we know the rank ordering of the value of purchases from each of the three suppliers. We define *SUPPLIER SIZE* as this rank ordering (i.e., *SUPPLIER SIZE* = 1 for the most important supplier; etc.). Assuming that suppliers that provide a larger volume of inputs are larger firms, adding this variable should, to some extent, give us a sense of the effect of supplier size. When *SUPPLIER SIZE* is included as a regressor, its coefficient is of the predicted sign and very significant; as expected, once supplier size was controlled for, even in this highly imprecise manner, the coefficient on *COMPETITION* increases (to about 0.95).

Another concern may be heterogeneity across countries. In particular, there are vast differences in key variables, specifically access to credit, which goes from 0.08 (Tanzania) to almost 0.7 (Zimbabwe). To ensure that no particular country is driving our result, we repeated our analyses for each country individually. The coefficient on COMPETITION was positive in all countries (except Tanzania, where there were insufficient observations to calculate standard errors[8]), taking on values from 0.16 to 0.95. We cannot reject the hypothesis of equal coefficients, though any test of such a hypothesis is statistically very weak.[9]

[8] In any event, Tanzania presents a special situation, and a strong case may be made for excluding Tanzanian firms from the analysis altogether: since a majority of the Tanzanian business community is Moslem, business owners are reluctant to talk about credit-related issues, since usury is disallowed under Islam. The fact that credit might be provided without reference to interest rates does not alter the fact that managers are very reluctant to admit to being involved in any kind of credit transaction, which accounts for the very low level of reported credit provision in the Tanzanian dataset. Among Asian businessmen in Tanzania, which is almost exclusively Moslem, the reported rate of credit transactions was exactly zero. If we do exclude Tanzania, the coefficient on COMPETITION is essentially unchanged.

[9] We also could not reject the joint hypothesis that all coefficients are zero; again, this is simply because the statistical test is so weak.

Our results hold reasonably consistently across our sample. It is therefore quite puzzling that the results in this paper apparently contradict those of McMillan and Woodruff (2000), who examine the determinants of credit access in Vietnam. They report that, in their sample, there is greater provision of credit for firms that would have trouble finding alternative suppliers, i.e., firms whose suppliers do not face competition. We believe, however, that these results may readily be reconciled with our own. Specifically, McMillan and Woodruff's results are about lock-in, rather than ex ante competition. In their survey, they asked firms two questions about their suppliers that relate to competition: how long it would take to find alternative suppliers if the current one disappeared; and whether they purchased the input from multiple suppliers. Note that both of these questions deal with the extent to which firms are locked into particular relationships, and are not about incentives to establish relationships initially. In other words, their regressions are much more closely analogous to our regressions that look at the percentage of a firm's inputs that are purchased from their most important supplier. When framed this way, the results are very close to those reported here. In a sense, the only difference is that we are much better able to control for unobserved firm quality because we have multiple observations per firm.[10]

Our results must also be reconciled with those of Petersen and Rajan (1995). The basic difference is that their data come from the U.S., where formal financial institutions are far more prevalent than in sub-Saharan Africa. Also, with active credit rating agencies, information on credit histories would be readily available. In other words, one

[10] Finally, the random effects regressions sometimes produce a negative sign on avg(*COMPETITION*), i.e., firms that are generally in competitive environments are less likely to obtain credit. This is a firm-level (as opposed to relationship-level) effect that would be a part of McMillan and Woodruff's measure of competition. If it were to dominate the competitive-relationship effect, this could also account for the difference in results.

would not expect credit to be a primary means of locking in customers. Also, there is the fact that the Peterson and Rajan are looking at lending institutions, so credit is not the hook to obtain and keep customers for some other product. Rather, credit *is* the product, so it is peculiar to think about any distinction between price competition and credit competition in this context.

6. Conclusion

In the economics literature, it has traditionally been argued that monopolists will be more likely to invest in surplus-increasing relationships. This paper provides a model where the opposite may hold, and looks at data from the establishment of trade credit relationships to provide evidence on this question. Since our results persist even with the inclusion of firm fixed-effects, it is unlikely that the observed relationship between competition and credit access is being driven by differences across firms in different types of markets.

Note, however, that the welfare and policy implications of the development of credit relationships are not entirely clear. We have argued that the primary reason that competition may promote credit provision is that it allows firms in competitive markets to gain some degree of market power over their customers. To the extent that this allows a firm to extract rents through monopoly pricing, some of the benefits of competition may be attenuated. In more developed countries, this problem of credit 'lock in' has been mitigated by the existence of credit rating agencies that track companies' credit histories. Such organizations are only beginning to emerge in the less developed economies from which we draw our data (see, for example, Fisman, 2000). Our results suggest that the development of such institutions could be a tremendous boon for buyers – not only would

increased credit information facilitate the provision of *more* credit, it would also diminish the monopoly power that proprietary credit relationships may engender.

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Table 1a - Summary Statistics

	Full Sample	Ghana	Kenya	Tanzania	Zambia	Zimbabwe
Size	122	63.36	87.1	98.9	82.31	271.72
	(940)	(143)	(205)	(207)	(197)	(188)
AGE	17.93	15.23	17.94	14.99	17.66	23.36
	(959)	(145)	(210)	(208)	(201)	(195)
OVERD	0.46	0.25	0.63	0.25	0.46	0.69
	(954)	(144)	(209)	(208)	(202)	(191)
SUBSID	0.03	0.01	0.01	0.02	0.01	0.1
	(960)	(145)	(210)	(208)	(202)	(195)
ASIAN	0.3		0.53	0.24	0.27	0.13
	(703)		(194)	(165)	(173)	(171)
EURO	0.15		0.01	0	0.13	0.47
	(703)		(194)	(165)	(173)	(171)
GENDER	0.87	0.76	0.92	0.94	0.89	0.81
	(751)	(119)	(183)	(162)	(156)	(131)
Number of Obs. In Parentheses						
CREDIT	0.32	0.32	0.4	0.08	0.16	0.63
	(2311)	(306)	(447)	(492)	(525)	(541)
LENGTH	10.23	6.5	8.38	8.84	9.45	15.87
	(2311)	(306)	(447)	(492)	(525)	(541)
COMPETITION	0.83	0.94	0.87	0.83	0.8	0.78
	(2311)	(306)	(447)	(492)	(525)	(541)
ETHNIC	0.08		0.14	0.05	0.04	0.11
	(1478)		(338)	(385)	(447)	(308)
FREQUENCY	2.38	2.23	1.99	2.76	2.56	2.34
	(1903)	(177)	(431)	(379)	(431)	(485)

Table 1b - Summary Statistics with Sample Resticted to Firms with Variation in CREDIT

	Full Sample	Ghana	Kenya	Tanzania	Zambia	Zimbabwe
Size	254.87	101.86	133.73	516.61	164.02	482.81
	(188)	(43)	(31)	(14)	(47)	(48)
AGE	22.41	17.44	17.53	23	25.74	26.72
	(188)	(45)	(32)	(14)	(47)	(50)
OVERD	0.66	0.32	0.88	0.71	0.74	0.72
	(187)	(44)	(32)	(14)	(47)	(50)
SUBSID	0.04	0	0.03	0	0.02	0.1
	(188)	(45)	(32)	(14)	(47)	(50)
ASIAN	0.36		0.66	0.63	0.44	0.05
	(111)		(29)	(8)	(32)	(42)
EURO	0.27		0.03	0	0.19	0.55
	(111)		(29)	(8)	(32)	(42)
GENDER	0.84	0.74	0.96	1	0.88	0.76
	(123)	(35)	(27)	(7)	(25)	(29)
Number of Obs. In Parentheses						
CREDIT	0.5	0.47	0.49	0.5	0.45	0.57
	(527)	(120)	(86)	(40)	(135)	(146)
LENGTH	11.03	5.86	7.87	9.93	10.27	18.29
	(527)	(120)	(86)	(40)	(135)	(146)
COMPETITION	0.84	0.96	0.83	0.88	0.91	0.67
	(527)	(120)	(86)	(40)	(135)	(146)
ETHNIC	0.07		0.1	0	0.05	0.1
	(254)		(59)	(24)	(91)	(80)
FREQUENCY	2.5	2.08	2.23	2.86	2.93	2.42
	(466)	(81)	(86)	(37)	(124)	(138)

Table 2 - Access to Supplier Credit -
Cross-Sectional Logit Regressions

Dependent Variable: CREDIT

	(1)	(2)	(3)	(4)
LENGTH	0.040	0.030	0.047	0.032
	(0.17)	(0.017)	(0.026)	(0.032
COMPETITION	0.946	0.920	1.216	1.292
	(0.337)	(0.346)	(0.507)	(0.562)
FREQUENCY		0.160	0.237	0.255
		(0.092)	(0.133)	(0.155)
ETHNIC			1.19	1.217
			(0.738)	(0.770)
Log(SIZE)	0.777	0.699	0.901	0.460
	(0.093)	(0.095)	(0.152)	(0.188)
AGE				0.020
				(0.022)
avg (LENGTH)	-0026	0.0004	-0.025	-0.031
	(0.023)	(0.024)	(0.036)	(0.045)
avg (COMPETITION)	0.004	0.048	-1.032	-0.809
	(0.561)	(0.5790	(0.785)	(0.868)
avg (FREQUENCY)		-0.236	-0.360	-0.297
		(0.138)	(0.200)	(0.226)
avg (ETHNIC)			0.867	0.315
			(1.01)	(1.027)
SUBSID				-0.107
				(2.97)
OVERDRAFT				0.870
				(0.525)
GENDER				1.695
				(0.817)
ASIAN				1.720
				(0.585)
EURO				0.986
				(0.822)
Chi2	-172.75	150.27	92.99	74.31
Log Likelihood	-933.37	-811.04	-439.21	-357.66
Obs.	2202	1817	1177	1022

Standard Errors in Parentheses
All regressions have industry-country fixed effects

Table 3 – Determinants of Credit Acess
Firm Fixed Effects: Logistic Regression

Dependent Variable: CREDIT			
	(1)	(2)	(3)
LENGTH	0.036	0.029	0.040
	(0.015)	(0.016)	(0.023)
COMPETITION	0.863	0.729	0.852
	(0.319)	(0.322)	(0.465)
FREQUENCY		0.120	0.165
		(0.083)	(0.123)
ETHNIC			0.847
			(0.651)
Chi2	11.73	10.28	10.64
Log likelihood	-185.67	-159.17	-78.57
Obs.	527	452	231

Standard Errors in Parentheses

Table 4 - Interactive Effect of Market Structure and Length of Relationship

Dependent Variable: CREDIT	RE	FE
LENGTH	0.005	-0.010
	(0.02)	(0.023)
COMPETITION	0.234	0.260
	(0.47)	(0.498)
LENGTH * COMP	0.046	0.036
	(0.02)	(0.024)
Chi2	171.23	14.14
Log likelihood	-931.12	-184.47
Obs.	2202	527

Standard errors in parentheses
Random Effects regressions include avg(LENGTH); avg(COMPETITION); and industry-country dummies as controls

Table 5 - Effect of 'Dependence' on Credit Access, Sample Restricted to Non-Monopoly Relationships, FE Regression

Dependent Variable: CREDIT				
	RE	RE	FE	FE
LENGTH	0.052	0.047	0.049	0.038
	(0.018)	(0.016)	(0.022)	(0.022)
PERCENTAGE	0.005	0.095	0.003	0.066
	(0.004)	(0.020)	(0.005)	(0.024)
PERCENTAGESQ		-0.00075		-0.0005
		(0.00016)		(0.00018)
Chi2	183.77	182.46	6.22	15.24
log liklihood	-593.57	-581.94	-90.47	-85.97
Obs.	1518	1518	259	259

Standard errors in parentheses
Random Effects regressions include avg(LENGTH); avg(COMPETITION); and industry-country dummies as controls