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Borrowers' Discouragement and Creditor Information

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Abstract

Bank discouragement is one of the most important factors preventing firms from accessing credit. This discouragement stems from strong information asymmetry between firm and bank. To reduce this asymmetry, the latter can either gather information from the firm or access public information on the firm through credit databases. We argue that the presence of credit bureaus, set up by the regulator, which reduces information asymmetry, helps reduce banking discouragement.
More specifically, this study is the first to use credit registries to capture the occurrence of screening errors. Our results clearly suggest that the probability of being discouraged decreases when creditor information is available. This phenomenon is even more obvious in regard to more opaque structures, such as risky firms or small and medium-sized firms. In contrast, relationship lending reduces the importance of external creditor information in determining the extent to which borrowers are discouraged. Our results are consistent with previous research on information asymmetry in financial intermediation and show the importance of the legal environment in which firms operate for their financial decisions.

JEL Codes: G21; L13.

Keywords: Discouragement; Borrower; Creditor information; Relationship lending; Information asymmetry.

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1) Introduction

Ensuring access to credit for companies has long been a key goal of international organizations. A major obstacle for firms in general and for small and medium-sized enterprises (SMEs) in particular is limited access to credit, not only through rejected applications but also in the form of a reluctance to apply. For the United States, Levenson and Willard (2000) estimate that the number of discouraged borrowers is twice as large as the number of rejected borrowers. That is, discouragement with respect to applying may be a much more important barrier since it supplants credit rationing, the oldest, best-known obstacle to receiving credit (Jaffee and Russell, 1976; Stiglitz and Weiss, 1981). Hence, this issue represents a major challenge for regulators, who also have a role to play (Macher et al., 2011). Kon and Storey (2003) show that an important determinant of discouragement is information asymmetry between lender and borrower, mostly for SMEs (Bertrand et al., 2021). As we know, such information asymmetry can be reduced in two ways: internally, by the accumulation of information through exchanges, or externally, by the creation of credit bureaus or registries that possess information (Bertrand and Klein, 2021). However, the establishment of such institutions is largely up to regulators and the laws they can put in place to facilitate their creation.

The aim of this study is to clarify for regulators the usefulness of developing credit registries by examining the impact of such registries on the probability of firms being discouraged. Kon and Storey (2003), in their seminal theoretical study on borrowers' discouragement, assess the importance of information asymmetry to determine discouragement. Information asymmetry, or at least attempts to reduce it, lies at the heart of financial intermediation. In any type of transaction, both parties must collect a sufficient amount of trustworthy information to adjust a contract's specificities to risk pricing. Given the risky nature of loans to firms and institutions, the collection of relevant information to reduce asymmetry is crucial. Kon and Storey (2003) highlight three main consequences of information asymmetry that directly bear on borrowers' discouragement. First, screening errors committed by banks when they assess the creditworthiness of potential borrowers. Although the rejection of the application of a good borrower is less significant from the bank's perspective than the validation of a bad one, the true (that is, social and economic) cost of such rejections remains substantial. Second, the administrative and financial burden charged to the candidate borrower also represents a key determinant of discouragement. In essence, banks circumvent the issue of information asymmetry by transferring the burden of proof to the borrower, thus significantly increasing

the financial and psychological costs of an application. Finally, since they cannot precisely evaluate or rule out any of the underlying risks of a credit transaction, banks tend to require a higher interest rate to compensate for unforeseen or unobservable adverse events that could significantly modify the credit default probability.

Since the question of information is of crucial importance, banks invest substantial resources to collect as much and as accurate information as possible. This collection of information can be conducted in two ways: internally (by relationship lending, for example) or externally (via credit bureaus or registries). As highlighted by Bertrand and Klein (2021), although research evidence is available on the reduction of information asymmetry from a microeconomic perspective (primarily based on firm characteristics), much less is known regarding macroeconomic determinants, particularly the legal and informational environment. Credit databases facilitate information acquisition to supplement ad hoc information gathered through relationship lending (Bertrand and Klein, 2021) and play a significant role in reducing information asymmetry. These credit databases are divided into two categories (Pagano and Jappelli, 1993). On the one hand, credit bureaus are private initiatives by companies to collect and sell information on potential borrowers. On the other, credit registries are public state or governmental initiatives aimed at providing sufficient information on borrowers.

In this study, our goal is to empirically investigate the impact of the presence, or absence, of information on borrowers' discouragement. More specifically, we rely on a rich dataset to assess the effect of creditor information, credit bureaus and credit registries on the probability of being discouraged. Our contribution to the literature is threefold. Since credit bureaus and credit registries aim at reducing information asymmetry, the first contribution of our study is its empirical testing of the theoretical predictions postulated by Kon and Storey (2003). Here, we attempt to elucidate the relationship between the availability of information, facilitated by the firms' legal and informational environment, and discouragement. Our second contribution is our evaluation of the impact of additional or reduced opacity in the relationship. To this end, we investigate whether risky firms, firm size (small and medium) or the presence of alternative funding sources affect the correlation between creditor information and borrowers' discouragement. Finally, our third contribution relates to the use of a rich dataset that enables us to accurately evaluate discouragement and the effect of the availability of information on candidate borrowers. Our survey-based dataset enables us to clearly identify candidate borrowers who have been discouraged from seeking credit.

Our study analyzes data from various sources, notably the World Bank's Enterprise Survey (WBES) and Doing Business databases. The WBES dataset consists of data from a large firm-based survey conducted on a representative sample of international firms from more than 150 different countries from 2010 to 2020. This dataset enables us to clearly assess whether potential applicants have been discouraged in the sense of Kon and Storey (2003) based on their answers to a set of questions.

Our results confirm the predictions postulated by Kon and Storey (2003). We find that the availability of creditor information and the presence of credit bureaus or credit registries is significantly and negatively correlated with the probability of being discouraged. Our results also highlight a nonlinear and concave, i.e., inverted U-shaped, relationship between creditor information and discouragement, consistent with Kon and Storey (2003). When disentangling the dynamics of the relationship further, we find that creditor information is even more determinant for risky firms or small and medium-sized firms. We also conduct additional robustness checks, addressing other proxies for creditor information or discouragement, endogeneity, and self-selection bias, all confirming our findings.

Our study significantly contributes to the increasing stream of literature on institutional borrowers' discouragement. Our study also contributes to the literature demonstrating the importance of the legal environment on bank behavior (Kirstein, 2002; Fernández et al., 2010) and, more precisely, on facilitating access to and transmission of information (Bertrand and Klein, 2021; Sundgren and Alexeyeva, 2022). Developing credit bureaus and credit registries clearly represents a positive externality for the lending industry, both from the credit demander's and from the lender's perspective. The development of such institutions can reduce both the opacity of transactions and the probability of discouragement for rational and irrational candidate borrowers, which in turn could lead to additional loan contracts and better resource allocation.

The remainder of the paper proceeds as follows. Section 2 presents the literature review and our hypothesis development. Section 3 describes the data used in the analysis. Section 4 is devoted to empirical analyses, while Section 5 presents the robustness checks. The final section concludes.

2) Related literature and hypotheses

The literature on discouraged borrowers remains in its infancy. The cornerstone study in the field is that by Kon and Storey (2003). Their theoretical model clearly associates information

with the concept of discouraged borrowers. They define discouraged borrowers as good borrowers who do not apply to banks for loans because they think they will be rejected. The authors incorporate the extent to which borrowers are discouraged in the nonmeasurable application costs that accompany each loan request. They ground their model on well-established research evidence on credit rationing (Jaffee and Russell, 1976; Stiglitz and Weiss, 1981; De Meza and Webb, 1987). However, their model is based on imperfect information and differs significantly from others in the field since discouraged borrowers do not apply to banks at all, and thus, the reasons for their discouragement are intrinsic, psychological, and usually subjective. Kon and Storey (2003) highlight three main consequences of information asymmetry that directly bear on borrowers' discouragement: screening errors committed by banks when they assess the creditworthiness of potential borrowers, administrative and financial application costs and higher interest rates.

In the Kon and Storey model, the impact of information asymmetry on discouragement is nonlinear. According to Kon and Storey, when information is scarce, banks are most likely to select their borrowers randomly. Therefore, there is no incentive for a borrower to invest significant resources in preparing the best application file. However, as more information is collected by banks, application costs should increase since candidate borrowers would like to be evaluated in a fair manner and would provide as much information as possible. Certain borrowers may not be willing to pay these additional costs and may decide not to apply; i.e., they are discouraged. However, more information possessed by the bank also leads to a better evaluation of borrower profiles, which should reduce screening errors. If this information were known by candidate borrowers, those who were discouraged or suspected unfairness might be encouraged to apply.[3]

The first study to highlight the importance of discouragement in the U.S. market is Levenson and Willard (2000), who find that there are twice as many discouraged borrowers as rejected borrowers in the U.S. and advocate in favor of an even greater impact of discouragement than of credit rationing. There is a large consensus in the literature that the larger the information asymmetry is, the larger the number of discouraged borrowers. Smaller firms are, for instance, more numerous in the discouraged population of borrowers (Levenson and Willard, 2000; Chakravarty and Xiang, 2013; Mac an Bhaird et al., 2016). Opacity and geographical distance are also key determinants of borrower discouragement (Brown et al., 2011; Gama et al., 2017). Since discouragement is also a behavioral concept, CEO characteristics have been

[3] The interested reader should refer to Kon and Storey (2003) for additional details and implications.

identified as influential factors (Chakravarty and Xiang, 2013; Fastenbauer and Robson, 2014; Gama et al., 2017). Another important component is a previous relationship with a bank. Relationship lending significantly reduces information asymmetry and should impact discouragement (Berger and Udell, 2012; Uchida et al., 2012). In relationship lending, the loan officer may have acquired informal information that can support better creditworthiness when insufficient data are available, for instance, in the case of small and not well-established young entrepreneurs (Boot, 2000). A natural consequence of this phenomenon is a reduced interest rate, which may further reduce discouragement (Bharath et al., 2011). Other research studies corroborate the findings on these determinants by investigating similar or different markets as well as different time periods (Han et al., 2009; Freel et al., 2012; Fraser, 2014; Ferrando and Mulier, 2022; Xiang et al., 2015; Cole, 2016). Naegels et al. (2022) model the specific process by which female Tanzanian borrowers are discouraged. They find that negative perceptions are present and that they significantly affect candidate female borrowers' intention to apply.

As shown by this recent evidence, in addition to firm-specific or entrepreneur-specific characteristics, the most important factor influencing discouragement is access to information, as advocated by Kon and Storey (2003). Fortunately, lenders have access to credit databases providing them information about the firms seeking credit. These databases are often used in the literature to evaluate the level of available creditor information. Two main sources have been employed. First, credit bureaus are private institutional initiatives in which a given financial intermediary collects information from its members and makes it available inside the group and occasionally outside it in exchange for a fee (Jappelli and Pagano, 2000). According to the Doing Business database of the World Bank, the presence of credit bureaus increased from approximately 15% to 31% from 2005 to 2017. Second, public credit registries emerge from governmental agencies or public institutional entities supervised by the banking authority. Public credit registries are legally mandatory and consider a significantly larger number of intermediaries than private credit bureaus. Comparing them with credit bureaus, one can observe that the hidden cost of increasing the quantity of considered entities is reduced information accuracy and quality. The Doing Business database also accounts for a significant increase in the prevalence of public credit registries from 3.3% to 13.6% from 2004 to 2017. These figures show that access to creditor information is currently even easier and much more widespread than previously.

The key studies on creditor information directly relate information asymmetry to adverse selection (Jaffee and Russell, 1976; Stiglitz and Weiss, 1981). Pagano and Jappelli (1993) further show that sharing information has a positive impact on adverse selection, which is also priced in the interest rate charged by financial intermediaries. In addition, Jappelli and Pagano (2002) empirically show that lending activity increases in tandem with information sharing, while credit risk significantly decreases. Djankov et al. (2007) further demonstrate that private access to credit is facilitated when more creditor information is available. Part of the accrued lending activity catalyzed by creditor information is likely related to a decrease in the number of discouraged borrowers. Padilla and Pagano (2000) conjecture that borrowers are encouraged to improve the design of their credit-demanding project to reduce extreme default penalties, which implies lower interest rates, lower default rates and higher accrued lending for the bank. More recently, De Hass et al. (2021) contribute to the debate by showing that the implementation of a new credit registry reduces defaults in microcredit applications while increasing the return on lending. They further show that lending tightens at both the extensive and intensive margins after an increase in information sharing. From the lenders' perspective, having access to more and more accurate information helps reduce selection costs and improves credit screening, which in turn facilitates better default predictions (Barron and Staten, 2003; Kallberg and Udell, 2003; Powell et al., 2004; Luoto et al., 2007; Brown et al., 2009; Dierkes et al., 2013; De Haas et al., 2021).[4]

Against this background, one cannot doubt the effect of the availability of creditor information on borrowers' discouragement. However, the literature on this topic is not extensive. As shown in the literature review, previous studies only use size, geographical or relationship lending as a way to materialize and proxy the level of opacity in a transaction, which should foster information asymmetries. Giang (2021), who uses the same dataset analyzed in our study, investigates the effect of the presence of credit registries on the probability of being discouraged and finds that information sharing through public credit registries reduces the number of discouraged borrowers. However, to the best of our knowledge, our study is one of the first to thoroughly study the predictions postulated by Kon and Storey (2003) by investigating the impact of the presence of both credit bureaus and

[4] We invite the interested reader to read these papers to learn more about the advantages of information sharing from the lender's perspective. Since the main aim of this paper is to relate information sharing to borrower's discouragement, we do not review this literature in detail here. Additional useful references are Galindo and Miller (2001), Love and Mylenko (2003), Powel et al. (2004) and Triki and Gajigo (2012).

credit registries on the probability of being discouraged. Overall, the extensive literature enables us to develop four hypotheses:

Hypothesis 1: The availability of creditor information reduces the probability that borrowers will be discouraged.

Hypothesis 2: The presence of credit bureaus reduces the probability that borrowers will be discouraged.

Hypothesis 3: The presence of credit registries reduces the probability that borrowers will be discouraged.

Hypothesis 4: The relationship between creditor information and the probability of being discouraged is nonlinear.

All these hypotheses are thoroughly supported by the literature. In our empirical design, we aim to test these hypotheses. We rely on a rich dataset thanks to which we can clearly identify discouraged borrowers and the creditor information available in the market at the time of an application.

3) Data

Our study analyzed data from the WBES dataset, which has been extensively used in past research, notably in Chakravarty and Xiang (2013) and Rostamkalaei et al. (2020). The WBES gathers firm-level data related to a large number of topics, including access to finance, corruption, infrastructure, crime, competition, labor, obstacles to growth, and performance measures. Our sample includes data from 124 countries for the period 2010 to 2020 (see Appendix A). The WBES dataset provides precise indicators of whether a company required, applied for, and obtained credit. Since our dependent variable refers to borrowers' discouragement, we use answers to survey questions K16 and K17 to assess a given firm's discouragement regarding applying for credit (see Appendix B for question details).

Discouragement implies that a firm might not apply for credit, despite needing it. Thus, we also include question K17. Then, we apply the definition of a discouraged borrower provided by Chakravarty and Xiang (2013): a firm is discouraged if it needs credit but does not apply whether because (*1*) the application procedures are too complex, (*2*) the interest rates are not favorable, (*3*) collateral requirements are too restrictive, (*4*) the size of the loan and maturity

are insufficient, or (5) it doubts the application will succeed.[5] Businesses that chose the "no need" or "don't know" responses are not defined as discouraged and are excluded from the main dataset. *Discouraged* equals 1 if the firm does not ask for a loan for other reasons and 0 otherwise.

As highlighted in the previous section, our aim is to assess the impact of the availability of creditor information on the level of discouragement of a potential borrower. To evaluate creditor information, we rely on the Depth of Credit Information Index (which we refer to as Creditor Information), created by the World Bank. This index includes the effects of private bureaus as well as credit registries and ranges from 0 to 8. The score on this scale is determined based on eight key elements of a credit registry or a credit bureau. A score of 4 means that 4 out of these 8 elements are offered in the country under scrutiny.

We then break the Credit Information Index down to separate the elements related to private bureaus and public credit registries. We use the World Bank indicator of public credit registry coverage (Public Registry) and private bureau coverage (Private Bureau) to assess the role of each component. These indicators "report the coverage of individuals and firms by a private credit bureau/public credit registry with information on their repayment history, unpaid debts, or credit outstanding from the past 5 years – expressed as a percentage of the adult population" (World Bank Doing Business).

4) Empirical Analysis

The objective of this study is to investigate the impact of the availability of creditor information, held either in public registries or private bureaus, on the level of discouragement a borrower might experience. Since our dependent variable is a binary response variable, we conduct logit regressions of the following form:

$$Prob\ (Discouraged_i = 1|x_i') = \frac{exp(x_i'\beta)}{1 + exp(x_i'\beta)},$$

[5] A stricter definition of discouragement only includes creditworthy firms that need credit but do not apply for it (e.g., Kon and Story, 2003). Creditworthiness is difficult to measure in advance. In the robustness checks, we include only firms with existing lines of credit, i.e., which have been identified previously as creditworthy by a bank, to test this stricter definition.

where *Discouraged*$_i$ is the response variable (1 if potential borrower *i* has been discouraged from borrowing and 0 otherwise), $\boldsymbol{x_i'}$ is a 1*(k+1) vector of the *k* explanatory variables (including intercept), and $\boldsymbol{\beta}$ is a (k+1)*1 vector of coefficients (including intercept). In the study, we run several logit regression models that include a set of control variables and different proxies for the creditor information as regressors. All the variables used in our models are presented in detail in Table 1, while descriptive statistics are displayed in Table 2.

Insert Table 1 about here.

Insert Table 2 about here.

Our core analysis consists of four main logistic regression models, which satisfy the preceding equation. The first model uses the general availability of creditor information as the main independent variable of interest:

$$\begin{aligned} x_i'\beta = {} & \beta_0 + \beta_1 \mathrm{CreditorInformation_i} + \beta_2 \mathrm{CEO\_Exp_i} + \beta_3 \mathrm{CEO\_gender_i} + \beta_4 \ln(\mathrm{size})_i \\ & + \beta_5 \ln(\mathrm{age})_i + \beta_6 \mathrm{Sole_i} + \beta_7 \mathrm{Legal_i} + \beta_8 \mathrm{Obstacle_i} + \beta_9 \mathrm{Certified_i} \\ & + \beta_{10} \mathrm{Account_i} + \beta_{11} \mathrm{Export_i} + \beta_{12} \mathrm{Foreign\_Own_i} + \beta_{13} \mathrm{Credit_i} \\ & + \beta_{14} \mathrm{R\&D_i} + \beta_{15} \mathrm{Inflation_i} + \beta_{16} \mathrm{Fin\_Develop_i} + \delta_y + \delta_s + \delta_c + \varepsilon_i \end{aligned}$$

The set of explanatory variables is based on the literature. As suggested by Gama et al. (2017), we also control for CEO experience (*CEO_Exp*) because the more experienced a company's CEO is, the better the chances that the company will obtain a loan. We also control for the gender of the CEO (CEO_gender). We also control for firm-specific variables related to riskiness and creditworthiness. The logarithms of size and age are associated with the probability of obtaining credit and hence with discouragement (Cole and Sokolyk, 2016). Asiedu et al. (2013) further argue in favor of the inclusion of the firm's ownership structure, whether it is sole ownership or not (*Sole*), and its legal status (*Legal)*. We also include a dummy variable representing the self-reported difficulty of accessing credit from the firm's perspective. This *Obstacle* variable equals 1 if the firm believes access to credit is difficult. *Certified* is a dummy variable equal to 1 if the firm has a certified financial statement, which is a form of concrete information that tends to be prominent in bank–borrower relationships (Berger and Udell, 2006). The variable *Account* provides a proxy for the firm's familiarity with formal financial services. We follow Presbitero et al. (2014) and control for firm internationalization by including dummies for *export* to identify direct and indirect exporters

and *foreign ownership* to indicate if the owner is located abroad. We consider alternative sources of funding using the firm percentage of trade credit (*Credit*). The percentage of R&D investment (*R&D*) provides a relevant indicator of riskiness (Riding et al., 2012). We also add two macroeconomic variables, inflation rate (*Inflation*) and ratio of domestic banking credit to gross domestic product (GDP) (*Fin_Develop)*, to mitigate the potential omitted variable bias in relation to the local economic environment, which influences both the quantity of credit available and lawmaking. We finally control for firm-, industry- and year-specific effects by including dummies to control for firms, industries, and years. Standard errors are clustered by country. All the variables are detailed in Table 1. The second and third models are exact replications of the model elaborated above. However, in them, the *Creditor information* variable is replaced by the variables *Credit Registry* and *Credit Bureau* in the second and third models, respectively. Finally, the fourth model tests for a nonlinear relationship between the independent variable *Creditor Information* and the dependent variable by including *Creditor Information*^{2}. The results are presented in Table 3.

Insert Table 3 about here.

The results clearly support our main hypothesis that the more creditor information there is, the lower the level of discouragement of candidate borrowers. This outcome is consistent throughout our four models. The lower the information asymmetry in the legal environment of the candidate borrowers, the lower the probability that they will be discouraged. The presence of credit registries or credit bureaus displays a nearly identical impact in terms of magnitude and significance on the dependent. The fourth model further highlights a nonlinear component in the relationship that displays an inverted U-shape in the effect. Figure 1 provides a graphical representation of this relationship. Overall, our results are completely consistent with the theoretical literature and, most notably, in perfect agreement with the predictions of Kon and Storey (2003).

Insert Figure 1 about here.

The control variables also present interesting results. Female CEOs (*CEO Gender*) have a higher probability of being discouraged. This outcome is consistent with Naegels et al. (2022). Sole ownership firms (*Sole*) and limited corporations in their legal status (*Legal*) are also positively related to the probability of being discouraged, as are *Obstacle* and *Inflation*. In contrast, firm size (*Ln(size)*), having certified financial statements (*Certified*) or being more acquainted with financial services (*Account*) are negatively related to the probability of being discouraged, as are *R&D* and the country's *financial development*.

We further disentangle the mechanism by conducting two additional analyses. We first split the sample based on firm size. We conjecture that the probability of being discouraged should differ for small and large firms. We also split the sample based on the level of country income criteria.[6] The results are depicted in Table 4.

Insert Table 4 about here.

The results show that the relationship is even more apparent for small and medium-sized firms as well as firms operating in countries with a larger GDP. Therefore, in essence, the results are mostly valid for firms that suffer from opacity or lack funding alternatives and for firms operating in more developed countries, in which the legal environment is stronger.

5) Robustness tests

a) Alternative measures of Creditor Information

To check the robustness of our results, we first use two alternative proxies to capture creditor information. The first is the Business Extent of Disclosure Index (*Business Disclosure*) proposed by the World Bank. This proxy, ranging from 0 to 10, assesses the extent to which information on ownership and financial health of companies is disclosed. Second, we rely on Djankov (2008a) to evaluate the ex-ante disclosure requirements (*Disclosure Ex Ante*) to quantify the amount of information currently in the hands of the lender when it is considering

[6] See Table 1 for further details on how these variables are constructed.

a request from a candidate borrower. The results are displayed in the left panel of Table 5. The outcomes are not affected.

Insert Table 5 about here.

b) Alternative measures of Discouragement

Kon and Storey (2003) understand discouraged borrowers as creditworthy firms that need credit but do not apply for it. Empirically, creditworthiness has always been assumed in the discouragement literature due to the difficulty of assessing it without a credit application. For example, Chakravarty and Yilmazer (2009) classify a firm as discouraged if it answered "yes" to the question "During the last three years, were there times when the firm needed credit but did not apply because it thought the application would be turned down?" and answered "zero" to the question "How many times did the firm apply for new loan in the past three years?" Han et al. (2009) classified discouraged firms as firms that "did not apply because of fear of rejection" (p. 416). Chakravarty and Xiang (2013) assume discouraged firms to be those that did not apply to a loan because (1) the loan procedure was too complicated, (2) interest rates were too high, (3) collateral requirements were too high or (4) the firm believed there was corruption in allocation. None of these studies closely examine creditworthiness. Mac an Bhaird et al. (2016) also consider that all firms that fear rejection are discouraged firms. This limitation might reflect the difficulty of empirically measuring creditworthiness and as well as a theoretical overlap between the concept of discouragement (which does not necessarily relate to creditworthiness) and the economic consequences of discouragement (which are only adverse for creditworthy discouraged firms).

To circumvent this issue, we adopt Petersen and Rajan's (1994) method and focus on firms that already possess a line of credit with a financial institution. The underlying idea is that banks have open lines of credit for these firms and engage in short-term lending with them. From the bank's perspective, these firms are creditworthy. The central panel of Table 5 presents the results of this additional analysis and shows that they are consistent with the main findings highlighted above.

c) Truthful respondents

A major difficulty related to the use of the WBES dataset is that the variables that we derive are self-reported by the respondents. While it is not possible to fully eliminate concerns regarding the reliability of these responses, we attempt to mitigate such concerns by considering the interviewee's

perception of the interviewee's responses to the questions. The WBES dataset includes a variable that adopts the following values: (i) *truthful*, (ii) *somewhat truthful*, or (iii) *not truthful*. The right panel of Table 5 presents this additional analysis, where only *truthful* respondents are included. All the results remain similar.

d) Self-selection model

As explained by Cole and Sokolyk (2016), self-selection bias can be a problem in studies on discouragement, and our sample only includes companies with a need for credit. In fact, companies that do not require credit have potentially made their decision not to apply for credit based on the information environment in which they operate, which leads to a self-selection issue.

To control for this problem, we follow Van de Ven et al.'s (1981) method of using a bivariate probit selection model. The aim of this approach is to (1) model the probability of requiring credit (thus, we generate a *Need* variable, equal to one if the firm needs credit and zero otherwise); (2) compute the selection parameter λ, also called the Heckman lambda, and (3) include this parameter in our main equation to control for the self-selection effect.

Table 6 (left panel) displays our results indicating that the *Creditor Information* variable remains negative and significant, which confirms our initial findings. Furthermore, the self-selection parameter λ is also negative and significant, proving the importance of controlling for this effect.

Insert Table 6 about here.

e) IV regression

In all the previously mentioned analyses, creditor information in the market is considered completely exogenous. This hypothesis seems valid for public credit registries since they are provided by the government. *Business Disclosure* and *Disclosure ex ante* are also derived from the legal environment of the market under scrutiny (Kysucky and Norden, 2015). However, the effect of credit bureaus might be endogenous since they are established by financial institutions to circumvent a lack of information on potential borrowers. If lenders are acquainted with a degree of borrower's discouragement, this experience may affect the level of information they would like to access through credit bureaus. The binary response models presented above may therefore suffer from endogeneity. The most traditional approach to addressing endogeneity is to include a valid instrument as a regressor. In our specific setting, two instruments are added to control for the potential endogeneity of the relationship between

the probability of being discouraged and the presence of credit bureaus.[7] We first control for the country's membership in the Association of Consumer Credit Information Suppliers (ACCIS). The objective of this association (created 1990) is to expand and develop credit bureaus. Past participation in the ACCIS is likely to affect the amount and quality of creditor information available later. The variable *ACCIS* is a dummy variable that takes the value of 1 if the country is an ACCIS member and 0 otherwise. Our second instrumental variable identifies countries that have signed the Memorandum of Understanding on the Exchange of Information among National Central Credit Registers for the Purpose of Passing It on to Reporting Institutions (20 February 2003) (MOU). The MOU has had a large impact on legislation in several countries (Jentzsch, 2008). All the countries in our sample except Hungary and the United Kingdom have signed the MOU. The MOU variable is constructed as a binary variable that takes the value of 1 if a country has signed the memorandum and 0 otherwise. These two variables are likely to explain the value of *Creditor Information* but cannot be influenced by the probability of being discouraged of candidate borrowers. The results of these IV approaches are provided in Table 6 (columns (5) and (6)). The results clearly reveal the presence of endogeneity and the valid nature of two instruments selected to capture it. However, once we control for endogeneity, the results remain consistent with a negative effect of creditor information on the probability of being discouraged.

6) Concluding remarks

For financial intermediaries active in the lending industry, correctly assessing the risks and adequately sketching the profile of their credit-demanding institutional clients is crucial. However, one phenomenon deprives them of a large number of credit contracts and thus a large source of revenue. This phenomenon is borrowers' discouragement with respect to applying for credit. Discouraged borrowers assume (occasionally wrongly) that it is not worth investing time in preparing a credit application since the chances of its being accepted are small. This matter is of substantial importance: previous researchers, most notably Levenson and Willard (2000), have estimated that the number of discouraged borrowers is twice as large as that of rationed borrowers. Different reasons may lead borrowers to feel discouraged, but Kon and Storey (2003) theoretically postulate that the level of information asymmetry is a key factor in determining their discouragement. To date, studies adopting this model have focused

[7] These instruments are also used in Bertrand and Klein (2021).

on the microeconomic parameters that impact information asymmetry (e.g., relationship lending between bank and firm). Only a small number of studies have tried to empirically test the predictions postulated by Kon and Storey (2003) using macroeconomic variables. The aim of this paper was to enrich this literature by investigating the impact of the firm's informational environment, which is an aspect of the legal environment, on the probability of being discouraged.

Assembling a rich database from different sources, notably the WBES survey-based dataset, we test whether the availability of creditor information and the presence of credit bureaus and credit registries reduce the probability of a borrower being discouraged. Based on several logit specifications, our results clearly highlight that the availability of more public or private information significantly reduces the probability of being discouraged, consistent with Kon and Storey (2003) predictions. Investigating further, we also find that the impact of creditor information is larger for small and medium-sized firms as well as more risky firms, i.e., more opaque structures. Our results are robust to the use of different creditor information and discouragement proxies, endogeneity issues and self-selection biases. Overall, our findings are completely consistent with the literature.

This study strongly argues in favor of the usefulness of creditor information in the lending industry. From a regulatory perspective, our study shows the importance of developing a legal context favorable to the development of credit bureaus to reduce discouragement. It also enables us to recommend lenders to facilitate the application process for borrowers and send them strong positive signals prior to application to reduce the discouragement probability. From the private and public sector perspectives, our study also reveals the crucial importance of credit databases, whose use should be extended.

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Table 1. Variable definitions

Variable name	Definition
Dependent variables	
Discouraged	Dummy variable equal to 1 if the firm is discouraged (i.e., decides not to apply), 0 if it applied for credit.
Independent variables	
Creditor information variables	
Creditor Information Index	Index that measures the depth of credit information measures rules and practices affecting the coverage, scope and accessibility of credit information available through either a credit bureau or a credit registry.
Credit Bureau Coverage	Number of individuals and firms listed in a credit bureau's database with information on their borrowing history within the past five years, expressed as a percentage of the adult population.
Credit Registry Coverage	Number of individuals and firms listed in a credit registry's database with information on their borrowing history within the past five years, expressed as a percentage of the adult population.
Business Disclosure	Measures of the extent of disclosure of ownership and financial information required from companies.
Disclosure Ex Ante	Measures of disclosure requirements the firm must meet when operating a transaction.
Firm characteristics	
CEO_Exp	Manager experience (years).
Ln(Size)	Natural logarithm of firm total assets.
Ln(Age)	Natural logarithm of firm age.
Sole	Dummy variable equal to 1 if the firm has only one owner, 0 if it has more.
Legal	Dummy variable equal to 1 if the firm is a limited corporation, 0 otherwise.
Obstacle	Dummy variable equal to 1 if the firm considers that access to finance is a "Major Obstacle" or a "Very Severe Obstacle", 0 otherwise.
Certified	Dummy variable equal to 1 if the firm's annual financial statements are checked or certified by an external auditor.
R&D	Dummy variable equal to 1 if the firm spent on formal R&D activities, 0 otherwise.
Account	Dummy variable equal to 1 if firms have a checking or savings account, 0 otherwise
Export	Dummy variable equal to 1 if firm is a direct exporter (i.e., more than 10% exports in its sales), 0 otherwise
Foreign_Own.	Dummy that equals 1 if firms have a foreign owner, 0 otherwise
Credit	Proportion of total annual purchases of material inputs purchased on credit.
Macroeconomic variables	
Inflation	Rate of inflation
Fin_Develop	Financial development: Domestic banking credit to the private sector, as a share of GDP
Instruments	
ACCIS	Dummy variable equal to 1 if the country in which the firm evolves has membership in the Association of Consumer Credit Information Suppliers.
MOU	Dummy variable equal to 1 if the country has signed the Memorandum of Understanding on the Exchange of Information among National Central Credit Registers for the Purpose of Passing It on to Reporting Institutions

Table 1 defines each variable used in all the models presented in the study. The first column contains the name of the variable, the second column contains its definition, and the final column contains the main source from which the data have been collected.

Table 2. Descriptive statistics

	Mean	Std. Dev.	Applicant	Discouraged	diff.
Discouraged	0.493	0.500			
Creditor Information Index	4.901	2.847	5.118	4.677	0.442***
Credit Bureau Coverage	33.943	34.198	41.184	26.510	14.674***
Credit Registry Coverage	15.774	24.109	20.126	11.308	8.818***
Business Disclosure	6.575	1.862	7.650	6.189	1.461***
Disclosure Ex Ante	43.460	26.109	55.878	39.001	16.877***
CEO Experience	19.018	15.445	20.832	17.151	3.681***
CEO gender	0.152	0.359	0.144	0.160	-0.016***
Ln(Size)	3.418	1.396	3.785	3.039	0.746***
Ln(Age)	2.868	0.962	2.947	2.786	0.161***
Sole	0.471	0.499	0.380	0.564	-0.185***
Legal	0.108	0.310	0.104	0.112	-0.009**
Obstacle	0.305	0.46	0.257	0.354	-0.097***
Certified	0.504	0.500	0.585	0.420	0.165***
Account	0.889	0.314	0.927	0.850	0.076***
Export	0.997	0.058	0.997	0.997	-0.000
Foreign Own.	0.077	0.266	0.094	0.059	0.035***
Credit	13.427	23.058	15.374	11.424	3.950***
R&D	0.219	0.413	0.284	0.152	0.132***
Inflation	6.329	7.541	6.191	6.471	-0.279***
Financial Development	43.272	26.183	45.468	41.013	4.455***
Observations	35,777				

Table 2 presents the descriptive statistics of all the variables used in this study. The first column contains the name of the variable. The second and third columns show the mean and standard deviation of each variable for the global sample, respectively. The fourth and fifth columns present the means of the applicants' and discouraged borrowers' groups, respectively. The last column depicts the *t value* statistics associated with the statistical test of mean differences between the two aforementioned groups. The null postulates equality of means between the two groups, while the alternative postulates the opposite. *, **, and *** denote that the difference between the two groups is statistically and significantly different from 0 at the 10%, 5%, and 1% levels, respectively.

Table 3. Main results

	(1) Discouraged	(2) Discouraged	(3) Discouraged	(4) Discouraged
Creditor Information Index	-0.026***			0.008***
	(0.000)			(0.004)
Creditor Information²				-0.003**
				(0.039)
Credit Registry Coverage		-0.004***		
		(0.000)		
Credit Bureau Coverage			-0.003***	
			(0.000)	
Manager Experience	-0.007***	-0.006***	-0.007***	-0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
CEO Female	0.057***	0.044**	0.054**	0.055***
	(0.005)	(0.038)	(0.011)	(0.007)
Ln(Size)	-0.196***	-0.192***	-0.191***	-0.196***
	(0.000)	(0.000)	(0.000)	(0.000)
Ln(Age)	0.014*	0.012	0.012	0.014*
	(0.084)	(0.166)	(0.173)	(0.082)
Sole	0.112***	0.125***	0.123***	0.111***
	(0.000)	(0.000)	(0.000)	(0.000)
Legal	0.129***	0.120***	0.129***	0.130***
	(0.000)	(0.000)	(0.000)	(0.000)
Obstacle	0.209***	0.227***	0.225***	0.209***
	(0.000)	(0.000)	(0.000)	(0.000)
Certified	-0.279***	-0.268***	-0.285***	-0.278***
	(0.000)	(0.000)	(0.000)	(0.000)
Account	-0.240***	-0.250***	-0.229***	-0.243***
	(0.000)	(0.000)	(0.000)	(0.000)
Export	0.184	0.167	0.176	0.181
	(0.142)	(0.180)	(0.170)	(0.147)
Foreign Own.	0.040	0.055*	0.061**	0.038
	(0.165)	(0.063)	(0.038)	(0.185)
Credit	0.000	0.000	0.000	0.000
	(0.878)	(0.569)	(0.405)	(0.878)
R&D	-0.262***	-0.274***	-0.267***	-0.262***
	(0.000)	(0.000)	(0.000)	(0.000)
Inflation	0.007***	0.008***	0.005***	0.007***
	(0.000)	(0.000)	(0.000)	(0.000)
Financial Development	-0.004***	-0.003***	-0.004***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
Year dummies	Yes	Yes	Yes	Yes
Sector dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Cluster	Country	Country	Country	Country
Constant	0.831***	0.747***	0.839***	0.829***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	35,777	32,544	32,544	35,777
Pseudo R^2	0.173	0.182	0.181	0.173

Table 3 presents the results of our logit regressions conducted at the firm level. The dependent variable is Discouraged. All models have variance clustered at the country level. The main figures are the parameter estimates, while the numbers in parentheses are the standard errors. *, **, and *** denote significant parameter estimates at the 10%, 5%, and 1% levels, respectively. See Table 1 for the definitions of the variables. Sectorial dummies are a set of dummies, one for each sector we control for (Manufacturing, Energy Production, and Water Production).

Table 4. Further analysis

	Size		Income		
	Small & Medium	Large	Low	Medium	High
	(1)	(2)	(3)	(4)	(5)
	Discouraged	Discouraged	Discouraged	Discouraged	Discouraged
Creditor Information Index	-0.028***	-0.012	0.053	-0.073	-0.020***
	(0.000)	(0.264)	(0.124)	(0.193)	(0.000)
Control variables	All	All	All	All	All
Cluster	Country	Country	Country	Country	Country
Constant	0.843***	1.064**	1.526**	0.234	0.561***
	(0.000)	(0.013)	(0.017)	(0.640)	(0.001)
Observations	28,124	7,641	3,811	2,100	29,779
Pseudo R^2	0.138	0.214	0.148	0.146	0.174

Table 4 presents the results of additional logit regressions conducted at the firm level. The dependent variable is Discouraged. All models have variance clustered at the country level. The main figures are the parameter estimates, while the numbers in parentheses are the standard errors. *, **, and *** denote significant parameter estimates at the 10%, 5%, and 1% levels, respectively. See Table 1 for the definitions of the variables. Sectorial dummies are a set of dummies, one for each sector we control for (Manufacturing, Energy Production, and Water Production).

Table 5. Robustness

	Alternative Creditor Info.		Line of Credit			Truthful Respondents		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Discouraged		Discouraged			Discouraged		
Business Disclosure	-0.006**							
	(0.042)							
Disclosure Ex Ante		-0.067***						
		(0.000)						
Creditor Information Index			-0.029***			-0.005**		
			(0.000)			(0.049)		
Credit Registry Coverage				-0.003***			-0.003***	
				(0.000)			(0.000)	
Credit Bureau Coverage					-0.004***			-0.001*
					(0.000)			(0.061)
Control variables	All	All	All	All	All	All	All	All
Cluster	Country	Country	Country	Country	Country	Country	Country	Country
Constant	-0.683**	1.915***	1.915***	1.745***	1.827***	-0.771**	-0.683**	-0.656**
	(0.033)	(0.000)	(0.000)	(0.000)	(0.000)	(0.015)	(0.033)	(0.042)
Observations	35,777	35,777	21,748	20,024	20,024	18,117	16,681	16,681
Pseudo R^2	0.168	0.169	0.149	0.156	0.159	0.158	0.166	0.164

Table 5 presents the results of robustness checks. We first include two alternative measures of creditor information, in which the dependent variable is Discouraged (first two estimation columns). The last three columns are exact replications of the models presented in the core analyses but with an alternative dependent variable Discouraged2. All models have variance clustered at the country level. The main figures are the parameter estimates, while the numbers in parentheses are the standard errors. *, **, and *** denote significant parameter estimates at the 10%, 5%, and 1% levels, respectively. See Table 1 for the definitions of the variables. Sectorial dummies are a set of dummies, one for each sector we control for (Manufacturing, Energy Production, and Water Production).

Table 6. IV regression

	(1)	(2)	(3)	(4)	(5)	(6)
	Need	Discouraged	Discouraged	Discouraged	Creditor Information	Discouraged
ACCIS					1.103***	
					(0.000)	
MOU					-0.865***	
					(0.000)	
Creditor Information Index		-0.025***				-0.032***
		(0.000)				(0.000)
Credit Registry Coverage			-0.004***			
			(0.000)			
Credit Bureau Coverage				-0.003***		
				(0.000)		
λ		-0.064	-0.145***	-0.077		
		(0.165)	(0.002)	(0.104)		
Ln(Sales)	-0.002*					
	(0.071)					
Construction	0.204***					
	(0.000)					
WK	0.112***					
	(0.000)					
Control variables	All	All	All	All	All	All
Cluster	Country	Country	Country	Country	Country	Country
Constant	0.208	0.889***	0.878***	0.907***	1.526**	0.234
	(0.295)	(0.000)	(0.000)	(0.000)	(0.017)	(0.640)
Observations	84,004	35,777	32,544	32,544	35,777	35,777
Pseudo R^2	0.107	0.173	0.182	0.181	0.313	0.181
Exogeneity (J-stat)					0.87	
Exogeneity (p.value)					(0.320)	
Relevance (F-stat)					23.89	
Relevance (p.value)					(0.000)	

Table 6 presents the results of IV regressions conducted to control for potential endogeneity. The dependent variable is Discouraged. All models have variance clustered at the country level. The main figures are the parameter estimates, while the numbers in parentheses are the standard errors. *, **, and *** denote significant parameter estimates at the 10%, 5%, and 1% levels, respectively. See Table 1 for the definitions of the variables. Sectorial dummies are a set of dummies, one for each sector we control for (Manufacturing, Energy Production, and Water Production). The last lines of the table present the statistics of the IV regressions.

Figure 1. Inverted U-shaped nonlinear relationship

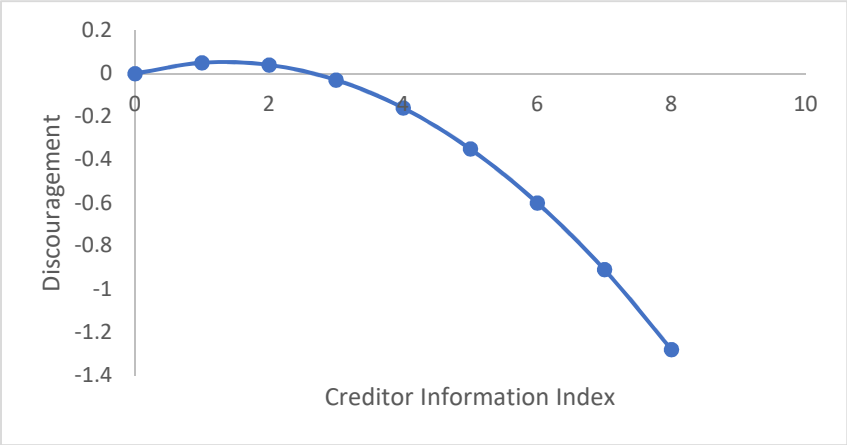

Figure 1 presents the shape of the nonlinear relationship between the level of discouragement (*Discouraged* variable) on the Y axis and creditor information (*Creditor Information Index* variable) on the X axis using the coefficient of both variables presented in Table 3 (column 4).

Appendix A. Sample of countries

Country	Years	Country	Years	Country	Years
Afghanistan	2014	Grenada	2010	Papua New Guinea	2015
Albania	2013; 2019	Guatemala	2010; 2017	Paraguay	2010; 2017
Antigua and Barbuda	2010	Guinea	2016	Peru	2010; 2017
Argentina	2010; 2017	Guyana	2010	Philippines	2015
Armenia	2013; 2020	Honduras	2010; 2016	Poland	2013; 2019
Azerbaijan	2013; 2019	Hungary	2013; 2019	Portugal	2019
Bahamas	2010	India	2014	Romania	2013; 2019
Bangladesh	2013	Indonesia	2015	Russia	2012; 2019
Barbados	2010	Israel	2013	Rwanda	2011; 2019
Belarus	2013; 2018	Italy	2019	Senegal	2014
Belize	2010	Jamaica	2010	Serbia	2013; 2019
Benin	2016	Jordan	2013; 2019	Sierra Leone	2017
Bhutan	2015	Kazakhstan	2013; 2019	Slovak Republic	2013; 2019
Bolivia	2010; 2017	Kenya	2013; 2018	Slovenia	2013; 2019
Bosnia and Herzegovina	2013; 2019	Kosovo	2013; 2019	Solomon Islands	2015
Bulgaria	2013; 2019	Kyrgyz Republic	2013; 2019	South Sudan	2014
Burundi	2014	Lao PDR	2016; 2018	Sri Lanka	2011
Cambodia	2016	Latvia	2013; 2019	St Kitts and Nevis	2010
Cameroon	2016	Lebanon	2013; 2019	St Lucia	2010
Central African Republic	2011	Lesotho	2016	St Vincent and Grenadine	2010
Chad	2018	Liberia	2017	Sudan	2014
Chile	2010	Lithuania	2013; 2019	Suriname	2010; 2018
Colombia	2010; 2017	Malawi	2014	Tajikistan	2013; 2019
Costa Rica	2010	Malaysia	2015	Tanzania	2013
Croatia	2013; 2019	Mali	2016	Thailand	2016
Cyprus	2019	Malta	2019	Timor-Leste	2015
Czech Republic	2013; 2019	Mauritania	2014	Togo	2016
Côte d'Ivoire	2016	Mexico	2010	Trinidad and Tobago	2010
DRC	2013	Moldova	2013; 2019	Tunisia	2013; 2020
Djibouti	2013	Mongolia	2013; 2019	Turkey	2013; 2019
Dominica	2010	Montenegro	2013; 2019	Uganda	2013
Dominican Republic	2010; 2016	Morocco	2013; 2019	Ukraine	2013; 2019
Ecuador	2010; 2017	Mozambique	2018	Uruguay	2010; 2017
Egypt	2013; 2016; 2020	Myanmar	2014; 2016	Uzbekistan	2013; 2019
El Salvador	2010; 2016	Namibia	2014	Venezuela	2010
Estonia	2013; 2019	Nepal	2013	Vietnam	2015
Eswatini	2016	Nicaragua	2010; 2016	West Bank and Gaza	2013; 2019
Ethiopia	2011; 2015	Niger	2017	Yemen	2013
Gambia	2018	Nigeria	2014	Zambia	2013; 2019
Georgia	2013; 2019	North Macedonia	2013; 2019	Zimbabwe	2011; 2016
Ghana	2013	Pakistan	2013		
Greece	2018	Panama	2010		

Appendix B. Enterprise Survey question details

K.16. With reference again to the previous fiscal year [year], did this establishment apply for any lines of credit or loans?

- *Yes.*
- *No.*
- *Don't know (spontaneous).*

K.17. What was the main reason why this establishment did not apply for any line of credit or loan?

- *No need for a loan; establishment had sufficient capital.*
- *The application procedures were complex.*
- *Interest rates were not favorable.*
- *Collateral requirements were too high.*
- *The size of the loan and maturity were insufficient.*
- *Did not think it would be approved.*
- *Other.*
- *Don't know (spontaneous).*