Uncovering Collateral Constraints

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Abstract

Collateral plays two roles. It may be used as an ex-ante *commitment* against agency risk or for *hedging* expected default risk. Using cross-country loan level data, we find that the commitment motive explains collateralization. We also uncover a collateral "pecking order" driven solely by commitment concerns. While the bank accepts firm-specific assets susceptible to agency risk for low risk firms, it prefers non-specific assets for firms prone to agency risk. We find that information environments with institutions such as credit registries and objective rating criteria increase rating precision, and show that our results are not a consequence of rating imprecision.

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Collateral has been a prominent characteristic of loan contracts since ancient times. In the earliest statute of Roman Law, the Twelve Tables, "De Debitore in Partes Secando" describes how the debtor or her estate is to be divided upon default. The law of *cession*, introduced by the Christian emperors of Rome, allowed debtors to avoid debtor's prison if the debtor ceded, or yielded up, all his fortune to his creditors. Agreeing to transfer assets to the creditor upon default has two implications. First, the debtor should should be less likely to default if default is costly. Second, the creditor is able to recover - at least partially - the loan made to the debtor.

In this paper we examine the role of collateral. From an ex-ante standpoint, theoretical literature examining the use of collateral provides two reasons for a bank to ask for collateral. On the one hand, the bank may need to ask for collateral because it is unable to discern the borrower's quality. In this particular case, collateral provides a credible mechanism for *commitment* against agency risk, such as moral hazard and asymmetric information.[1] On the other hand, the bank may be aware that the borrower is in a potentially unprofitable line of business exposed to production risk or business risk. The *hedging* view proposes that, independent of borrower type and agency risk, pledging collateral provides a hedge, or insurance, against expected default risk. Theories supporting the hedging view argue that collateral relieves financing constraints by allowing the lender to reduce expected losses upon default.[2] The two views on the role of collateral differ substantially on how one should perceive the role of collateral. While the *commitment* view credits collateral with preventing agency risk altogether, the *hedging* view treats collateral as a passive instrument used only for transferring default risk from one economic agent to another.

[1] These models argue that collateral mitigates financial frictions stemming from moral hazard and adverse selection effects. See for example Aghion and Bolton (1992), Barro (1976), Chan and Thakor (1987), Johnson and Stulz (1985), Hart and Moore (1994, 1998), Hart (1995), Holmstrom and Tirole (1997), Park (2000), Rajan and Winton (1995), and Stiglitz and Weiss (1981), among others.

[2] The arguments in Dewatripont, Lagos, and Matthews (2003), Holmstrom (1999), Inderst and Mueller (2005), Innes (1990), Jensen and Meckling (1976), Lacker (1992), and Zwiebel (1996) all propose that collateral is used to hedge default risk.

We construct new tests that empirically separate these two views and find *commitment* to be the primary motive for collateralization. Our empirical design to separate commitment from hedging is based on the simple observation that if borrowers use collateral to credibly commit themselves against agency risk, then one should *not* observe that particular risk in equilibrium ex-post. Specifically, if commitment explains collateralization then default should be unrelated to agency risk. For the sake of simplicity, suppose there are two types of risks that a bank faces from a borrower ex-ante: agency risk and production risk. Agency refers to the usual risk that borrower may be of bad type or that he might misbehave in the future. Production risk refers to the business risk inherent in any project. If collateral is used to *commit* against agency risk then collateral should be positively correlated with measures of ex-ante agency risk, but uncorrelated with default. Further, default must arise as a consequence of the uncorrelated component of production risk. Conversely, if collateral provides a *hedge* against realized default, then collateral should be positively correlated with observed default and uncorrelated with ex-ante agency risk.

The identification strategy hinges on the observation that if borrowers use collateral to credibly commit themselves against agency risk, then default should be unrelated to agency risk. This allows us to overcome the identification challenge that to otherwise separate commitment and hedging motives one would need to observe both agency risk and default risk, measured at loan origination and independently of collateralization. To take the identification strategy to the data, we require an ex-ante measure of borrower risk that captures both agency and default risk, and default, which can be driven by agency and/or production risk. We first purge from the ex-ante measure of ex-ante firm risk the component that predicts default. Since the original ex-ante measure takes into account both preventable agency risk and the expected default risk (i.e. production risk in the example earlier), focusing on the component orthogonal to realized default risk allows us to isolate ex-ante agency risk. We then use the ex-ante agency and expected default risk measures to test commitment and

hedging view predictions.

A stylized fact from a sample of borrowers from the multinational bank that will be at the center of our study hints that the commitment role of collateral is the most important. We use credit dossiers of borrowers in Argentina to identify and classify the reasons for default. If the commitment role is at play then default should be unrelated to agency risk. From the population of 511 borrowers of this division, 133 default at some point in time after initiation. Loan officers classify defaults into any one or more of 30 reasons for default or early warning categories originally provided by the bank. In Appendix 1 we provide a detailed description of the reasons for default, and further classify each default into seven classifications according to: Financial Leverage, Industry Conditions, Receivables/Bad Debt, External Hard Information, Business Strategy, Management and Union Conditions. Of the seven classifications, Management problems reflect Agency risk while the remaining six categories reflect Production risk. Figure 1 plots the seven classifications and percentage frequency given by loan officers for the 133 default cases in Argentina. Results suggest that Financial Leverage (28%) and Industry Conditions (22%) (production risk) are the main reasons of default. Consistent with the commitment role of collateral, management problems (agency risk) explains only 6% of defaults.

We explore the role of collateral using a novel cross-country data set containing 9,211 small and business loans issued by a multinational bank in 15 countries. The 15 countries, which range from India, Turkey, and Chile, to Korea, Malaysia, and Hong Kong, differ widely in their level of institutional and financial development, which allows us to further study the effects of the commitment view of collateral across economies where agency risk may differ. The data include comprehensive borrower-level information at loan origination including: liquidation value of the collateral and asset class, loan pricing, an ex-ante measure of firm risk computed by the bank, and ex-post default.

Following Liberti and Mian (2010), we estimate the collateral cost of financing and esti-

mate how it varies with agency and business risk. We estimate the collateral cost using two measures. The first is the dollar cost of collateral, that is, the value of collateral demanded for every dollar lent out. Our second measure of collateral cost is the type of asset pledged as collateral. For example, a firm that is forced to pledge non-firm-specific assets (e.g., land and real estate) is more constrained relative to a firm that can also pledge firm-specific assets (e.g., inventory, account receivables) as collateral.[3] This allows us to uncover both the role of collateral and a pecking order of collateral with respect to the asset type.

To estimate agency and production risk, we use the ex-ante bank risk assessment, which is common across countries, to predict ex-post loan default. The ex-ante risk measure is derived from an information template (the Customer Selection Criteria) that includes the bank loan officers assessment of production risk (such as profitability, leverage, and overall business trend, among others), as well as agency risk (such as quality and reliance of information provided, management character, and company and personal checking, among others), but not the level or type of collateralization. Importantly, the ex-ante measure of borrower risk needs to be independent of collateral and loan pricing to identify the causal relation of risk on collateral. Additionally, in additional tests we employ bank-borrower relationship characteristics to instrument agency risk and measures of default risk and operational firm measures to instrument production risk. Finally, for Argentina where we have the Customer Selection Criteria responses we use the bank loan officers assessment of production risk and agency risk directly.

We employ a within-country estimate of the collateral cost to identify the role of collateral. These estimations completely absorb factors influencing the collateral choice and the levels of agency and production risk in an economy, as well as the demand or supply of collateral within each country. Further, this approach ensures that any results are not simply a result

[3]The recent U.S. credit crisis highlights the severe problems in financing that can arise when lenders no longer feel comfortable accepting a particular class of assets (in this case, mortgage backed securities) as collateral.

of institutional factors such as economic development that might affect the level of agency risk. Using this approach, we estimate collateral cost as the collateral spread, which is the difference in collateralization rates between high- and low-risk loans within the same economy. Further, we also include borrower characteristics to directly control for the supply for collateral. Hence, our estimations of the collateral spread examine the effect of higher agency and production risk on collateral demand compared with loans of lower risk in the same economy, while controlling for the supply of collateral.

The paper finds that consistent with the *commitment view*, initial collateralization is strongly and positively correlated with ex-ante agency risk but completely uncorrelated with production risk, as instrumented by default. These results reject the *hedging* motive for collateralization. The magnitude of the commitment effect is also quite large. Going from the lowest to highest quartile of ex-ante agency risk distribution increases the rate of initial collateralization by 11 percentage points when the mean rate of collateralization is 55 percent. However, a similar shift in production risk has no effect on collateralization.

Understanding the role of collateral is important, not only because its widespread use, but also because of its implications for monetary policy and lending behavior of financial institutions.[4] These have implications for the type and quality of collateral preferred by banks. In this regard, we uncover an interesting "pecking order" of collateralized assets that lends further support to the commitment view that collateral limits agency risk. We find that the bank is more likely to accept firm-specific assets that are prone to agency concerns from firms with low agency risk. Examples of agency prone assets include inventory and machinery since their value is susceptible to bad actions such as stealing or neglect by firm

[4]Many influential theories use the presence of collateral to explain a wide variety of phenomena, including financing constraints and investment (Chaney, Sraer and Thesmar (2012), the cost of debt capital (Benmelech and Bergman (2009), financial contracts and liquidation values (Benmelech, Garmaise and Moskowitz (2005), business cycles (Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Aghion, Banerjee, and Piketty (1999)), income inequality (Banerjee and Newman (1993)) and poverty traps (Mookherjee and Ray (2002). Further, collateral -or at least quality of collateral- played a critical in the recent financial crisis by amplifying shocks (Gorton and Ordonez (2012).

management. On the other hand the bank only accepts non-specific assets not susceptible to agency concerns from firms with high ex-ante agency risk. Non-specific assets include land and real estate, cash, and bank guarantees which are difficult to hide or abscond with, and have valuations less susceptible to management neglect. We also reveal a middle-ground of assets such as promissory notes, import and export letters of credit, financial securities that are used to a lesser extent as collateral but nonetheless provide some protection from agency concerns.

Next, we exploit differences in financial development across the 15 countries to provide further support for the commitment view of collateral. If collateral is used as an ex-ante commitment mechanism to prevent agency risk, and stronger financial development such as creditor rights protect lenders from agency costs, then if the *commitment* view explains the use of collateral the collateral spread should be lower in economies with stronger financial institutions and/or development. We show this to be the case. Going from the lowest to highest quartile of ex-ante agency risk distribution increases the rate of initial collateralization by as much as 21 percentage points in countries with weak creditor rights, but only 3 percentage points in countries with strong creditor rights. The results confirm that stronger financial institutions lower collateral spreads by improving financial development in a country, and that the channel through which financial development lowers collateral spread is by protecting lenders from agency risk.

As in any empirical study there are identification concerns. A direct concern of our strategy is that agency and production risk might be correlated, or that default might arise because of agency risk if agency risk is not perfectly mitigated by collateral choice. Our empirical methodology separates default and agency risk. However, any component of agency risk correlated with default will naturally be explained by the predicted risk measure and therefore the residual risk measure will capture the uncorrelated component of agency risk. Thus, our empirical strategy may be better thought of as separating default risk (as a result

of production and/or agency risk) from agency risk. If collateral is employed to mitigate agency we should find that the component of agency risk uncorrelated with default alone explains collateral choice.

A second concern is that our results capture risk grade imprecision. Our identification strategy relies on risk grade being precisely measured, otherwise, the instrumented agency risk will most likely contain default risk. We mitigate this concern by re-estimating our results in information environments where precision is highest such as those incorporating a credit registry, private credit bureau, or stronger collateral laws, or programs that rely on objective credit manual questions. We repeat the identification strategy and results hold: agency risk alone explains collateralization.

A third concern is that the bank loan contract also includes an interest rate spread which might also be sensitive to firm risk. Consequently, there is a concern that examining collateralization alone might lead to an inaccurate estimate of the elasticity of collateralization demand. We show that our findings are robust to this concern. Finally, to mitigate the concern that the supply of collateral might vary by firm type, we control for the supply of collateral at the borrower level using balance sheet and income sheet data to ensure that results are driven by the demand for collateral.

Our work is the first to empirically separate the commitment and hedging motives of collateralization. A number of theoretical papers have highlighted the role of collateral as a commitment against agency risk. Our empirical results are consistent with papers such as Barro (1976), Stiglitz and Weiss (1981), and Chan and Thakor (1987) which argue that the threat of agency risk in the form of unobserved borrower attribute or action leads to greater use of collateral as a commitment device.[5] Although papers such as Bester (1985) make the opposite prediction by suggesting that low risk firms might sort on high collateral

[5]Rajan and Winton (1995), and Park (2000) suggest that collateral may also be used as commitment by the *lender* to provide monitoring effort. However, these models are written in the context of institutional loans with other public bond-holders, an environment different from the one our firms belong to.

- low interest rate contracts, our empirical results do not favor such explanations.

This paper is closely related to recent empirical work that highlights the role of collateral in financial contracts. Berger and Udell (1995) and Jimenez, Salas, and Saurina (2006) show that creditors require firms with poor repayment histories or firms with greater default risk to secure their loans with collateral. Benmelech and Bergman (2009) construct industry-specific measures of redeployability and show that more redeployable collateral leads to lower credit spreads, higher credit ratings, and higher loan-to-value ratios. Benmelech and Bergman (2011) propose that a firm's bankruptcy reduces collateral values of other industry participants, thereby increasing the cost of external debt finance industry wide. Similar to our results, pledging more liquid non-specific collateral eases financing constraints. Chaney, Sraer and Thesmar (2011) show that investment is sensitive to collateral value by examining US real estate pledged as collateral. Cerqueiro, Ongena and Roszbach (2014) show that banks respond to an exogenous reduction in collateral value by increasing interest rates and reducing monitoring on collateral, increasing the delinquency of borrowers. Berger, Frame and Ioannidou (2011, 2012) examine a credit registry to test theories of collateral and find results supportive of commitment and hedging motives.

The rest of the paper proceeds as follows. Section 1 analyzes the theoretical framework and discusses the identification strategy for the empirical tests. Section 2 describes the data of our paper. Section 3 examines the dual role of collateral and tests the commitment and hedging views of collateral. Section 4 uncovers a pecking order for collateral. Section 5 discusses identification concerns and Section 6 concludes.

1 Empirical Methodology

1.1 Conceptual Framework

We present a simple model of lending to illustrate the dual role of collateral in lending contracts. Collateral is used to commit borrowers against agency risk and/or hedge against production risk. Since banks hold debt claims on their borrowers' assets, default is their primary measure of risk. There are two fundamental sources of potential default risk facing a bank. We define one as ex-ante preventable *agency risk*, and the other as ex-post *production risk*. Agency risk may take the form of information asymmetry and/or moral hazard. However, the assumption is that the bank and lender can write some contract ex-ante that mitigates or prevents this agency risk. On the other hand, production risk cannot be prevented ex-ante, but instead the loan contract describes how the bank protects itself from this risk ex-post.

Consider an economy with a continuum of firms each wanting to invest \$1 by borrowing from a bank. The loan contract between a bank and firm takes the form of an interest rate $r > 1$ and a collateral amount $w < 1$ pledged by the firm. Firms vary by their risk attributes denoted by the pair (α, β), where α and β are both between 0 and 1. β captures the production risk inherent in a firm's technology. The firm can produce $Y > 1$ with probability $(1 - \beta)$ and 0, otherwise. α on the other hand captures the degree of agency risk inherent in a firm. If a firm produces an output Y, it can choose to repay the promised interest rate $r < Y$ to the bank or declare default strategically. In case of default, the firm loses part of its future productivity due to a loss of reputation in financial markets given by $(1 - \alpha)Y$. It also loses its initial collateral worth $w < 1$ in case of default. Hence the bank agrees to lend only if the lending constraint holds:

$$(1 - \beta)r + \beta w \geq 1 \tag{1}$$

and the firm chooses not to default only if the following IC condition holds:

$$Y - r \geq \alpha Y - w \tag{2}$$

Our measure of agency risk, α, in (2) effectively represents the fraction of firm assets that the borrower can abscond with.

In the above framework, a bank can use collateral w either to receive commitment against agency risk (α), or to hedge against realized default risk (β). Papers such as Barro (1976), Stiglitz and Weiss (1981), and Chan and Thakor (1987) argue that in the face of agency risk of the sort captured by α, a bank may impose collateral requirements to minimize risk. This can be seen from (2) where collateral worth $w = r - (1 - \alpha)Y$ guarantees no agency risk in equilibrium.

A second potential use of collateral comes as a hedge against production risk. It is common among practitioners to think of collateral as a hedge against actual default by a firm. Theory also provides a number of rationales for why a banker may want to hedge default. For example, work by Jensen and Meckling (1976), Innes (1990), and Dewatripont, Legros, and Matthews (2003) suggests that banks may want to transfer more of the risk towards the firm for incentivizing managers. Similarly, organizational literature such as Holmstrom (1999) and Zwiebel (1996) suggests that loan officers within a bank hierarchy might be excessively risk averse due to intra-firm agency issues and career concerns. Consequently the higher β is, the more attractive collateralization appears to the bank under the hedging hypothesis. This hedging view of collateral can be seen in (1) where collateral worth $w = \frac{1-(1-\beta)r}{\beta}$ guarantees that the bank is willing to lend.

The commitment and hedging views differ dramatically in their perception of collateral. The commitment view describes collateral as an effective tool for minimizing agency risk in the economy. If the commitment view of collateral is at play then agency risk should be

preventable (through collateral) and thus realized default must be a result of production risk only, i.e.: default risk *is* production risk. The hedging view treats collateral as a passive tool used only for sharing existing risk across agents.

Proposition 1. *Under the pure commitment view, collateralization is uncorrelated with production risk β, but positively correlated with agency risk α (i.e. $w = r-(1-\alpha)Y$). Under the pure hedging view, collateralization is positively correlated with production risk β (i.e. $w = \frac{1-(1-\beta)r}{\beta}$), but uncorrelated with ex-ante agency risk α. Combining the commitment and hedging views, collateralization commits against agency risk and therefore realized default is a result of production risk only.*

Of course, Proposition 1 is somewhat stylized in so much that agency and production risk are uncorrelated and agency risk is perfectly mitigated by collateral choice. In such a stylized setting, a concern is that outside of this setting agency and production risk might be correlated, or that default might arise because of agency risk if agency risk is not perfectly mitigated by collateral choice. In such instances, Proposition 1 might be better thought of as separating the commitment view of collateral from the hedging perspective of collateral, where default can be a consequence of production and/or agency risk. The important take-away from Proposition 1 is that if collateral is employed to mitigate agency risk we should find that the component of agency risk uncorrelated with default should explain collateral choice.

1.2 Regression Specification

To investigate the dual role of collateral in lending contracts, one needs to be able to separate agency risk (α) from production risk (β). Unfortunately, risk classifications, such as ours, generally contain both agency risk and expected production risk, which combined might explain predicted default. However, Proposition 1 implies that if collateral is employed to

mitigate agency risk, then default will be unrelated to agency risk and that production risk alone will predict default.

We exploit this equilibrium implication to decompose the ex-ante risk grade into its components that reflect agency risk and production risk by purging risk grade of the component that predicts future default, which will be related to production risk only. In particular, let R_i^0 be the initial ex-ante risk grade and Z_i^T be the ex-post realized default for firm i in our sample. Then by projecting R_i^0 on Z_i^T,

$$R_i^0 = \alpha + \beta_1 Z_i^T + \varepsilon_i \tag{3}$$

one can separate R_i^0 into the component $\widehat{R}_i^0$ that predicts Z_i^T, and the orthogonal residual component R_i^{Z0} that contains only ex-ante agency risk information. R_i^{Z0} thus becomes our firm-level measure of agency risk, and $\widehat{R}_i^0$ the expected production risk measure.

As mentioned above, our empirical strategy may be better thought of as separating default risk (due to production and/or agency risk) from agency risk. Then, R_i^{Z0} will capture the component of agency risk uncorrelated with default.

Proposition 1 can be tested by running the initial rate of collateralization Y_i^0 on agency and production risk measures:

$$Y_i^0 = \alpha_{cj} + \beta_1 R_i^{Z0} + \beta_2 \widehat{R}_i^0 + \varepsilon_i \tag{4}$$

If the *commitment view* of collateral explains collateralization, then $\beta_1 > 0$. Alternatively, $\beta_2 > 0$ if the *hedging view* of collateral is at play.

In equation (4), $\hat{\beta}$ is an unbiased estimate of β only if the error term is uncorrelated with our measures of agency and production risk. The concern, however, is that country-specific, or country-industry-specific, factors, may be spuriously correlated with expected firm risk. For example, the average level of collateralization in a country may depend on macro factors

(such as the industry mix of investments), and these factors may in turn be correlated with the average agency or production risk as well. In such circumstances, β will be biased. Similarly, the measurement of ex-ante risk rating may not be comparable across countries. For example, a risk grade of "A" in one country may not be comparable to a grade of "A" in another. We address the concern of country-specific spurious factors by including country (c) fixed effects in equation (4). The country fixed effects account for aggregate changes in the demand or supply of collateral within each country. Further, because the cross-sectional data are constructed around the same time period for all countries, country fixed effects also absorb any contemporaneous or expected shocks hitting various economies. Thus, our coefficient of interest is not affected by time-varying factors such as business cycles or growth opportunities. In addition to country fixed effects we also include borrower characteristics to directly control for the supply for collateral. These include firm size, the ratio of net fixed assets-to-total assets, the ratio of cash-to-total assets, and profitability measured by the ratio EBITDA-to-Sales. Larger firms, firms with greater fixed assets and more profitable firms likely have greater supply of collateral, while firms with higher cash holdings have a higher supply of cash collateral. Throughout, standard errors are computed after allowing for correlation in a given country-industry.[6]

To estimate equation (4), we first need to separate agency and production risk. Of course, a valid concern in estimating equation (3) is that our measure of default imprecisely measures the expected default from the perspective of the lender. Then, we would imprecisely measure production risk, $\widehat{R}_i^0$ and it is likely that agency risk R_i^{Z0} would be plagued with production risk. Ultimately, this would bias our estimations in equation (4) towards the commitment channel of collateral. We mitigate this concern by estimating the decomposition of risk in four ways.

[6]In unreported results we re-did all the analysis clustering at the country level. Results hold both qualitatively and quantitatively. We want to control for having two similar firms within an industry therefore the treatment and inferences are at the country-industry level.

Our first empirical model of estimating equation (3) follows Proposition 1 and employs default as the instrument to identify production risk. However, we also include country-industry fixed effects when estimating equation (3). This does two things. Firm production risk is likely related to industry effects such as cash flow volatility and business model but aggregate shocks most likely affect firms commonly within industry.[7] The inclusion of country-industry effects attributes such common effects on collateral to the hedging perspective. Additionally, the inclusion of country-industry effects ensures that average differences in default risk across countries due to macro factors, as well as differences in grading schemes across countries, are factored out. Second, we complement model 1 with firm-level characteristics that are expected to be related to production risk. We include the maximum number of delinquent days that the borrower exhibits over the two year period, a dummy variable indicating whether the borrower is an exporter, and firm size captured by sales. Delinquency days allow us to more precisely observe the firms that are defaulting on the loan. Exporter firms face different types of risk, both foreign demand risk and foreign exchange risks, than purely domestic firms. Exporters are concentrated in certain industries (e.g.: textiles) and are, on average, larger and safer than non-exporters. Our focus on exporter status is similar to Bertrand (2004) and Xu (2012), who show that import penetration affects production risk. Generally, firm risk is expected to be negatively related to production risk as a firm's increased product lines and customers offer better diversification from shocks to production risk.

In model 3 we attempt to estimate agency risk rather than rely on using the residual component, which mitigates the concern that our measure of agency risk is plagued with production risk. In addition to estimation production risk as in model 2, we also estimate agency risk using borrower-level measures of agency captured by personal lending measures

[7]For example, industry level cash-flow volatility or systematic risk might be good candidates for predicting production risk. These are subsumed by country-industry fixed effects.

such as, personal client, borrower age, and relationship length, to capture the component of the risk rating attributable to agency risk. The measures capture the degree of agency risk that the bank perceives in a borrower at the time of loan initiation. For example, agency risk should be less of a concern in older firms where there is a greater track record of behavior, or in situations where the owners are personal clients of the bank. We repeat estimation of equation (4) using these three models to mitigate any concern arising from the separation of risk in equation (3).

Finally, we examine the loan officer responses to credit manual questions to identify production and agency risk directly. The Customer Selection Criteria for Argentina is reported in Appendix 2, while a complete picture of the criteria for the 15 countries is reported in Appendix 3. We identify those questions that relate to production risk only and those that relate to agency risk only, and then use these to instrument the component of the risk grade that reflects production risk and agency risk respectively. For example, responses to questions on financial strength, such as leverage or interest service coverage ratio and those on overall business trend or sales turnover relate to production risk. While those questions relating to personal legal history, personal checking account history, and the loan officer's assessment of the reliability of information provided by the company clearly relate to agency risk. Unfortunately, we observe the loan officer responses at the borrower level in one country only, Argentina.

Once we have estimated the effects of agency and production risk on collateralization we test for effects of total, agency and production risk on the level of collateral type (the pecking order of collateral), and also for how the effects of agency and production risk on collateralization and the pecking order of collateral vary with financial development across countries. In the next section we describe the data used to conduct the tests specified in this section.

2 Data Description

Our data comes from the small and medium-sized private lending division of a large multi-national bank that operates in 15 emerging market economies. The data contain every loan issued by the bank and follow each loan over a 2-year period from 2002 to 2004. Information is updated every six months. Although the original data set has 12,591 firms we are left with a cross-sectional sample of 9,211 firms after applying several screening rules. First, we drop 766 firms that are already in default at the beginning of our sample period. These firms are not actively borrowing during our sample period, and as such we do not know their ex ante risk assessment, nor the initial level of collateralization demanded by the bank. Second, another 1,599 firms are excluded as they are missing the ex-ante risk rating variable, which is an important measure in our identification strategy. Finally, 1,406 firms do not draw any loan from the bank during our sample period and hence are dropped because there is no collateral information on these firms.[8]

The range of countries in our final sample of 9,211 firms is diverse in terms of geographical location, financial development, and per capita income as reported in Table 1. The number of loans (firms) is not uniform across countries, varying from 1,440 in the Czech Republic to 96 in Pakistan. This potentially raises the concern that our results might be driven by one or two countries with a large number of observations or with a higher share of loans outstanding as a percentage of total loans. Accordingly, we carefully test for this in the analysis section below. There are a total of 86 (finely defined) industries in our sample. The full list of industries, and the number of firms belonging to each industry, is reported in Appendix 4. Lending across industries appears to be well-diversified with no industry having a concentration above 10% of total lending.

For every loan we observe the borrower's identity, industry, and country. We also observe

[8]The bank has approved some loan amount for these firms, but as these firms chose not to withdraw against the approved amount, they are not required to put up any collateral.

the total approved loan, total loan outstanding, loan default status, the firm's risk as determined by the bank, delinquency, and both the type and liquidation value of the collateral used to secure the loan. We use the first observation for each loan in our sample to represent the initial loan characteristics at the time of origination. We then determine for each loan its end-of-sample period default status. This variable takes a value of 1 if a firm goes into default by the end of the sample period (i.e., within 2 years), and 0 otherwise. Additionally, we determine for each loan its delinquency status, which captures the maximum number of days delinquent the borrower is over the two year period. We also observe time-varying borrower financial characteristics that we employ as controls to capture the borrower level supply of collateral. These are sales size, the ratio of net fixed assets-to-total assets, the ratio of cash-to-total assets, and profitability measured by the ratio of EBITDA-to-sales. Importantly, we include these controls in all estimations of collateralization rate to ensure that results stem from demand rather than supply-side considerations. We also observe whether the borrower firm is an exporter, and thus potentially exposed to production risk beyond their own country as well as currency risk measured by the use of import and/or export letters of credit. Turning to the individual bank-borrower relationship, we observe if the management team/owner of the borrowing firm is also a personal client of the bank (i.e. conducts independently personal banking activities with our bank), the borrower firm age (in years) and the number of total bank relationships. Table 2 provides summary statistics for all the variables in our data set. Because our empirical methodology uses country and country-industry fixed effects, we report country and country-industry demeaned standard deviations as well.

A key variable in our analysis is the ex-ante risk grade of a borrower. The grade varies from "A" (Best) to "D" (Worst) and represents the riskiness of the borrower at the time of loan origination as determined by the bank's loan officer. Additionally, we transform the risk grade into a numerical variable by assigning "A"= 1, "B"= 2, "C"= 3, and "D"= 4,

as is common in studies examining credit ratings. The risk grade is based upon two sets of information, which take into account measures of production as well as agency risk. The first includes objective measures of firm performance related to production risk based on firm and industry fundamentals such as profitability, sales growth, past credit history, financial flexibility and previous Chapter 11 situations. The second set includes subjective measures of firm performance which some of them are related to agency risk such as assessment of the "quality and reliance" of information, personal and legal checking, management interviews, and site visits.[9] The firm risk grade is an ex-ante assessment of the firm, before any decision is made about how much to lend to the firm and on what terms. Thus, the risk grade does not include information on ultimate loan terms such as collateral, interest rates, and maturity. This is important because otherwise firms with a high level of collateral may be given a safe grade due to the collateral, and not because the firm's cash flows are less risky. Table 2 shows that all four grades are fairly well represented in the data and that there is significant variation in grades not only across countries but also within country and country-industry categories.

The bank also constructs a variable on firm size using firm sales as benchmark. Specifically, the bank categorizes firms into four sales size groups, where a grade of "0" corresponds to smaller firms with total net sales less than \$1M and a grade of "3" corresponds to larger firms with net sales above \$25M. We find that firms in our sample are skewed towards smaller-sized firms, which is consistent with the focus of the lending program. Further, there is significant variation in firm size, not only across countries, but also within country and country-industry. Our data also includes information on loans, risk and default. The mean outstanding loan amount is \$398,430, and 5.47% of the firms enter into default.

[9]For example, before coming up with the final ex-ante risk grade for a firm, a loan officer responds to questions such as: "How reliable is the information provided by the management?" "Does the firm have good governance and control mechanisms?" "Does the firm have professional management?" and similar questions related to management and firm performance that are subjective in nature.

An important dimension of our data is its information on loan collateralization. For each loan, the bank records the liquidation value of collateral pledged for the loan. This reflects the bank's assessment of the market value of the collateral in the event of bankruptcy, assuming the lender receives full ownership of the collateral.[10] We divide the liquidation value of collateral (in the beginning of the sample) by the approved loan amount to construct the collateralization rate for a loan. The average collateralization rate is 55.1% with a standard deviation of 44.3%.

In addition to the value of collateral, our data also include the type of asset pledged as collateral. Asset types correspond to one of eleven categories: (i) accounts receivable including factoring of receivables, contract orders, and post-dated checks, (ii) bank guarantees, (iii) cash, both foreign and domestic, (iv) financial securities such as bonds and shares, (v) real estate, including land and buildings, (vi) firm-specific collateral which captures collateral that is specific to the operational business of the firm under consideration[11], (vii) inventory, (viii) firm machinery and equipment, (ix) import and export letters of credit, which are provided by a third-party and used as a method to facilitate payment of international trade transactions, (x) third-party guarantees, and (xi) promissory notes. Table 2 shows the composition of collateral by summarizing the percentage of collateral value that belongs to each of the eleven collateral categories. Land and real estate are the most common types of collateral, followed closely by firm-specific assets, machinery and equipment, accounts receivable, and cash.

The type of collateral varies significantly along three dimensions that likely impact the desirability to the lender: its "specificity" to the firm's operation and performance, how "movable" any physical asset is; and the provider of the collateral. For example, firm specific

[10]The value is not from a fire-sale of assets. Rather, it is an orderly liquidation value referring to the value obtained if the asset is sold in 180 days.

[11]We discussed with loan officers the reason to categorize this collateral as firm-specifc. Loan officers indicate that this category captures collateral that does not merit classification in any of the other categories but is specific to the operational business of the firm under consideration.

assets are highly specific to the state of a firm, are easily movable in the sense that the borrower can shift or divert them away from the lender, and are provided by the borrower. However real estate is arguably non-specific, immovable, yet still provided by the borrower. A bank guarantee is non-specific and provided by a third party. We further classify the eleven collateral types based on these three dimensions into six categories as follows: (i) accounts receivables, which are both specific and movable assets but contractually are provided by a customer of the borrower rather than the borrower, (ii) bank guarantees, (iii) cash and financial securities which include the two categories cash and financial securities from above, (iv) immovable assets, which includes land and real estate (v) movable assets, which includes firm-specific assets, inventory, machinery, and leased equipment from above, (vi) third-party guarantees, which includes import and export letters of credit, third-party guarantees, and promissory notes.

We want to emphasize that country bank managers are free to lend to whomever they want and have complete discretion in terms of the value and type of collateral they demand from each borrower. Headquarters of the bank in New York approves and allocates overall lending limits for each country but each country-based lending division has complete discretion to implement, execute and monitor the lending program locally. Pricing, credit process, procedures and delinquency management are managed by each division at the local-country level, although lending terms and requirements are standardized and consisted across countries. Product offerings are similar across countries.[12] The central objective given to each country manager is to maximize the return on lending assets while minimizing defaults.

[12]The rationale of these programs is to offer a small and mid-market segment of borrowers almost all credit and non-credit products available to large corporate borrowers. The strategy of these programs is designed to achieve a robust and consistent growth in the small and medium-sized borrower segment targeting well-managed companies with typically entrepreneurial management style, growth prospects and leveraging cross-selling opportunities. The attractiveness of this segment lies in its large and well-established base, which is typically the engine of growth for developing economies, revenue characteristics, high cross-sell opportunities, and capacity for self-funding through marketing of liability products. Generally, this segment, although competitively banked, provides an untapped market for traditional products offered to large-sized borrowers.

Thus, none of our findings on the relationship between collateralization rates and firm risk are "hard wired" by bank rules.

3 The Dual Role of Collateral

3.1 Separating Agency Risk and Production Risk

To understand the role of collateral in lending we separate ex-ante risk grade into agency and production risk as described in Section 1.1. Table 3 presents the instrumentation of production and agency risk. We present four empirical models of the separation of risk. Model 1 is presented in column (1) and estimates production risk using future default, and agency risk as the residual risk grade. As one would expect, default is positively associated with risk grade.

In order to make our measures of default more precise, we include borrower-level measures of default. Model (2), presented in column (2), estimates production risk using default and borrower-level measures of default risk and production risk, and agency risk as the residual risk grade. The additional measure of default risk is delinquency days, and the measures of production risk include a dummy indicating if the firm is an exporter and firm size. Higher future delinquency is positively associated with risk grade, which offers further support that the bank incorporates expected future default into the evaluation of risk. Additionally, both Model 1 and Model 2 include country-industry fixed effects. Both of these models hinge on the finding in Proposition 1 that if collateralization is a mechanism to mitigate agency risk, then this same component of agency risk will not explain default in equilibrium.

Model 3 provides an alternative to Model 2 in so much that rather than estimating agency risk as the residual in a regression identifying default risk, we identify the component of the residual that can be explained by borrower-level proxies for agency risk. This alleviates the concern that we mis-measure agency risk. In column (3) of Table 4 we estimate agency risk

using the three proxies for agency risk. In column (4) we estimate risk grade on the measures of default risk and agency risk together. To identify agency concerns we include measures of banking relationship, such as Personal Client, Borrower Age and Length of Relationship, which affect the bank's evaluation of agency to instrument agency risk. Aggregate firm risk is negatively related to firm age and positively related to whether the firm's management is a personal client and relationship length. This first finding is consistent with firm age mitigating agency concerns through establishing a track record. High risk firms holding longer and personal relationships is consistent with adverse selection as cause of borrower credit constraints.

Finally, we focus on Argentina only and use loan officer responses to bank credit manual questions to identify production and agency risk. The credit manual questions are presented in Appendix 2 for the 511 borrowers. We identify those questions that relate to production risk only and those that relate to agency risk only, and then use these to instrument the component of the risk grade that reflects production risk and agency risk respectively. Of the 44 customer selection criteria, we identify 36 as relating to production risk and 8 as relating to agency risk. For example, criteria related to the financial strength, such as leverage, current ratio and interest service coverage ratio relate to production risk. While those questions relating to personal and legal history, personal checking account history, and the loan officer's assessment of the reliability and quality of information provided relate to agency risk. When instrumenting agency and production risk we are agnostic on the precise relation between the response and risk and thus include responses non-parametrically in the estimations. The results of these estimations are omitted for brevity.

3.2 The Commitment and Hedging Perspectives of Collateral

In Table 4 we present estimation results of equation (4). These results test Proposition 1, described in Section 1.2. The first stage instrumentation of production and agency risk is

presented in Table 3.[13] In Table 4 columns (1) to (4) examine how agency and production risk affect collateralization. In column (1) we employ observed default to instrument for production risk in equation (3), and then include the instrumented production risk and estimated agency risk in equation (4). In column (2) we include the additional default variables in the instrumentation of production risk, presented in column (2) of Table 3. A valid concern of the results in column (1) is that default captures only the handful of borrowers that ultimately default, and therefore may underestimate production risk. To address this concern we include delinquency days as well as a measure of exposure to production risk relating to foreign demand, foreign exchange, and quotas.

The results in columns (1) and (2) reveal that the increase in collateralization with risk grade is solely explained by agency risk. The coefficients on production risk and agency risk describe the collateral spread with respect to an increase in each of these risks. The results in column (2) reveal that an increase in risk grade from "A" to "D" (an increase in the parametric risk grade of 3.0 points) associated with agency risk increases collateralization by 11.37%, and an increase in risk grade from "A" to "D" associated with production risk increases collateralization by 2.10%, though the latter is not significant. The results also imply that collateralization rate is completely uncorrelated with the ex-post default rate measure. This suggests that, consistent with the commitment view of collateral, collateralization is employed to mitigate agency risk, but not to hedge against expected production risk. Column (3) presents results in which we instrument production risk and agency risk, by including only the component of residual risk that is related to our proxies for agency risk. This approach alleviates the concern that the measure of agency risk in columns (1) and (2) is imprecise if our instruments insufficiently explain production risk. Once again, we

[13] In order to make the results comparable across borrowers, we standarize each borrowers' predicted agency and production risk quantities by subtracting the sample mean and dividing by the standard deviation. The resulting standardized measures of risk have a mean of zero and a standard deviation of one, which retains the standard deviation of the raw measure. Therefore a one standard deviation change in the risk measures is interpreted as a one grade change (i.e. "A" to "B") in risk rating.

find that the increase in collateralization with risk grade is solely explained by agency risk.

In column (4) we turn to the loan officer response to credit manual questions for the case of Argentina. The estimations in columns (1) - (3) exploit the observation that if collateral mitigates agency risk then agency risk should not be related to default, to identify agency and production risk. Hence, our identification strategy hinges on default. The credit manuals allow us the opportunity to identify production and agency risk directly using the ex-ante measures that provided input for the risk grade, albeit for Argentina only. The results mirror those using default to identify production risk: agency risk alone explains collateralization.

Although collateral spread is robust to controls such as country-industry, and size fixed effects, there may be a concern that the estimate is primarily driven by one or two countries. Table 1 shows that the distribution of loans across countries is highly skewed, with countries such as the Czech Republic having 1,440 loans whereas others such as Pakistan have only 96. The regressions in Table 4 weigh each loan equally, in effect giving a lot more importance to the Czech Republic relative to Pakistan. This would be a concern, for example, if collateral was used to hedge production risk only in countries with a smaller sample size. We test whether the estimated collateral spreads on agency risk and production risk is primarily driven by a couple of countries by giving each country equal weight in the regression regardless of the number of loans from that country. To do so, we estimate the country-specific collateral spread for each of production and agency risk. We then use these country-specific collateral spreads as the dependent variable in columns (5) and (6), which are run at the country level. The equal country-weighted collateral spread results for production and agency are similar to earlier estimates: collateralization appears to be entirely driven by commitment against agency risk.

4 The Collateral Pecking Order

The results in the previous section show that the value of collateral per dollar lent increases with borrower agency risk. However, in addition banks may restrict their preferences in terms of the type of marginal asset accepted as collateral as borrower agency risk increases. For example, a bank might accept firm-specific assets such as inventory that are more susceptible to concerns regarding a borrowers agency risk for low risk firms, but as agency risk increases the bank may demand non-specific assets such as cash, land and real estate, and guarantees as collateral. A key feature of our data set is that it permits us to look at how the composition of collateral varies with firm risk.

We examine the collateral pecking order by studying the composition of collateral demanded by banks. The asset types correspond to one of six categories: (i) accounts receivables, which are both specific and movable assets but contractually are provided by a customer of the borrower rather than the borrower, (ii) bank guarantees, (iii) cash and financial securities which include the two categories cash and financial securities from above, (iv) immovable assets, which includes land and real estate (v) movable assets, which includes firm-specific assets, inventory, machinery, and leased equipment from above, (vi) third-party guarantees, which includes import and export letters of credit, third-party guarantees, and promissory notes.

Given the results on the commitment view of collateral, a natural pecking order one might expect to observe is that banks will accept firm specific or movable assets prone to agency concerns (e.g. inventory, machinery and equipment) from borrowers with low agency risk, and demand non-specific assets from borrowers with high agency risk. These type of non-specific assets include cash, land and real estate mortgage, and guarantees and liquid securities. For example, collateral that is mobile and hence not perfectly secured (such as inventory and firm equipment) may be stolen by managers in bad states of the world, while,

on the contrary, it is more difficult to abscond with land and bank guarantees. One rationale for such a pecking order could be that firm specific assets are subject to suffer from moral hazard and hence largely dependent on the quality of firm. Similarly the value of firm-specific assets might fall faster for lower quality firms. Non-specific assets do not share these concerns as their value is independent of firm performance and future behavior.

It is important to note that, since we estimate collateralization rates using the liquidation value of the asset, we are not simply studying how different types of asset might have different liquidation values. If, instead, we were using the market value then any results might be driven by differences in liquidation value, as described by Schleifer and Vishny (1992) and documented by Acharya, Bharath and Srinivasan (2007) plus others. Since our estimations already control for liquidation value effects we can be bolder in suggesting that the pecking order is driven by agency concerns as well.

We uncover the pecking order by estimating the collateralization rate by asset type. This allows us to estimate the collateral spread by asset type. Importantly, this methodology estimates the collateral spread by asset type within country which reveals the elasticity of collateral to risk while controlling for aggregate factors that might otherwise explain the supply and/or demand of collateral. A valid concern is that collateral type is endogenous to borrower risk. Perhaps worse quality firms have less supply of firm-specific assets, which would lead to these types of assets being used less by the riskiest borrowers. However, it is worth emphasizing that we include firm size, the ratio of fixed assets-to-total assets, the ratio of cash-to -total assets, and profitability for each borrower in addition to country fixed effects the estimation of collateral spread. This gives us comfort that results are not driven by certain countries or firms exhibiting higher borrower risk and a lower supply of specific or non-specific assets.

Table 5 examines how total borrower risk impacts the collateral pecking order. In column (1) we present results for total collateralization rate. In columns (2) to (7) we estimate

collateral spread by asset type. The results in columns (2) through (7) of Table 5 show an interesting and systematic pattern. As firm quality deteriorates, the bank is less likely to accept firm-specific collateral. On the other hand, the bank is more likely to demand non-specific collateral types such as land and real estate, cash, and bank guarantees, as borrower quality deteriorates. In addition, we find that accounts receivable are demanded as collateral more as firm quality deteriorates. This might be explained by the fact that although accounts receivable tend to be firm-specific, they are also provided by a third party in the form of receivables and post-dated checks that may alleviate agency concerns. Additionally, the results in Table 5 reveal that loan size plays a role in the type of collateral pledged. In Table 10 we showed that larger loans resulted in higher collateralization rates. Further, larger loans tend to use non-specific assets as collateral.

The collateral pecking order can be more explicitly seen when we plot the cumulative impact of each one grade downgrade on the probability of an asset class being used as collateral. Figure 2 shows that for initial grade downgrades (i.e. from "A" to "B", and "B" to "C"), the bank *reduces* the percentage of firm-specific collateral allowed. However, the demand for industry-specific assets is largely unchanged by grade downgrades from "A" to "B", and "B" to "C", but the bank demands less industry-specific assets for downgrades from "C" to "D". Further, as the grade deteriorates from "C" to "D", the bank only accepts non-specific and hard types of collateral at the margin such as land and real estate, cash, bank guarantees and to a lesser extent third party assets such as guarantees and accounts receivables. Thus we observe an interesting "collateral pecking order" in terms of which assets the bank is willing to accept as collateral. While various forms of collateral are acceptable for the very best firms, as firm risk increases, the bank stops accepting certain forms of specific collateral. For very high risk firms, the bank only accepts hard and non-specific forms of collateral such as cash and land. In summary, there is a sharp shift in the composition of collateral towards non-specific assets - and away from specific assets - as firm risk increases.

Next, we examine whether the collateral pecking order presented in Table 5 is explained by the commitment view of collateral. We estimate equation (3) by asset type using the model in column (2) of Table 3 to separate agency and production risk, and present the estimation results in columns (2) - (7) of Table 6. Column (1) presents the total collateralization rate results for agency and production risk, which was presented in column (2) of Table 4. We find strong support for the commitment view of collateral. The demand for non-specific assets, which offer lenders better protection from agency risk and borrowers stronger commitment against agency risk, increases as borrower agency risk increases. However, specific assets that offer little protection against borrower agency risk are used less when agency risk is high.

Finally we examine how financial development affects the pecking order of collateral. In more financially developed economies, Liberti and Mian (2010) document that stronger financial development protects lenders from agency costs because lenders can employ contracts such as loan covenants to restrict borrowers from risk-shifting. Therefore we should expect that the positive collateral spread on agency risk shown in Table 4 is lower in economies with stronger financial institutions and/or development. If the pecking order commits against agency risk and financial development better protects lenders from agency concerns, one should expect the results in Table 6 to be strongest for borrowers in economies with weak creditor rights. On the other hand the pecking order should be less pronounced in economies with strong creditor rights.

We estimate equation (5) by collateral type to test how the the relation between collateral spread and agency and production risk varies with financial development.

$$Y_i^0 = \alpha_c + \beta_1 R_i^{Z0} + \beta_2 \widehat{R}_i^0 + \beta_3 R_i^{Z0} * F_c + \beta_4 \widehat{R}_i^0 * F_c + \varepsilon_i \tag{5}$$

where F_c is financial development measured as the country-level creditor rights index.

The creditor rights index measures the ease with which creditors secure assets in the event of bankruptcy, and is taken from Djankov, McLiesh, and Shleifer (2007).[14] The index is the sum of four variables that capture the relative power of secured creditors in the event of bankruptcy: (i) the requirement of creditor consent when a debtor files for reorganization, (ii) the ability of a creditor to seize collateral once petition for reorganization is approved, (iii) whether secured creditors are paid first under liquidation, and (iv) whether an administrator, and not management, is responsible for running the business during the reorganization. A value of one is added to the index for each of these creditors protections afforded under a country's laws and regulations. Thus a score of 0 suggests very poor creditor rights whereas 4 suggests strong creditor rights. We use the creditor rights index for 2003 reported in the DMS data set. Given the very high level of persistence in creditor rights for a country over time, our results do not change if we use the average creditor rights index over a different time period.[15] The results are presented in Table 7.

We find that the collateral pecking order is more pronounced in economies with weak creditor rights. In column (1) we present evidence for total collateralization and find that the demand elasticity for collateral is 6.96% (9.51%+1*-2.15%) per grade of agency risk for economies with creditor rights equal to one, but only 0.9% for economies with strong creditor rights. This equates to a collateralization spread (the change in collateralization going from high to low risk borrowers) of 21 percentage points in economies with weak creditor rights and 3 percentage points in economies with strong creditor rights. Further, the stronger demand for non-specific assets as collateral when faced with high agency costs is dampened by strong creditor rights. For example the demand elasticity for land and real estate is 3.89% per grade of agency risk for economies with creditor rights equal to one, but only 0.66% for strong creditor rights economies. Interestingly, strong creditor rights also opens the door for

[14]The creditor rights index is downloaded from the DMS data at www.andrei-shleifer.com.

[15]Our results are robust to using alternate measures of financial development such as the ratio of private credit to GDP.

firms to use a wider range of asset type as collateral. The negative and significant coefficient on $AgencyRisk$ and positive and significant coefficient on $AgencyRisk \times CreditorRights$ for movable assets implies that banks reduce demand for this specific asset from borrowers with high agency risk in economies with weak creditor rights, but accept movable assets as collateral from borrowers of similar riskiness in economies with strong creditor rights.

It is worth reiterating these findings on the collateral pecking order. We already know from Tables 4 and 5 that collateral commits against agency risk and that a pecking order of collateral exists. Therefore, if the coefficient on $CreditorRights$ x $AgencyRisk$ in Table 6 were negative for all asset types, this would not be a big surprise - all that it would have meant is that as agency risk decreases in financially developed economies, both specific and non-specific types of collateral are equally likely to be reduced. However, the manner in which the effect of agency risk on collateralization rate varies with financial development also varies by collateral type paints a different picture. The fact that the the coefficient on $CreditorRights$ x $AgencyRisk$ in Table 6 tends to be negative for non-specific assets (land and real estate, guarantees), but positive for firm-specific assets reveals that not only does financial development mitigate concerns related to agency, as implied by the lower collateral spread, but the composition of collateral also shifts towards specific assets. As Liberti and Mian (2010) point out this suggests that financial development not only reduces the reliance on collateral, but also enables banks to accept firm-specific forms of assets as collateral. However, our results go further and show that the channel through which financial development reduces demand for non-specific collateral is by better protecting lenders from agency concerns.

5 Identification Issues

5.1 Information Environment and Rating Precision

The results presented in this paper explore the dual role of collateral. The identification in equations (3) and (4) hinge on there not being some alternative explanation for the relation between collateral, both level and type, and borrower risk, both agency and production. In this section we consider and rule out identification concerns. The ideal experiment to test equation (4) is to pick a set of firms, randomly assign each firm a risk type and grade and then measure how the *demand* for collateralization differs across low and high risk firms. Unfortunately nature is seldom this accommodating. We must therefore pay particular attention to factors that might affect a firm's risk rating and its equilibrium rate of collateralization at the same time. We discuss two such factors and then test how they actually co-vary with firm risk and collateralization in the data.

First, the borrower rating may exhibit imprecision. We implicitly assume that risk grade is an accurate measure of borrower risk, and further that it is a good combined measure of production and agency risk. Ordinarily, having an imprecise measure would simply downward bias the relationship between risk and collateral. However, our identification strategy hinges on the proposition that, if collateral mitigates agency risk, production risk alone explains default. This proposition allows to instrument agency risk with the component of risk grade unrelated to default. This approach is problematic if risk grade imprecisely measures default, because then the instrumented agency risk likely contains default risk. To mitigate this concern, we identify those observations where the risk grade is likely to be most precise, and repeat the identification in Table 10 and results in Table 4 for this subset of observations.

We measure precision in risk grade as the sensitivity in how well risk grade predicts future default. For example, a precise risk grade would accurately predict future default such that a higher risk grade would be positively associated with future default. In contrast,

a randomly allocated risk grade would be expected to have zero predictive power of default, and there would be little relation between risk grade and future default. Thus, a more precise risk grade should have a larger positive relation with default, all else equal. We posit that precision is likely related to the information environment faced by loan officers when evaluating the credit risk of the borrower. Specifically, we expect that firm size, the existence of a credit registry or private credit bureau, the existence of better collateral laws, the reliance on subjective credit manual questions (as opposed to objective questions), and the focus of the lending program all affect precision.[16][17]

We examine the precision of the risk grade by estimating the relation of risk grade on default and further how this is effected by the information environment:

$$Default_i = \alpha_c + \beta_1 R_i^0 + \beta_2 Information_i + \beta_3 Information_i * R_i + \beta_4 X_i^0 + \varepsilon_i \qquad (6)$$

where $Default$ is a dummy variable equal to one if the borrower enters default in the future, R_i^0 is the risk grade, $Information$ is an information environment measure, X_i are borrower-level control variables, and α_c are country-level fixed effects. $Information$ measures include the following: a dummy variable equal to one if the borrower is large as defined by the bank (Sales Size 1); a dummy variable equal to one if the country has a public credit registry; a dummy variable equal to one if the country has a private credit bureau; a dummy variable equal to one if the country's collateral law index is above the median; the fraction of credit manual questions that are subjective; and the focus of the lending program measured as the number of industries normalized by the number of borrowers in the lending program.

The results are presented in Table 8. Overall, the risk grade is precise in so much that it

[16]The credit registry or private credit bureau data are taken from DHMS, and the collateral law index is taken from the World Bank Doing Business Report

[17]The classification of credit manual questions is presented in Appendix 3. Some criteria are common across countries. For example, all countries have leverage, some sort of coverage ratio measure (one of interest coverage ratio, debt service coverage ratio or EBITDA-to-financial cost) and years in industry. There is variation in terms of specific criteria and subjective criteria.

predicts default and a worse risk grade is more strongly associated with default. Examining the results for large firms, we find that these firms are less likely to experience default compared with smaller firms, but that the risk grade better predicts default than for smaller firms: comparing the coefficients on $Risk\ Grade$ and $Risk\ Grade \times Information$ reveals that the risk grade for large firms is roughly twice as precise than for smaller firms. This latter result is common across the information environments we study. Risk grade is more precise in information environments where the loan officer is able to rely more on hard information (e.g., large firms, countries with public credit registries or private credit bureaus in place or better collateral laws, and more specialized lending programs both in terms of customer selection criteria with fewer subjective credit questions and the number of industries per borrowers.) We exploit these results on grade precision to rule out that our main results are an artifact of grade imprecision. In Table 9 we repeat the estimation in column (2) of Table 4 for the sub-sample of observations with a more "precise" information environment based on the results in columns (1) - (6) of Table 8. The main results continue to obtain: agency risk alone explains collateralization.

5.2 Examining Collateralization Rate and Interest Rate Spread

The focus of this paper is explaining the role of collateral, and understanding the sensitivity of demand for collateral to agency and default risk. However, the bank loan contract also includes an interest rate spread which might also be sensitive to firm risk. Consequently, there is a concern that examining collateralization alone might lead to an inaccurate estimate of the elasticity of collateralization demand. This would be a concern if interest rates and collateralization act as substitute commitment mechanisms against agency risk.

The results in Section 1.1 offer some insight. Proposition 1 implies that while spread offers a natural mechanism for banks to manage default risk, spread might aggravate agency problems. Specifically, examining constraint (2) reveals that a higher interest rate leads to

the firm retaining less of the output and therefore the manager more inclined to default. Put differently, a higher interest rate spread aggravates the agency problem, which in turn requires a greater collateral commitment.

We examine the empirical relation between collateralization and interest rates in Table 10. We test for the relation while overcoming some of the obstacles faced in prior literature, such as endogeneity and selection bias. In particular, it is important to note that our measure of risk, Risk Grade, is an assessment of borrower firm risk that is independent of the collateral pledged and the interest rate. This is in stark contrast to ratings provided by third parties such as credit ratings of public firms which asses the credit risk after taking collateral into consideration. In column (1) of Table 10 we show a positive collateral spread on average as collateralization increases with firm risk, consistent with the main results in this paper. All estimations include country fixed effects to purge common factors that might explain collateralization rate and interest rate spread, as well as borrower characteristics.

In columns (2) - (4) of Table 10 we examine the relation between collateralization rate and interest rate spread. The results show that, controlling for risk classification, loan size and collateral supply, collateralization increases with interest rate spread. In column (2) we repeat the within country-industry tests and show that, controlling for the level of borrower risk, collateralization rate and interest rate spread are positively related. An increase in spread of 100 basis points is associated with a 1.16 percentage point increase in the collateralization rate. Higher interest rates create a larger wedge between output and the firm's proceeds, which aggravates the agency problem and in turn requires greater collateral to mitigate. One concern with the result presented in column (2) is that although we control for the effect of risk grade on collateralization rate, we are estimating the sensitivity of collateralization to interest rate spreads within a country, and that risk grade might vary within a country. To address this concern, we repeat the estimation employing country-industry-risk grade fixed effects (column (3)) and country-industry-borrower size-risk grade

fixed effects (column (4)). This ensures that we estimate the sensitivity of collateral to interest rates across firms with the same ex-ante risk grade, and of similar size in the same country-industry. Once again, we find that the collateralization rate is positively related to the interest rate spread, which offers support for the commitment perspective of collateral.

5.3 The Supply of Collateral

The third concern is that the equilibrium rate of collateralization may be affected by the supply of a firm's collateralizable assets. For example, firms with greater (or cheaper) supply of collateralizable assets may be willing to put up more collateral per dollar borrowed in exchange for lower interest rate charged by the bank. We only need to worry about this concern if the supply of collateralizable assets is negatively correlated with risk grade, *i.e.* as grade deteriorates, firms have more collateralizable assets available to them. Throughout we control for the supply of collateralizable assets by including borrower level balance sheet and income statement items in the estimations of collateralization rates. Overall, we find that the supply of collateral is important in explaining collateralization, but that our results are robust to the inclusion of these measures. Further, in untabulated results we show, perhaps unsurprisingly, that collateral supply is positively associated with borrower quality.

6 Concluding Remarks

The use of collateral predominantly as a commitment device to prevent agency risk raises a number of interesting questions for further inquiry. At one end of the spectrum, existing macro literature treats collateral as one of the main causes for frictions that lead to volatility, contagion, and poverty traps. At the other end however, micro theory coupled with the evidence presented in this paper perceives collateral as a critical factor in limiting agency risk. It may not be unreasonable therefore to think of collateral as the "necessary evil"

needed to sustain financing in a less than perfect world.

This view of collateral raises a number of interesting research questions regarding alternative mechanisms available to an economy for limiting agency concerns. Even a cursory look across economies suggests that there are other potential avenues for dealing with agency risk. Such alternatives include more efficient enforcement of laws, market discipline through the use of credit registries, social or venture networks with better enforcement and information tools, and better social norms. At least some of these alternative mechanisms for dealing with agency risk are likely to be more efficient than collateral from a macro perspective. There is also apparent variation across economies in the availability and use of these alternative mechanisms. What explains such variation? Why do some economies adopt different and potentially superior mechanisms for dealing with agency risk than others? We hope that future work will guide us towards the answers.

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Figure 1: Reasons for Default

The figure plots reasons for default and the percentage frequency given by loan officers for 133 default cases of the 511 borrowers in the lending program in Argentina. Loan officers classify defaults according to 30 reasons for default/early warnings originally provided by the bank. We classify the original reasons, reported in Appendix 1, into 7 classifications: Financial Leverage, Industry Conditions, Receivables/Bad Debt, External Hard Information, Business Strategy, Management and Union Conditions.

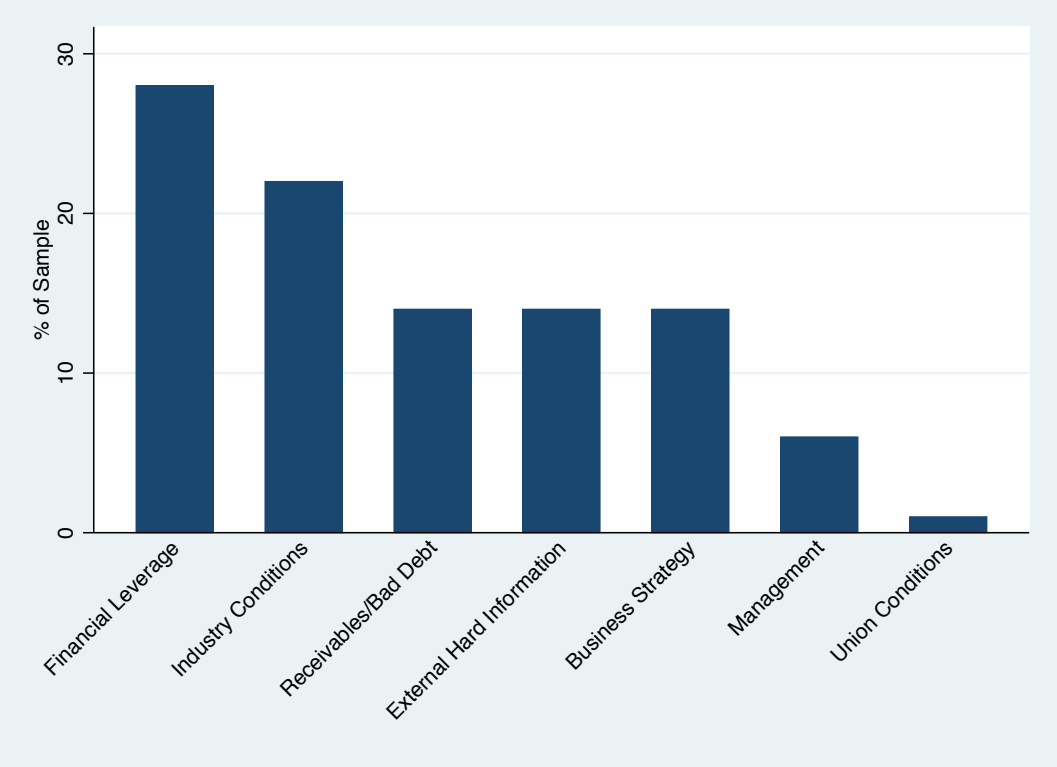

Figure 2: Cumulative Effect of the Collateral Pecking Order

The figure plots the cumulative effect of the collateral pecking order. The cumulative effect on collateral demand is plotted for each asset class. The cumulative effect measures the effect on collateral from moving from Risk Grade "A" (1) to Risk Grade "D" (4). Assets classes vary in there specificity from firm- and industry-specific (high specificity) to guarantees, cash, and land (low specificity).

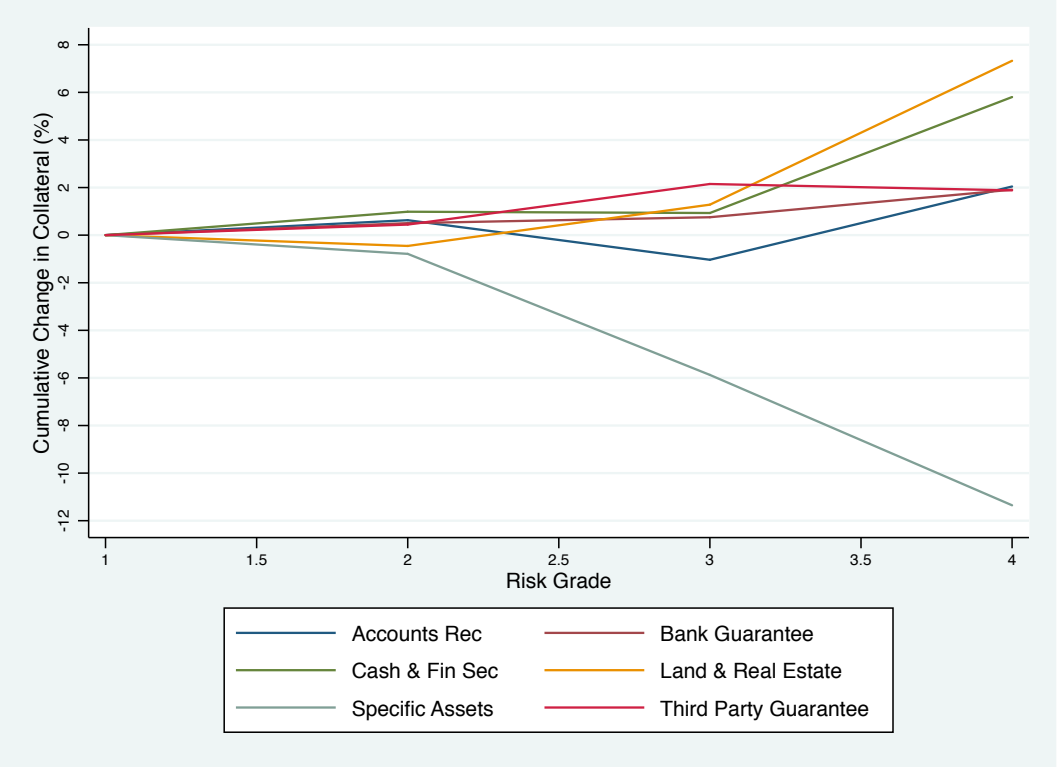

Table 1: Data Description by Country

This table presents the distribution of data by country along with the countrys financial and economic development measures. The data comes from a sample of 9,211 small and medium-sized private firms borrowing from a multinational bank in 15 different emerging markets. Countries are ordered in alphabetical order. For each country the table reports Number of Firms, Average Size of the Loan ($000), Number of Industries, the Number of Firms as a % of Total Firms and the relative importance of the country as a % of Total Loans. The economic and financial development indicators Creditor Rights, Public Registry, Private Bureau, and GDP per Capita are from Djankov, McLiesh and Shleifer (2007) data downloaded from www.andrei-shleifer.com. Collateral Law Index is from the World Bank Doing Business database. This measure captures the simplicity, efficiency and accessibility of the business regulatory environment in relation to collateral laws only as they apply to domestic firms. Lending Program indicators include the ratio of Subjective Questions in the Customer Selection Criteria over the Total Number of Questions (% Subjective Credit Questions) and the Number of Industries normalized by the number of borrowers in the lending program. These measures are constructed using the bank's Credit Manuals from the lending programs of each specific country. Appendix 4 reports the sample distribution of firms by industry.

	Avg. Loan					Financial Development					Lending Program	
Country	No. of Firms	Size ($000)	No. of Ind	% of Total Firms	% of Total Loans	Creditor Rights	Public Registry	Private Bureau	Collateral Law Index	GDP per Capita	% Subjective Credit Questions	#Ind. per Borrower
Argentina	511	528	23	5.5	7.4	1	1	1	6	3,650	25.00	4.50
Chile	1,248	127	77	13.5	4.3	2	1	1	3	4,390	6.25	6.17
Czech Rep.	1,440	296	73	15.6	11.6	3	1	1	5	6,740	37.50	5.07
Hong Kong	1,169	618	65	12.7	19.7	4	0	1	8	25,430	13.33	5.56
India	494	626	49	5.4	8.4	2	0	0	5	530	20.00	9.91
South Korea	1,427	94	71	15.5	3.6	3	1	1	6	12,020	0.00	4.98
Malaysia	697	339	62	7.6	6.4	3	1	1	8	3,780	33.33	8.90
Pakistan	96	599	35	1.0	1.6	1	1	0	5	470	15.38	36.46
Romania	135	191	47	1.5	0.7	1	0	0	6	2,310	23.50	34.81
Singapore	237	680	58	2.6	4.4	3	0	0	8	21,230	41.67	24.47
Slovakia	140	472	43	1.5	1.8	2	1	0	8	4,920	37.50	30.71
South Africa	307	1505	59	3.3	12.6	3	0	1	8	2,780	14.29	19.22
Sri Lanka	102	468	17	1.1	1.3	2	0	1	2	930	37.50	16.67
Taiwan	443	723	54	4.8	8.7	2	1	1	3	13,320	30.77	12.19
Turkey	765	358	54	8.3	7.5	2	1	0	3	2,790	23.10	7.06
Total/average	9,211	398	86	100.0	100.0	2.3	0.6	0.6	5.6	7,019	23.27	15.11

Table 2: Summary Statistics: Cross-Country Firm-Level Data

This table presents cross-country firm-level summary statistics of all the variables used in the empirical analysis for the sample of 9,211 firms. All variables are measured at the beginning of the sample except Default Status and Risk Grade Decrease Status which are estimated at the samples end. Standard deviation (SD) within country is computed after demeaning each variable at the 15 country levels, while SD within each country-industry is computed after demeaning each variable at the 782 country-industry categories. All variable definitions are described in Appendix 5.

Variable	Mean	SD	SD within Country	SD within Country-Industry	Obs.
Loan Characteristics					
Risk Grade	2.65	0.99	0.90	0.80	9,211
A	0.14	0.35			9,211
B	0.29	0.46			9,211
C	0.33	0.47			9,211
D	0.23	0.42			9,211
Total Loan Approved (in $000)	601.37	995.45	763.46	655.20	9,211
Loan Outstanding (in $000)	398.43	905.33	669.46	568.39	9,211
Interest Rate Spread (%)	7.93	2.96	2.48	2.21	9,211
Default by End of Sample	5.47	22.74	18.32	14.59	9,211
Delinquent Days	11.56	69.65	11.56	11.56	9,211
Collateralization Rate	55.10	44.33	33.14	30.35	9,211
Breakdown of Collateralization Rate by:					
Accounts Receivables	9.00	25.88	11.84	10.35	9,211
Bank Guarantees	0.89	9.23	0.89	0.89	9,211
Cash & Financial Securities					
Cash	7.81	23.45	14.25	10.98	9,211
Financial Securities	0.02	1.48	0.02	0.02	9,211
Land/Real Estate	13.30	31.67	21.26	18.35	9,211
Movable Assets Firm-Specific Assets					
Firm-Specific Assets	8.09	28.64	9.54	5.84	9,211
Inventory	3.24	16.35	2.90	2.48	9,211
Machinery & Equipment	11.95	29.97	19.05	13.48	9,211
Third-Party Guarantees					
Import/Export Letters of Credit	0.10	3.01	1.00	0.67	9,211
Guarantees	0.20	4.15	2.02	0.77	9,211
Promissory Notes	0.55	6.86	3.32	2.45	9,211
Financial Characteristics					
Sales Size Indicator	0.95	0.99	0.71	0.64	9,211
0	0.40	0.49			9,211
1	0.35	0.48			9,211
2	0.14	0.35			9,211
3	0.11	0.31			9,211
Net Fixed Asset Ratio (%)	0.33	0.20	0.18	0.16	9,211
Cash/Assets (%)	0.07	0.03	0.03	0.03	9,211
EBITDA/Sales (%)	0.15	0.22	0.15	0.14	9,211
Exporter (dummy)	0.21	0.41	0.39	0.17	9,211
Relationship Characteristics					
No. Bank Relationships	7.00	2.35	7.00	7.00	9,211
Personal Client (dummy)	0.21	0.13	0.11	0.10	9,211
Firm Age (years)	22.10	10.12	9.14	3.98	9,211

Table 3: Decomposition of Production and Agency Risk

This table reports first stage estimates of the decomposition of risk grade into production and agency risk. Production risk is estimated as the component of Risk Grade that explains default in Model 1 (Column (1)), and default, delinquency and export status in Model 2 (Column (2)). Agency risk is estimated as the residual Risk Grade in Models 1 and 2. In Model 3 (Column (3)), production risk is estimated as in Column (2) and agency risk is estimated as the component of Risk Grade related to the borrower-bank relationship characteristics. Column (4) estimates risk grade on measures of default risk and agency risk together. Default is a dummy variable that takes a value of 1 if it records whether the loan enters default status by the end of the sample period (2 years), and 0 otherwise. By construction no firm is in default at the beginning of the sample. Delinquent Days is the maximum delinquency recorded (measured in days) over the sample period. Exporter is a dummy variable that takes a value of 1 if the bank indicates the borrower is an exporter, and 0 otherwise. Personal Client is a dummy variable that takes a value of 1 for those borrowers whose owners have a previous personal-banking relationship with the bank, and 0 otherwise. Borrower Age is measured by the number of years the borrower has been in business (e.g., the constitution of the company as a legal entity). Length of Relationship is the number of months the borrower and the bank have been in a relationship. Risk Grade is the borrower risk grade assigned by loan officers at the beginning of the sample, which takes on values of "A" (Best) to "D" (Worse). The variable is transformed into a continuous variable by assigning the values: "A"=1, "B"=2, "C"=3, and "D"=4. It is based on an index of the ex-ante assessment rating for each borrower. To ensure comparability across borrowers, we standardize each borrowers predicted agency and production risk quantities by subtracting the sample mean and dividing by the sample standard deviation. The unit of observation is at the borrower firm level. There are 782 country-industry fixed effects and 4 firm sales size fixed effects. All fixed effects are denoted as FE. All variable definitions are given in Appendix 5. Standard errors are reported in parentheses and are computed after allowing for correlation in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable	Risk Grade			
Identification	Production Risk		Agency Risk	Production & Agency Risk
	(1)	(2)	(3)	(4)
Default	0.38***	0.23***		0.22**
	(0.04)	(0.05)		(0.09)
Ln(Delinquent Days)		0.05***		0.03*
		(0.01)		(0.02)
Exporter		-0.43***		-0.30***
		(0.09)		(0.06)
Personal Client			0.88**	0.95**
			(0.42)	(0.43)
Ln(Borrower Age)			-1.44***	-1.38***
			(0.34)	(0.33)
Ln(Length of Relationship)			2.19***	2.12***
			(0.41)	(0.40)
Country-Industry FE	Yes	Yes	Yes	Yes
Sales Size Indicator FE	No	Yes	Yes	Yes
Observations	9,211	9,211	9,211	9,211
Adj. R^2	0.31	0.33	0.50	0.52

Table 4: Collateralization Rate with Respect to Ex-Ante Firm Agency and Production Risk

This table reports OLS estimates of the collateralization rate with respect to ex-ante firm agency and production risk grade. Risk Grade is first decomposed into the components that account for production risk and agency risk, presented in Table 3. The unit of observation is at the borrower firm level in Columns (1) through (4), and at the country level in Columns (5) and (6). Column (1) presents results using the estimation from Model 1 (Default) to estimate production risk. Column (2) presents results using the estimation from Model 2 (Default, Delinquent Days, and Exporter) to estimate production risk. Columns (3) repeat the estimations in Columns (1) and (2) but agency risk is estimated directly using Model 3 (Personal Client, Borrower Age and Length of Relationship). The models are explained fully in Table 3. Column (4) employs loan officer responses to credit manual questions to identify production and agency risk directly. The credit manual responses are available for Argentina only and the manual questions are presented in Appendix 2 and discussed in the main paper. Columns (5) and (6) report equal-country weighted collateralization rate OLS estimates on production risk and agency risk, respectively. Decomposition estimations in Columns (1) through (3) include 15 country fixed effects, 4 firm sales size fixed effects and time-variant borrower characteristics. All fixed effects are denoted as FE. All variable definitions are given in Appendix 5. Standard errors are reported in parentheses and are computed after allowing for correlation in a given country-industry, except in Columns (4) and (5). *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable	Collateralization Rate				Country-level Collateralization Rate	
	Instrument					
Identification Model	Default (1)	Production Risk (2)	Production & Agency Risk (3)	Credit Manuals (4)	Production Risk (5)	Production Risk (6)
Production Risk	-0.03	0.70	-0.39	1.00	-1.96	
	(0.47)	(0.86)	(0.60)	(2.38)	(1.55)	
Agency Risk	3.87***	3.79***	2.24**	4.95***		3.32**
	0.55)	(0.52)	(0.92)	(1.67)		(1.38)
Ln(Total Loan Approved)	3.90***	3.91***	3.80***	2.13***		
	(0.64)	(0.65)	(0.68)	(0.94)		
Country FE	Yes	Yes	Yes	No	-	-
Borrower Characteristics	Yes	Yes	Yes	No	-	-
No. of Obs.	9,211	9,211	9,211	511	15	15
Adj. R^2	0.40	0.40	0.40	0.05	0.00	0.00

Table 5: Collateral Pecking Order

This table tests how the composition of collateral shifts as firm risk grade increases within a country. Collateralization Rate is measured by Asset Class used as collateral. Asset classes vary in there specificity from firm- and industry-specific (high specificity) to Guarantees, Cash, and Land & Real Estate (low specificity). We categorize 6 asset classes: Account Receivables, Bank Guarantees, Cash & Financial Securities, Land and Real Estate, Movable Assets and Third-Party Guarantees. The unit of observation is at the borrower firm level. Column (1) reports OLS estimates of the Total Collateralization Rate on Risk Grade. Risk Grade is the borrower risk grade assigned by loan officers at the beginning of the sample, which takes on values of A (Best) to D (Worse). The variable is transformed into a continuous variable by assigning the values: "A"=1, "B"=2, "C"=3, and "D"=4. It is based on an index of the ex-ante assessment rating for each borrower. Columns (2) through (7) report OLS estimates of the Total Collateralization Rate on Risk Grade for the 6 asset classes, respectively. All regressions include 15 country fixed effects, 4 firm sales size fixed effects and time-variant borrower characteristics. All fixed effects are denoted as FE. All variable definitions are given in Appendix 5. Standard errors are reported in parentheses and are computed after allowing for correlation in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable	Collateralization Rate (by Asset Class)						
	Total	Accounts Rec.	Bank Guarant.	Cash & Fin. Sec	Land & Real Estate	Movable Assets	Third-Party Guarant.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Risk Grade	3.63***	0.78**	0.75***	2.39***	2.50***	-3.91***	1.13
	(0.77)	(0.33)	(0.19)	(0.43)	(0.60)	(1.16)	(1.03)
Ln(Total Loan App.)	3.90***	1.22***	0.33***	0.42**	3.63***	-1.03**	0.52**
	(0.60)	(0.40)	(0.09)	(0.18)	(0.64)	(0.43)	(0.26)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	9,211	9,211	9,211	9,211	9,211	9,211	9,211
Adj. R^2	0.41	0.31	0.10	0.36	0.24	0.48	0.18

Table 6: Collateral Pecking Order with Respect to Ex-Ante Firm Agency and Production Risk

This table tests how the composition of collateral shifts with respect to ex-ante firm agency and production risk within a country-industry. Collateralization Rate is measured by the Asset Class used as collateral. Asset classes vary in there specificity from firm- and industry-specific (high specificity) to Guarantees, Cash, and Land & Real Estate (low specificity). We categorize 6 asset classes: Account Receivables, Bank Guarantees, Cash & Financial Securities, Land and Real Estate, Movable Assets and Third-Party Guarantees. The unit of observation is at the borrower firm level. Risk Grade is the borrower risk grade assigned by loan officers at the beginning of the sample, which takes on values of A (Best) to D (Worse). The variable is transformed into a continuous variable by assigning the values: "A"=1, "B"=2, "C"=3, and "D"=4. It is based on an index of the ex-ante assessment rating for each borrower. Risk Grade is decomposed into the components that account for production risk and agency risk in Model 2 presented in Column (2) of Table 3. Column (1) reports OLS estimates of Total Collateralization Rate on Production and Agency Risk. Columns (2) through (7) report OLS estimates of the Total Collateralization Rate on Production and Agency Risk for the 6 asset classes, respectively. All specifications include 15 country fixed effects and 4 firm sales size fixed effects. All fixed effects are denoted as FE. Variable definitions are given in the Appendix 5. Standard errors are reported in parentheses and are computed after allowing for correlation in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable	Collateralization Rate (by Asset Class)						
	Total	Accounts Rec.	Bank Guarant.	Cash & Fin. Sec	Land & Real Estate	Movable Assets	Third-Party Guarant.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Production Risk	0.70	-0.20	0.14	-0.17	1.03	-0.78	0.42
	(0.86)	(0.42)	(0.11)	(0.59)	(0.71)	(1.12)	(1.73)
Agency Risk	3.79***	0.42*	0.49***	1.96***	1.86***	-1.24**	0.17
	(0.52)	(0.24)	(0.15)	(0.33)	(0.49)	(0.53)	(0.39)
Ln(Total Loan App.)	3.91***	1.18***	0.31***	0.35*	3.61***	-1.02**	0.49*
	(0.65)	(0.39)	(0.08)	(0.18)	(0.63)	(0.44)	(0.30)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	9,211	9,211	9,211	9,211	9,211	9,211	9,21
Adj. R^2	0.40	0.31	0.10	0.36	0.24	0.48	0.18

Table 7: Collateral Pecking Order with Respect to Ex-Ante Firm Agency and Production Risk and Financial Development

This table tests how the composition of collateral shifts with respect to ex-ante firm agency and production risk and whether the shift varies with financial development within a country-industry. Collateralization Rate is measured by the Asset Class used as collateral. Asset classes vary in there specificity from firm- and industry-specific (high specificity) to Guarantees, Cash, and Land & Real Estate (low specificity). We categorize 6 asset classes: Account Receivables, Bank Guarantees, Cash & Financial Securities, Land and Real Estate, Movable Assets and Third-Party Guarantees. The unit of observation is at the borrower firm level. Risk Grade is the borrower risk grade assigned by loan officers at the beginning of the sample, which takes on values of "A" (Best) to "D" (Worse). The variable is transformed into a continuous variable by assigning the values: "A"=1, "B"=2, "C"=3, and "D"=4. It is based on an index of the ex-ante assessment rating for each borrower. Risk Grade is decomposed into the components that account for production risk and agency risk in Model 2 presented in Column (2) of Table 3. Financial Development is measured as the country-level creditor rights from Djankov, McLiesh and Shleifer (2007). Column (1) reports OLS estimates of Total Collateralization Rate on Production Risk, Agency Risk and the interaction of Creditor Rights with both risks. Columns (2) through (7) report OLS estimates of the Total Collateralization Rate on Production Risk, Agency Risk and the interaction of Creditor Rights with both risks for the 6 asset classes, respectively.: All specifications include 15 country fixed effects and 4 firm sales size fixed effects. All fixed effects are denoted as FE. All variable definitions are given in Appendix 5. Standard errors are reported in parentheses and are computed after allowing for correlation in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable	Collateralization Rate (by asset type)						
	Total	Accounts Rec.	Bank Guarant.	Cash & Fin. Sec	Land & Real Estate	Movable Assets	Third-Party Guarant.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Production Risk	-0.49	-1.60	1.05**	0.89	1.40	-2.30	1.32
	(2.47)	(1.05)	(0.49)	(1.28)	(1.47)	(3.28)	(2.75)
Agency Risk	9.51***	0.56	1.24***	2.94***	5.50***	-2.73**	0.63
	(1.45)	(0.68)	(0.38)	(0.87)	(1.19)	(1.19)	(1.11)
Creditor Rights ×	0.47	0.62	-0.41**	-0.48	-0.19	1.14*	-0.38
Production Risk	(1.11)	(0.42)	(0.20)	(0.52)	(0.55)	(0.60)	(0.80)
Creditor Rights ×	-2.15***	-0.06	-0.33***	-0.44	-1.21***	0.66**	-0.21
Agency Risk	(0.59)	(0.23)	(0.11)	(0.32)	(0.45)	(0.33)	(0.41)
Ln(Total Loan App.)	3.93***	1.17***	0.33***	0.36**	3.64***	-1.05**	0.51*
	(0.64)	(0.39)	(0.09)	(0.18)	(0.64)	(0.45)	(0.30)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	9,211	9,211	9,211	9,211	9,211	9,211	9,211
Adj. R^2	0.40	0.31	0.10	0.36	0.24	0.48	0.18

Table 8: Grade Precision and Information Environment

This table reports OLS estimates of default with respect to Risk Grade and the Information Environment. Precision in Risk Grade is measured as the sensitivity of Risk on Default Prediction. The unit of observation is at the borrower firm level. Default is an indicator variable that takes a value of 1 if the firm is in default at the end of the sample period, and 0 otherwise. Risk Grade is the borrower risk grade assigned by loan officers at the beginning of the sample, which takes on values of A (Best) to D (Worse). The variable is transformed into a continuous variable by assigning the values: "A"=1, "B"=2, "C"=3, and "D"=4. It is based on an index of the ex-ante assessment rating for each borrower. Information represents the information environment which is captured by 6 different measures at different levels borrower (Column (1)), country (Columns (2) to (4)) and Lending Program (Columns (5) to (6)). The 6 measures are: Large Firms, Public Credit Registry, Private Bureau, Collateral Law Index, %Subjective Questions and Number of Industries per 100 Borrowers. Large Firms is a dummy that takes a value of 1 if the borrower is in the Sales Size categories 2 and 3 as defined by the bank. Public Credit Registry is a dummy variable that takes a value of 1 if the country has a public credit registry, and 0 otherwise. Private Credit Bureau is a dummy variable that takes a value of 1 if the country has a private credit bureau, and 0 otherwise. Collateral Law Index is a dummy variable that takes a value of 1 if the country's collateral index is above the median. % Subjective Questions is the fraction of credit manual questions for each country that are subjective in nature relative to the total number of questions. The measure is constructed using the Credit Manuals of the bank for each country. The customer selection criteria for each country are summarized in Appendix 3. Number of Industries is the total number of industries (as per Appendix 4) normalized by the total number of borrowers in each country lending program. Estimations include 15 country fixed effects, 4 firm sales fixed effects and time-variant borrower characteristics. Fixed effects are denoted as FE. Standard errors are reported in parentheses and are computed after allowing for correlation in a given country-industry, except in Columns (4) and (5). *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable	Default					
Identification	Borrower	Country			Lending Program	
Information	Large Firms	Credit Registry	Private Bureau	Collateral Law Index	% Subj. Credit Questions	#Industries
	(1)	(2)	(3)	(4)	(5)	(6)
Risk Grade	2.64***	2.44***	2.01***	1.11***	4.49***	4.86***
	(0.43)	(0.67)	(0.56)	(0.29)	(0.70)	(0.66)
Risk Grade × *Information*	2.57***	1.12	1.60**	4.02***	-6.44***	-18.13***
	(0.94)	(0.83)	(0.74)	(0.68)	(2.34)	(3.82)
Information	-5.98***					
	(2.22)					
Ln(Total Loan App.)	1.12***	1.12***	1.12***	1.00***	1.07***	1.08***
	(0.22)	(0.22)	(0.22)	(0.20)	(0.21)	(0.21)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	9,211	9,211	9,211	9,211	9,211	9,211
Adj. R^2	0.13	0.13	0.13	0.14	0.13	0.13

Table 9: Collateralization Rate with Respect to Ex-Ante Firm Agency and Production Risk: Grade Precision and Information Environment

This table reports OLS estimates of the collateralization rate with respect ex-ante firm agency and production risk grade using the sub-sample of observations with more precise information environment. We define the sub-samples based on the results in Table 8, Columns (1) to (6). Column (1) to (6) use the sub-sample of large firms, countries with a public credit registry, countries with a private credit bureau, countries with a collateral law index, % Subjective Questions and Number of Industries above the median, respectively. For each sub-sample, we repeat the estimation in Table 3, Column (2) where we instrument production risk using Model 2 (Default, Delinquent Days and Exporter) and agency risk as the residual of this first-stage regressions. The unit of observation is at the borrower level. All regressions include 15 country fixed effects, 4 firm sales size fixed effects and time-variant borrower characteristics. All fixed effects are denoted as FE. All variable definitions are given in Appendix 5. Standard errors are reported in parentheses and are computed after allowing for correlation in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable	Collateralization Rate					
Identification	Borrower	Country			Lending Program	
Information Sub-sample	Large Firms	Credit Registry	Private Bureau	Collateral Law Index	Low %Subjective Questions	Low #Industries
	(1)	(2)	(3)	(4)	(5)	(6)
Production Risk	0.96	1.12	0.28	-0.43	1.65	0.41
	(1.06)	(1.04)	(1.00)	(0.96)	(1.33)	(0.89)
Agency Risk	4.87***	4.42***	3.43***	2.30***	3.77***	4.63***
	(0.98)	(0.55)	(0.56)	(0.74)	(0.54)	(0.80)
Ln(Total Loan App.)	-0.53	4.48***	4.20***	0.44	3.41***	4.32***
	(0.73)	(0.66)	(0.73)	(0.76)	(1.01)	(1.24)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	2,300	6,767	7,344	4,623	2,675	3,378
Adj. R^2	0.26	0.38	0.42	0.26	0.60	0.51

Table 10: Examining the Relation Between Collateralization Rates and Interest Rates Spread

This table reports OLS estimates of the collateralization rate and interest rate spread with respect to overall ex-ante firm risk grade. The unit of observation is at the borrower firm level. The dependent variable is Collateralization Rate. Collateralization Rate is measured as the percentage of the loan covered by the estimated liquidation value of the collateral. Interest Rate Spread is measured as the spread above the cost of funds of the bank to a particular borrower. It is calculated as the net revenue from funds over the quarterly average total loan outstanding. Risk Grade is the borrower risk grade assigned by loan officers at the beginning of the sample, which takes on values of "A" (Best) to "D" (Worse). The variable is transformed into a continuous variable by assigning the values: "A"=1, "B"=2, "C"=3, and "D"=4. It is based on an index of the ex-ante assessment rating for each borrower. Total Loan Approved represents the total amount of credit facilities that have been approved by the bank at the borrower level. There are 15 country fixed effects, 782 country-industry fixed effects and 4 firm sales size fixed effects. All fixed effects are denoted as FE. Borrower characteristics include Firm Sales Size FE, Net Fixed Assets-to-Assets, Cash-to-Assets, and Profitability measured by EBITDA-to-Sales. All borrower characteristics are time-variant except for Firm Sales Size. All variable definitions are given in Appendix 5. Standard errors are reported in parentheses and are computed after allowing for correlation in a given country-industry. *, ** and *** statistical significance at the 10, 5 and 1 percent levels.

Dependent Variable	Collateralization Rate			
	(1)	(2)	(3)	(4)
Risk Grade	3.63***	3.43***		
	(0.77)	(0.75)		
Interest Rate Spread		1.16***	0.86**	0.79*
		(0.38)	(0.41)	(0.44)
Ln(Total Loan Approved)	3.90***	5.45***	5.07***	5.23***
	(0.60)	(0.87)	(0.97)	(1.03)
Country FE	Yes	Yes	No	No
Country x Industry x Risk FE	No	No	Yes	No
Country x Industry x Size x Risk FE	No	No	No	Yes
Borrower Characteristics	Yes	Yes	Yes	Yes
No. of Obs	9,211	9,211	9,211	9,211
Adj. R^2	0.41	0.41	0.47	0.47

Appendix 1: Reasons for Default: Classification into Business and Agency Risk

The table reports descriptive statistics of the reasons for default and the corresponding classification into production and agency risk for borrowers that defaulted in the small and medium lending division in Argentina. There are a total of 511 borrowers in this country and 133 default cases through time. Loan officers classify defaults into any of the 30 reasons for default/early warnings provided by the bank. Each default case may have multiple reasons. We classify each reason into Production Risk or Agency Risk. We further categorize the original reasons into 7 classifications according to: Financial Leverage, Industry Conditions, Receivables/Bad Debt, External Hard Information, Business Strategy, Management and Union Conditions.

Reasons for Default / Early Warnings	No. Obs	Total	Classification	Production / Agency Risk
Negative External Information				
Trade Checking	133	38	External Hard Information	Production
Credit Bureau Reports	133	6	External Hard Information	Production
Central Bank Reports	133	17	External Hard Information	Production
Competitors, Suppliers or Buyers Speak Unfavorably about Management	133	14	Management	Agency
Economic Sector				
Too Much Business Diversification	133	6	Business Strategy	Production
Over Reliance on Single Product / Suppliers Customers / Strong Competition	133	23	Business Strategy	Production
Change in Competitive Position	133	3	Business Strategy	Production
Adverse Regulatory, Political or Economic Environment	133	6	Industry Conditions	Production
Any Downtrend in the Industry	133	49	Industry Conditions	Production
Sales Trend Follow Industry	133	43	Industry Conditions	Production
Cash Draining Subsidiaries / Problems in Some Co. of Economic Group	133	20	Business Strategy	Production
Too Rapid Business Growth	133	3	Business Strategy	Production
Quality Change				
Labor Problems	133	6	Union Conditions	Production
Responsible Officer with Deteriorating Health / No succession Plan	133	3	Management	Agency
Key Management Departure	133	3	Management	Agency
Partner or Family Problems	133	6	Management	Agency
Lack of Business Strategy	133	6	Management	Agency
Financial Change				
Inclusion of Second Tier Banks in Total Indebtedness	133	9	Financial Leverage	Production
Company has Access to Many Different Banks	133	23	Financial Leverage	Production
Banks Reduce Exposure / Growth in Collateralized Lending	133	9	Financial Leverage	Production
Business Indicator Change				
Too Rapid Fixed Assets Growth with Incorrect Financial Plans	133	6	Business Strategy	Production
Receivables Past Due	133	58	Receivables/Bad Debt	Production
Checking Account	133	3	Financial Leverage	Production
Long-term Need Financed with Short-Term Facilities	133	3	Financial Leverage	Production
Adverse Trend in Sales and Earnings	133	35	Financial Leverage	Production
Bad Debt from Buyers	133	3	Receivables/Bad Debt	Production
Unusual Sales of Fixed Assets	133	3	Financial Leverage	Production
Track Record				
Request of Renewals of Operations to Finance Seasonal Cycles	133	3	Business Strategy	Production
Problem in Clean-Up Checking Account	133	35	Financial Leverage	Production
Maximum Use of Checking Account Credit Facility	133	6	Financial Leverage	Production
Total Busines Risk				413
Total Agency Risk				32

Appendix 2: Credit Manual Questions: Customer Selection Criteria for Argentina

This table reports descriptive statistics of the Customer Selection Criteria used in Argentina to evaluate the 511 borrowers. For each borrower we have access to the initial customer selection criteria. The number of observation is not 511 for all criteria due to: a.) changes in the criteria through time; b.) Specific Criteria are unique to a particular industry; c.) there are incomplete observations. We classify each criterion according to the nature of the risk: Production Risk and Agency Risk. Each criterion can take a value of 1 (best) to 4 (worse). The categorical ranking is based on the rule behind each component. Rules can be quantifiable (i.e., Leverage, Current Ratio) or judgmental and qualitative in nature (i.e., Quality and Reliance of Information Provided, Overall Business Trend).

Customer Selection Criteria: Argentina	Production/Agency Risk	No. Obs.	Mean	Std. Dev.	Min	Max
Primary Criteria						
Previous Chapter 11	Production	511	1.008	0.128	1	3
Central Bank Classification (Most Recent)	Production	511	1.062	0.427	1	4
Years in Industry	Agency	511	1.167	0.444	1	3
Company & Personal Legal History	Agency	511	1.119	0.404	1	3
Company & Personal Checkings	Agency	511	1.172	0.551	1	4
Payment Behavior with Bank	Agency	436	1.191	0.539	1	4
Leverage	Production	56	1.815	0.834	1	4
Current Ratio	Production	33	1.813	1.109	1	4
Margin (Net Profit/Sales)	Production	35	1.529	0.514	1	2
Composite Debt Index	Production	448	2.135	1.083	1	4
Secondary Criteria						
Central Bank History (Last 2 Years)	Production	511	1.161	0.600	1	4
Profitability History (Last 3 Years)	Production	511	1.298	0.699	1	4
Overall Business Trend	Production	127	1.836	0.879	1	4
Debt Service Capacity	Production	29	1.357	0.842	1	4
Interest Service Coverage Ratio	Production	473	1.652	1.080	1	4
Banking Debt with 1st Tier Banks	Production	469	1.044	0.264	1	3
Encumbered Assets	Production	478	1.393	0.651	1	3
Quality and Reliance of Information Provided	Agency	486	1.279	0.545	1	3
Specific Criteria						
Price Volatility Coverage	Production	10	1.600	0.894	1	3
Official Car/Truck/Bus Dealer	Production	35	1.000	0.000	1	1
Trend in Sales	Production	33	2.063	1.124	1	4
Dividend Pay-Out Ratio	Production	29	2.571	1.342	1	4
Years Relation with Main Customers	Agency	2	1.000	0.000	1	1
Track Record with Main Suppliers	Agency	21	1.000	0.000	1	1
Brand	Production	21	1.000	0.000	1	1
Sales Turnover	Production	19	2.222	0.972	1	4
% Chattel Mortgaged	Production	23	1.727	0.905	1	3
Average Age Fleet	Production	25	1.833	0.718	1	3
Customer Business and Relationship	Agency	21	1.600	0.843	1	3
Insurance Co.	Production	2	1.000	0.000	1	1
Owned Land (% Total Working Land)	Production	2	2.000	0.000	2	2
% Land Mortgaged	Production	2	1.000	0.000	1	1
Financial Debt Over Fixed Assets	Production	2	3.000	0.000	3	3
Fleet Size	Production	4	1.000	0.000	1	1
ABF Transportation Unit Concurrence	Production	2	1.000	0.000	1	1
Financial Staus (1)	Production	8	2.500	0.577	2	3
% Cash Sales	Production	8	2.500	1.732	1	4
Facilities Ownership Status (Sq Meters Owned)	Production	8	2.750	1.500	1	4
Sales Breakdowm	Production	2	3.000	0.000	3	3
Financial Debt/EBITDA	Production	4	1.500	0.707	1	2
Monthly Sales by Vehicle	Production	4	2.000	1.414	1	3
Sales per Sq Mile	Production	2	1.000	0.000	1	1

Appendix 3: Information Environment: Customer Selection Criteria across Countries

This table reports the Customer Selection Criteria used in each country to evaluate borrowers. The information is extracted from each countrys own Credit Manual. Criteria vary across countries and are completed by loan officers for each of the borrowers. We classify each criterion according to the nature of the information: Objective (O) and Subjective (S). The classification is based on the visual observation whether there is a quantitative/quantifiable rule or a judgmental/qualitative component to the criterion under analysis. For example, the criterion Leverage is defined in the customer selection criteria with a clear rule: Leverage <1, <2 and >1, <3 and >2, >3 therefore we classify it as Objective. On the other hand, Quality and Reliance of Information Provided is subjective in nature since the rule is: High, Medium, Basic and, Unreliable. Each highlighted cell marked with an "O (objective criteria) or "S" (subjective criteria) represents that the particular criterion is part of the Customer Selection Criteria of the country. For the first country (Argentina), there are 16 customer selection criteria, 4 of which are subjective and 12 are objective in nature. Cells highlighted in light blue and pink correspond to objective and subjective criteria, respectively. Some criteria are common across countries: all countries have leverage, some coverage ratio measure (one of interest coverage ratio, debt service coverage ratio or EBITDA-to-Financial Cost) and years in industry.

Objective / Subjective	CUSTOMER SELECTION CRITERIA	Argentina	Chile	Czech	Hong Kong	India	Korea	Malaysia	Pakistan	Romania	Singapore	Slovakia	South Africa	Sri Lanka	Taiwan	Turkey	TOTAL
O	Availability of Collateral		O				O										2
O	Availability of Credit		O				O										2
S	Aging Risk: Quality of Account Receivables										S						1
O	Bank Financial Statement Analysis				O												1
S	Bank/Buyer References		S	S		S		S		S	S	S		S	S		9
O	Banking Debt with 1st Tier Banks	O					O	O									3
O	Capacity Utilization									O							1
O	Central Bank Classification (Last 2 Years)	O															1
O	Central Bank Classification (Most Recent)	O															1
O	Certification of Liquid Assets		O														1
S	Company & Personal Checkings	S		S	S			S	S		S	S	S	S	S	S	11
S	Company & Personal Legal History	S		S						S		S	S	S	S	S	8
S	Critical Success Factors							S			S						2
O	Current Ratio	O	O	O		O	O		O	O		O	O	O	O	O	12
O	Data Quality (Provide Financial Statements)		O		O												2
O	Days Receivables/Receivables Turnover			O	O	O						O	O	O		O	7
O	Days Payables/Trade Check			O	O							O					3
O	Debt Service Coverage Ratio		O			O	O	O	O	O	O		O	O	O	O	11
O	Debt-to-Sales Ratio		O														1
O	EBITDA-to-Financial Cost Ratio			O								O					2
O	Encumbered Assets	O											O	O	O	O	5
O	Interest Service Coverage Ratio	O			O	O	O		O				O	O	O		8
S	Key Management Experience				S	S		S	S		S			S		S	7
O	Management Experience (Years)									O			O				2
O	Last 12 Months of Sales		O														1
O	Leverage	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	15
O	Long Term Debt-to-Net Worth Ratio								O								1
O	Major Buyer Relationship				O												1
O	Market Diversification									O							1
O	Buyer Concentration/No Buyer Risk		O		O	O				O	O		O		O	O	8
O	Net Worth				O	O		O			O						4
O	Net Margin (%)								O	O				O			3
O	Number of Operating Profitable Years				O												1
O	Number of Management Positions		O														1
O	Operating Margin (%)					O			O	O	O						4
S	Overall Business Trend	S		S								S		S	S		5
O	Payment Behavior (with Bank)	O	O	O	O		O	O		O		O	O	O	O	O	12
O	Previous Chapter 11	O															1
O	Profitability History (Last 3 Years)	O	O	O	O		O	O	O			O	O	O	O	O	12
S	Quality and Reliance of Information Provided	S		S								S		S			4
O	Sales Trend/Sales Growth		O			O	O		O	O	O					O	7
O	Sales Turnover	O				O	O						O				4
S	Site Visit					S			S	S							3
O	Social Office Reference			O								O					2
O	Supplier Concentration/Supplier Risk					O		O		O							3
S	Supplier References			S						S		S					3
O	Tax Reference			O								O					2
O	Years in Industry or Business	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	15
	Total Subjective Criteria	4	1	6	2	3	0	4	2	4	5	6	2	6	4	3	
	Total Objective Criteria	12	15	10	13	12	12	8	11	13	7	10	12	10	9	10	
	Total	16	16	16	15	15	12	12	13	17	12	16	14	16	13	13	
	% Subjective Criteria Questions	25.0%	6.3%	37.5%	13.3%	20.0%	0.0%	33.3%	15.4%	23.5%	41.7%	37.5%	14.3%	37.5%	30.8%	23.1%	

Appendix 4: Data Description by Industry

This table presents the distribution of data by industry. The data comes from a sample of 9,211 small and medium-sized private firms in 15 different emerging markets borrowing from a large multinational bank. Although the original sample is a six-monthly panel over 2 years, this table only uses information from the first observation for each firm in the sample. Aggregate Lending is the sum of the loan size of all borrowers for that particular industry.

	Industry	No. of Firms	Agg. Lending ($ Million)	Av. Loan Size ('000s)	% of Total Firms	% of Total Lending	No. of Countries
1	Transportation	470	78.1	174.71	5.10	2.9	14
2	Apparel	461	328.00	748.44	5.00	8.8	14
3	Construction	424	89.10	217.79	4.60	2.4	11
4	Construction materials	415	121.00	301.28	4.51	4.2	13
5	Wholesale-Apparel	332	143.00	450.03	3.60	3.9	12
6	Wholesale- Elec. Goods	286	144.00	521.96	3.10	5.0	10
7	Machinery	277	73.10	273.65	3.01	3.2	13
8	Textiles	277	114.00	426.73	3.01	3.1	14
9	Consumer Goods	277	129.00	497.77	3.01	3.6	13
10	Wholesale- Groceries	267	90.20	352.16	2.90	3.4	11
11	Chemicals	240	69.60	306.75	2.61	3.2	15
12	Rubber and Plastic	231	75.50	340.21	2.51	2.3	12
13	Healthcare	231	18.40	84.3	2.51	0.5	9
14	Wholesale-Pro. Comm. Goods	212	70.7	346.76	2.30	2.1	15
15	Wholesale-Non-Dur. Goods	203	89.40	455.91	2.20	2.5	11
16	Food Products	185	90.20	518.24	2.01	2.8	13
17	Wholesale- Machinery	185	65.80	378.35	2.01	3.8	12
18	Wholesale- Chem. Goods	185	78.30	452.52	2.01	2.1	12
19	Wholesale- Dur. Goods	170	31.80	206.53	1.85	0.9	12
20	Bus. Serv.- Misc.	157	30.40	198.45	1.70	2.1	14
21	Wholesale- Lumber	138	48.70	363.74	1.50	1.7	12
22	Bus. Serv.- Equip. Rental	129	7.43	59.46	1.40	0.2	6
23	Bus. Serv.- Printing	129	57.30	473.42	1.40	1.6	10
24	Electrical Equip.	120	45.50	392.5	1.30	1.3	13
25	Electronic Equip.	120	61.80	561.39	1.30	1.7	10
26	Toys	102	46.10	479.92	1.11	1.3	12
27	Retail- Misc.	102	25.10	264.28	1.11	0.9	12
28	Software	102	31.40	337.49	1.11	2.1	9
29	Automobiles and Trucks	92	46.20	502.48	1.00	1.3	13
30	Wholesale- Plumb. Heat Equip.	92	44.5	483.34	1.00	1.4	10
31	Retail- Gas Stations	92	4.25	47.73	1.00	0.4	6
32	Bus. Serv.- Engineers Acc.	83	13.4	161.94	0.90	0.4	13
33	Wholesale- Paper Prod.	83	31.00	387.96	0.90	1.0	12
34	Wholesale- Auto Parts	83	26.70	342.31	0.90	1.1	8
35	Steel Works	83	36.90	479.5	0.90	1.2	12
36	Business Supplies	83	39.60	521.34	0.90	1.2	13
37	Personal Services	83	9.02	118.73	0.90	0.3	8
38	Retail- Auto Dealers	74	22.10	298.87	0.80	0.7	10
39	Wholesale- Sporting Goods	74	18.10	248.01	0.80	0.6	9
40	Wholesale- Home Furnish.	65	52.30	804.78	0.71	1.5	5

Data Description by Industry (continued)

	Industry	No. of Firms	Agg. Lending ($ Million)	Av. Loan Size ('000s)	% of Total Firms	% of Total Lending	No. of Countries
41	Fabricated Prod.	65	33.30	546.33	0.71	2.9	12
42	Printing Publishing	65	19.4	323.11	0.71	0.5	12
43	Bus. Serv.- Advertising	65	7.38	125.14	0.71	0.7	7
44	Wholesale- Drugs	56	17.90	319.65	0.61	0.7	8
45	Wholesale- Metals Minerals	56	21.5	398.75	0.61	0.6	10
46	Bus. Serv.- PR Consulting	56	6.08	114.74	0.61	0.3	9
47	Wholesale- Misc.	56	20.10	393.98	0.61	1.2	13
48	Pharmaceutical Prod.	56	34.80	696.22	0.61	0.9	10
49	Trading	46	6.25	132.94	0.50	0.2	8
50	Shipping Containers	46	15.9	346.21	0.50	0.4	11
51	Retail- Apparel	46	14.7	320.25	0.50	0.4	9
52	Restaurants Hotels	46	12.8	291.77	0.50	0.3	9
53	Wholesale- Petro. Prod.	46	30.8	751.02	0.50	0.9	8
54	Entertainment	37	1.84	48.51	0.40	0.0	4
55	Hardware	37	19.4	509.3	0.40	0.5	9
56	Wholesale- Farm Prod.	37	19.6	575.8	0.40	0.5	15
57	Bus. Serv.- Comp. Serv.	37	6.12	191.29	0.40	0.2	5
58	Industrial Metal Mining	28	5.32	177.4	0.30	0.2	5
59	Candy Soda	28	21.3	711.07	0.30	0.6	8
60	Wholesale- Beer Wine	28	6.44	280.13	0.30	0.2	13
61	Shipbuilding, Railroads	28	6.14	279.09	0.30	0.2	6
62	Retail- Electronic Stores	19	3.46	164.53	0.21	0.1	6
63	Medical Equip.	19	5.54	291.81	0.21	0.1	7
64	Telecommunications	19	1.14	60.2	0.21	0.0	9
65	Bus. Serv.- Cleaning	19	0.72	42.14	0.21	0.0	4
66	Measuring Control Equip.	19	6.1	358.75	0.21	0.2	9
67	Agriculture	19	9.12	570.05	0.21	0.2	6
68	Beer Liquor	19	8.33	520.59	0.21	0.2	4
69	Wholesale- Waste Material	19	7.82	488.77	0.21	0.2	6
70	Bus. Serv.- Personal Supply Serv.	19	0.9	64.44	0.21	0.1	5
71	Retail- Home Furnish.	19	0.9	64.27	0.21	0.0	6
72	Wholesale- Jewellery	19	9.54	681.3	0.21	0.3	12
73	Retail- Drug Stores	19	1.28	98.32	0.21	0.0	4
74	Retail- Food Stores	19	2.85	218.92	0.21	0.1	3
75	Retail- Merchandise Stores	11	4.29	357.17	0.12	0.2	8
76	Retail- Home Supply	10	1.49	135.15	0.11	0.1	3
77	Retail- Lumber	10	4.01	401.4	0.11	0.1	7
78	Insurance	10	0.31	38.14	0.11	0.0	2
79	Petro. Natural Gas	10	3.95	564.39	0.11	0.1	5
80	Utilities	10	0.38	53.74	0.11	0.0	4
81	Banking	10	1.58	315.67	0.11	0.0	4
82	Other	10	0.57	114.44	0.11	0.0	2
83	Retail- Department Stores	3	0.11	35.79	0.03	0.0	1
84	Tobacco Prod.	2	0.13	62.56	0.02	0.0	2
85	Defense	1	0.03	26.32	0.01	0.0	1
86	Not Specified	498	25	52.21	5.41	0.8	12
	Total	9,211			100	100	15

Appendix 5: Variable Definitions

The table presents the definitions of variables used in the paper including Loan, Financial and Relationship Characteristics as classified in Table 2. It also includes countries financial and economic development and lending program indicators. Loan, Financial and Relationship Characteristics and Lending Program indicators are proprietary data of the large multinational bank. The economic and financial development indicators Creditor Rights, Public Registry, Private Bureau, and GDP per Capita are from Djankov, McLiesh and Shleifer (DMS) (2007) data downloaded from www.andrei-shleifer.com. Collateral Law Index is from the World Bank Doing Business database. This measure captures the simplicity, efficiency and accessibility of the business regulatory environment in relation to collateral laws only as they apply to domestic firms.

Variable Name	Definition
Borrower Age	Measured by the number of years the borrower has been in business. This is counted from the constitution of the company as a legal entity.
Creditor Rights	An index that reflects the ease with which creditors can secure the assets in the event of bankruptcy. Takes on discrete values of 0 (weak creditor rights) to 4 (strong creditor rights).
Default Status	An indicator variable that takes a value of 1 if the firm is in default at the end of the sample period, and 0 otherwise.
Collateralization Rate	The percentage of the loan that is covered by the estimated liquidation value of the collateral.
Collateral Type	A classification system with eleven categories that describe the composition of collateral demanded by banks. The asset types correspond to one of eleven categories: (i.) account receivables including factoring of receivables, contract orders and post-dated checks, (ii.) bank guarantees including stand-by letters of credit, (iii.) cash, including both foreign and domestic, (iv.) financial securities such as insurance, bonds and shares, (v.) real estate, including land, residential and industrial building, (vi.) firm-specific assets which captures collateral that is specific to the operational business of the firm under consideration, (vii.) inventory, (viii) firm machinery and equipment, (ix.) import and export letters of credit, which are used as a method to facilitate payment of international trade transactions, (x.) third-party guarantees, and (xi.) promissory notes.
Delinquency (Days)	Maximum delinquency recorded over the sample period. It is measured in days.
Exporter	Dummy variable that takes a value of 1 if the bank indicates the borrower is an exporter, and 0 otherwise.
Interest Rate Spread	Spread charged to a borrower above the marginal cost of funds of the bank. It is calculated as ratio of net revenue from funds to the quarterly average total loan outstanding.
Length of Relationship	Number of months the borrower and the bank have been in a relationship. Relationship is defined as the length of the relationship with the bank including business with checking accounts and loans.
No. Bank Relationships	Number of bank relationships the borrower has with other financial institutions (including the one with this bank).
Personal Client	Dummy variable that takes a value of 1 for those borrowers whose owners have a previous personal-banking relationship with the bank, and 0 otherwise.

Variable Definitions (continued)	
Variable Name	Definition
Private Credit to GDP	The ratio of credit from deposits in financial institutions of the private sector relative to GDP expressed in percentage terms. It was averaged over 1999 to 2003 in the DMS data set.
Risk Grade	An index of the ex-ante assessment rating for a borrower, representing the riskiness of a borrower at the time of loan origination as determined by the bank's loan officer, which takes on values of "A" (Best) to "D" (Worse). The variable is transformed into a continuous variable by assigning the values: "A"=1, "B"=2, "C"=3, and "D"=4.
Risk Grade Decrease Status	An indicator variable that takes a value of 1 if the firm has been downgraded at the end of the sample period, and 0 otherwise.
Sales Size	An indicator variable that captures the size of the firm. The indicator depends on the total net sales of the firm as reported in the last available audited financial statement. Indicators 3, 2, 1, and 0 are for firms with net sales $\geq$\$25 million, $<$\$25 million and $\geq$\$5 million, $<$\$5 million and $\geq$\$1 million and $<$\$1 million, respectively. All currency reported is in US Dollars.
Total Loan Approved	The aggregate overall credit lines approved by the bank in US dollars.
Total Loan Outstanding	The actual amount withdrawn by the firm in US dollars. The Total Loan Outstanding is always less or equal to the Total Loan Approved.