CONTRIBUTI DI RICERCA CRENOS

COLLATERAL REQUIREMENTS, COST OF CREDIT, AND FIRMS' DISCOURAGEMENT FROM APPLYING FOR BANK LOANS

Pasqualina Arca
Gianfranco Atzeni
Luca Deidda

WORKING PAPERS

2024/17

arkadia

CENTRO RICERCHE ECONOMICHE NORD SUD
(CRENOS)
UNIVERSITÀ DI CAGLIARI
UNIVERSITÀ DI SASSARI

CRENOS was set up in 1993 with the purpose of organising the joint research effort of economists from the two Sardinian universities (Cagliari and Sassari) investigating dualism at the international and regional level. CRENoS' primary aim is to improve knowledge on the economic gap between areas and to provide useful information for policy intervention. Particular attention is paid to the role of institutions, technological progress and diffusion of innovation in the process of convergence or divergence between economic areas. To carry out its research, CRENoS collaborates with research centres and universities at both national and international level. The centre is also active in the field of scientific dissemination, organizing conferences and workshops along with other activities such as seminars and summer schools.
CRENoS creates and manages several databases of various socio-economic variables on Italy and Sardinia. At the local level, CRENoS promotes and participates to projects impacting on the most relevant issues in the Sardinian economy, such as tourism, environment, transports and macroeconomic forecasts.

www.crenos.unica.it
crenos@unica.it

CRENOS – CAGLIARI
VIA SAN GIORGIO 12, I-09124 CAGLIARI, ITALIA
TEL. +39-070-6756397

CRENOS - SASSARI
VIA MURONI 25, I-07100 SASSARI, ITALIA
TEL. +39-079-213511

Title: COLLATERAL REQUIREMENTS, COST OF CREDIT, AND FIRMS' DISCOURAGEMENT FROM APPLYING FOR BANK LOANS1

Prima Edizione: Ottobre 2024
ISBN: 978 88 68515 447

Viale Bonaria 98 · 09125 Cagliari
Tel. 070/6848663 · info@arkadiaeditore.it
www.arkadiaeditore.it

Collateral requirements, cost of credit, and firms' discouragement from applying for bank loans

Pasqualina Arca, Gianfranco Atzeni and **Luca Deidda**
University of Sassari & CRENoS

October 2024

Abstract

Using the BEEPS dataset on Eastern European and Central Asian firms, we investigate how the collateral requirements and the cost of credit expected by firms might discourage them from applying for credit. Based on the data we identify four reported discouragement reasons: (A) high probability of rejection, (B) high cost of credit, (C) high cost of application, (D) and other reasons. We develop a simple statistical model to derive the following set of predictions about the impact of expected collateral requirements and cost of credit on discouragement. First, collateral requirements and cost of credit should induce discouragement across all reported reasons. Second, higher expected collateral requirements and cost of credit should have a lower effect when the reported reason is (A). If the firm already fears rejection, a higher collateral requirement or a higher cost of credit should play little role. Third, collateral requirements should have a larger impact when the reported reason is (B). If the firm is discouraged by the high cost of credit rather than the fear of rejection, an increase in the expected collateral requirements becomes more significant as it may add the risk of rejection as an additional concern for the firm. We test these predictions using a multinomial logit model and we find robust evidence that supports all of them.

Keywords: discouraged, denied, credit rationing, loans to collateral value, cost of application, multinomial logit
Jel codes: G21, G32

Acknowledgement: We acknowledge the financial support from the Italian Ministry of the University and Research, PRIN grant No. E5D23006100006 and from Regione Autonoma della Sardegna legge 7/2007 - Bando MGR 2022.

1 Introduction

A firm's ability to secure external financing hinges on its capacity to repay debt, which depends on its financial health, profitability, governance, risk profile, and market conditions. In credit markets, especially for small businesses, lenders typically have less information than borrowers about these factors. Such significant information asymmetries imply that firms may need to signal their repayment capacity or align incentives with lenders—or both—to secure financing. Extensive literature shows that loan contracts introducing collateral requirements can help mitigate these asymmetries, thus enhancing firms' access to credit. Collateral serves two key roles. It provides an incentive for borrowers to repay by securing the loan with a portion of their wealth, which can be seized in case of default, and it acts as a signalling and screening device, allowing high-quality borrowers to demonstrate their creditworthiness and improving their chances of obtaining credit, and at more favourable terms.

Loan contracts offered by banks are firm-specific, with different banks proposing varying terms to each firm based on their own assessments following firms' application for credit. Therefore, firms only observe the specific terms of a loan, such as the cost of credit and collateral requirements—after applying to a particular bank. Before applying, firms may have some information about potential contract terms, but this information is often incomplete. In essence, firms can estimate the terms they might be offered, but such estimates are subject to uncertainty and a significant margin of error.

In the presence of non negligible costs of application, such an uncertainty about the terms of financing a firm would be offered, if any, might discourage firms from applying. That could be the case even if the firm would be, in principle, willing to obtain financing at the expected conditions or, more generally, at favourable enough conditions. This leads to an expanded definition of "discouraged borrowers" that builds on Jappelli (2009) concept. While Jappelli defines discouraged borrowers as those who avoid seeking credit due to fear of rejection, we broaden the definition to include firms that are deterred not only by the fear of rejection but also by the uncertainty about the contractual terms. That is, discouragement might be induced by the fear of unfavourable financing terms rather than by the fear of rejection. According to such a broader definition, in the presence of non-negligible application costs, discouragement becomes the outcome of the firm's evaluation of many interacting factors including the cost of application, the collateral requirements, the cost of credit, and all the other loan contract terms, as well as the possibility of being rejected. Importantly, firms' expectations about the loan contract they would be offered, if any, not only affect discouragement directly but also contribute indirectly to the role that other factors play, such as the cost of application, for instance. For instance, the expected collateral requirements and the cost of credit affect the importance that a firm attaches to the fact that applying for a loan is costly when deciding whether to apply for a loan.

The goal of our paper is to provide an empirical estimation of the determinants of discouragement based on the above logic based on BEEPS dataset on Eastern European and Central Asian Firms. Specifically, we would like to identify how expected collateral requirements and cost of credit shape firms' discouragement given that firms consider such elements as well as other factors,

including the cost of application, when deciding to apply for a loan or not. To do so, we implement a simple theoretical framework to identify the concurrent factors that determine the firm's decision to apply or not for credit when firms are not fully informed about the contractual terms they would be proposed by banks if applying.

We develop a simple statistical model whereby firms estimate the cost of loans and collateral requirements, two key elements of loan contracts, based on public information. Such estimates feed into the determination of the expected net present value (NPV) of the decision to apply or not for a loan. Such a NPV depends not only on the cost of credit and collateral requirements but also on other elements, including the cost of application and the characteristics of the project for which the firm demands funds. According to the model, each factor affecting the NPV of the decision to apply is a potential determinant of discouragement. The model also highlights how firms' expectations regarding the cost of credit and collateral requirements influence the perceived significance of other factors, such as the cost of applying or the profitability of the project to be financed, as potential sources of discouragement.

We map the discouraging factors identified in the model to the information contained in the BEEPS survey on the self-reported specific reason that, among other things, led a firm not to apply for a loan. Based on that information we identify four reported discouragement reasons: (A) high probability of rejection, (B) high cost of credit, (C) high cost of application, (D) and other reasons. The model's predictions are as follows. Collateral requirements and cost of credit should induce discouragement across all reported reasons. Moreover, higher expected collateral requirements and cost of credit should have a lower effect when the reported reason is (A). If the firm already fears rejection, a higher collateral requirement or a higher cost of credit should play a little role. Third, collateral requirements should have a larger impact when the reported reason is (B). If the firm is discouraged by the high cost of credit rather than the fear of rejection, an increase in the expected collateral requirements becomes more significant as it may add the risk of rejection as an additional concern for the firm.

We test for such predictions using a multinomial logit model. Specifically, based on firms' answers collected in the 2006-2012 BEEPS data set about the reasons for not applying for a loan, we provide empirical evidence on whether and how the loan-to-collateral ratio and the cost of credit contribute to explaining firms' discouragement depending on the reason for not applying for loans reported by firms. We find that expected collateral requirements and cost of credit are significant determinants of discouragement across the four main reported reasons why firms are discouraged. Moreover, the magnitude of the effects varies across the four discouragement reasons in a way that offers strong support to the model's prediction. Expected collateral requirements and cost of credit matter less when the firm does not apply for credit because it fears rejection, while collateral requirements matter more if the firm is discouraged by the high cost of credit. Our paper contributes to the literature by empirically assessing the multidimensional nature of discouragement.

After Jappelli (2009), the notion of discouraged borrowers has gained attention in the context of firms' access to external finance and credit rationing (Cole and Sokolyk, 2016; Han, Fraser, and Storey, 2009; Wernli and Dietrich, 2022). The existing evidence suggests that firms' discour-

agement is indeed a pervasive phenomenon. Levenson and Willard (2000) document that in the U.S., discouraged firms are twice as prevalent as firms that apply for credit and are rejected. Freel, Carter, and Tagg (2012) provide similar evidence for UK firms. According to ECB Data for the Euro area, in 2016 firms with a rejected loan application amounted to 2.5% of all firms, against 6% of firms discouraged from applying (Ferrando and Mulier, 2022). In the 2005-2016 SAFE dataset, 12% of the firms in need of external finance are discouraged from applying (Ferrando and Mulier, 2022). In the 2012-2016 BEEPS dataset, which contains firm data from Eastern Europe and Central Asia countries, firms that did not apply for a loan account for 41.77% of those in need of credit. Within the pool of firms that need credit, rejected firms account for 4.57% while those that did not apply because they feared rejection account for 3.04%. The existing literature that focuses on firms' discouragement compares discouraged and rationed firms with respect to firms' characteristics and their probability of being financed (Han, Fraser, and Storey, 2009; Freel, Carter, and Tagg, 2012; Levenson and Willard, 2000; Ferrando and Mulier, 2022). We contribute to this literature by extending the notion of discouraged borrowers to all non-applicant firms in need of credit. In such a scenario, the discouragement of firms becomes a multidimensional phenomenon, taking into account not only the fear of rejection but also other factors related to the fear of unfavourable financing terms.

The reminder of the paper is organised as follows. Section 2 introduces the theoretical framework and Section 2.1 describes the empirical predictions. Section 3 describes the data and the empirical setting. In particular, Section 3.1 reports the estimation procedure and Section 3.2 reports the results. Section 4 concludes the paper.

2 Theoretical framework

We consider an environment in which there is uncertainty on the firm-specific loan interest rate r_i and the minimum loan to collateral value k_i demanded by the banks, with

$$k_i = \frac{L_i}{C_i} \tag{1}$$

where C_i is collateral requested to firm i and L_i is the value of the related loan. We assume that k_i and r_i depend on characteristics specific to firm i according to the following bi-variate statistical model

$$k_i = \boldsymbol{\gamma} \boldsymbol{X}_i + \epsilon_i \tag{2}$$
$$r_i = \boldsymbol{\beta} \boldsymbol{Z}_i + \mu_i \tag{3}$$

where

$$\boldsymbol{X}_i = [x_{i,1}, ..., x_{i,N}] \tag{4}$$
$$\boldsymbol{Z}_i = [z_{i,1}, ..., z_{i,N}] \tag{5}$$

are the vectors of the firm's specific characteristics that systematically affect the loan-to-collateral value and the interest rate requested by the bank; $\boldsymbol{\gamma} = [\gamma_1, ..., \gamma_N]$ and $\boldsymbol{\beta} = [\beta_1, ..., \beta_N]$ are the vectors of the associated parameters; ϵ_i and μ_i are random error terms that capture idiosyncratic factors, which are independently and identically distributed across firms with $E(\epsilon_i) = 0$, and finite variance $\sigma_i^2 > 0$. We call $f(\epsilon_i)$ and $g(\mu_i)$ the density functions of ϵ_i and μ_i, with $f(\epsilon_i) \sim \mathcal{N}(0, \sigma_\epsilon^2)$, $g(\mu_i) \sim \mathcal{N}(0, \sigma_\mu^2)$. We note that $\boldsymbol{X}_i$ and $\boldsymbol{Z}_i$ might include country-level or sectoral characteristics common to all firms in the same sector or country.

Firm i observes its specific k_i and r_i only if applying for credit. However, like all other firms, firm i knows the statistical model (2)-(3), which banks use to determine k_i and r_i for each firm i. Let C_i^s be the collateral available to firm i and L_i^d the desired loan. Then, the minimum loan to collateral value firm i can offer would be

$$k_i^s = \frac{L_i^d}{C_i^s}. \tag{6}$$

Then, given the statistical model used by the bank (2), the necessary and sufficient conditions for firm i to be granted credit if applying are

$$k_i^s \leq \boldsymbol{\gamma X}_i + \epsilon_i \Rightarrow \epsilon_i \geq k_i^s - E(k_i) \tag{7}$$

where $E(k_i) = \boldsymbol{\gamma X}_i$. Accordingly, the probability of access to credit, if applying, for firm i is $Prob(\epsilon_i \geq k_i^s - E(k_i))$. Such a probability increases in $E(k_i)$. The higher the expected value of the loan-to-collateral ratio requested by the bank given firm i's characteristics, $E(k_i) = \boldsymbol{\gamma X}_i$, the lower the minimum value of realization of the firm-specific idiosyncratic component, ϵ_i, necessary for the firm to get access to credit, which results in a higher probability that the realization of ϵ_i satisfies condition (7). Moreover, assume that if financed, firm i operates an investment project that generates a cash flow $CF_{i,1}$ in one period of time, yielding a net future value

$$NFV_i = CF_{i,1} - (1 + r_i)I_{i,0} \tag{8}$$

where $I_{i,0}$ is the initial investment or cost of the project, and we assume that the loan entirely finances the project.[2] We further assume that firm i incurs a cost Ω_i in order to apply for the loan. Thus, the firm i project, if financed, is worth if

$$NFV_i \geq \Omega_i(1 + r_i). \tag{9}$$

Thus, we can define

$$r_i^s : CF_{i,1} - (1 + r_i)I_{i,0} = \Omega_i(1 + r_i) \tag{10}$$

the highest interest rate the firm i is willing to accept to undertake the project. Thus, given the statistical model used by the bank (3), the interest rate demanded by the bank cannot exceed r_i^s, that is

$$r_i^s > \boldsymbol{\beta Z}_i + \mu_i \Rightarrow \mu_i \leq r_i^s - E(r_i), \tag{11}$$

[2] Accordingly, we can think of $I_{i,0}$ as the size of the loan demanded by the firm.

where $E(r_i) = \boldsymbol{\beta}\boldsymbol{Z}_i$. Accordingly, the project's probability of being worthy if applying for firm i is $Prob(\mu_i \leq r_i^s - E(r_i))$. Such a probability decreases in $E(r_i)$.

Then, if firm i knows its k_i^s, r_i^s and its Ω_i, and can calculate $E(k_i)$ and $E(r_i)$ based on the statistical model (2)-(3), such a firm, if risk-neutral, applies for credit if and only if

$$Prob(\epsilon_i \geq k_i^s - E(k_i))Prob(\mu_i \leq r_i^s - E(r_i))E(NFV_i) \geq \Omega_i(1 + E(r_i)) \tag{12}$$

where, given $f(\epsilon_i) \sim \mathcal{N}(0, \sigma_\epsilon^2)$ and $g(\mu_i) \sim \mathcal{N}(0, \sigma_\mu^2)$

$$Prob(\epsilon_i \geq k_i^s - E(k_i)) = \int_{k_i^s - E(k_i)}^{\infty} f(\epsilon_i)d\epsilon_i = 1 - \frac{1}{\sqrt{2\pi}\sigma_\epsilon}\int_{-\infty}^{k_i^s - E(k_i)} e^{-\left(\frac{\epsilon_i}{\sqrt{2}\sigma_\epsilon}\right)^2} d\epsilon_i \tag{13}$$

and

$$Prob(\mu_i \leq r_i^s - E(r_i)) = \int_{-\infty}^{r_i^s - E(r_i)} g(\mu_i)d\mu_i = \frac{1}{\sqrt{2\pi}\sigma_\mu}\int_{-\infty}^{r_i^s - E(r_i)} e^{-\left(\frac{\mu_i}{\sqrt{2}\sigma_\mu}\right)^2} d\mu_i \tag{14}$$

The lower the net future expected value of the investment, $E(NFV_i)$ and/or the higher the application cost, Ω_i and/or the expected interest rate, $E(r_i)$, the higher the value of the probability of being financed necessary in order for the decision to apply for a loan to be worthy, which implies a lower loan-to-collateral value, k_i^s. Similarly, the higher the application cost, Ω_i, and/or the lower the expected loan-to-collateral ratio, $E(k_i)$, the higher the value of the probability that the project is worthy, which is necessary for the loan application being worthwhile, implying a higher interest rate demanded by the bank, r_i^s.

Accordingly, for a given firm's characteristics, there exist critical values of k_i^s and r_i^s call them, $\widehat{k}_i^s$ and $\widehat{r}_i^s$, such that

$$1 - \frac{1}{\sqrt{2\pi}\sigma_i}\int_{-\infty}^{\widehat{k}_i^s - E(k_i)} e^{-\left(\frac{\epsilon_i}{\sqrt{2}\sigma_i}\right)^2} d\epsilon_i = \frac{\Omega_i(1 + E(r_i))}{\left[\frac{1}{\sqrt{2\pi}\sigma_\mu}\int_{-\infty}^{\widehat{r}_i^s - E(r_i)} e^{-\left(\frac{\mu_i}{\sqrt{2}\sigma_\mu}\right)^2} d\mu_i\right][CF_{i,1} - I_{i,0}(1 + E(r_i))]} \tag{15}$$

where we substituted for $E(NFV_i)$ using (8), such that, firms with $k_i^s \leq \widehat{k}_i^s$ and $r_i^s \geq \widehat{r}_i^s$ apply for credit. In contrast, those with $k_i^s > \widehat{k}_i^s$ and $r_i^s < \widehat{r}_i^s$ are discouraged and do not apply.[3] Formally,

$$D_i = \begin{cases} 1 & \text{if } k_i^s > \widehat{k}_i^s \quad \text{and} \quad r_i^s < \widehat{r}_i^s \\ 0 & \text{otherwise} \end{cases} \tag{16}$$

where $D_i = 1$ if firm i is discouraged and $D_i = 0$ if the firm applies.

[3] It is immediate to verify that the RHS of (7) is increasing in k_i^s.

2.1 Empirical predictions

According to our theoretical model, a firm's decision to apply for a loan is determined by all the variables that make the firm participation constraint, equation (12), to hold. Thus, when it does not hold, we assume that a firm is discouraged. By substituting equation (8) into equation (12), we rewrite the firm's participation constraint by highlighting how uncertainty about k_i and r_i affect its different components as follows

$$\underbrace{Prob\big(\epsilon_i \geq k_i^s - E(k_i)\big)}_{a}\underbrace{Prob\big(\mu_i \leq r_i^s - E(r_i)\big)}_{b}\underbrace{[CF_i - \big(1 + E(r_i)\big)I_i]}_{c} \geq \underbrace{\Omega_i\big(1 + E(r_i)\big)}_{d}. \tag{17}$$

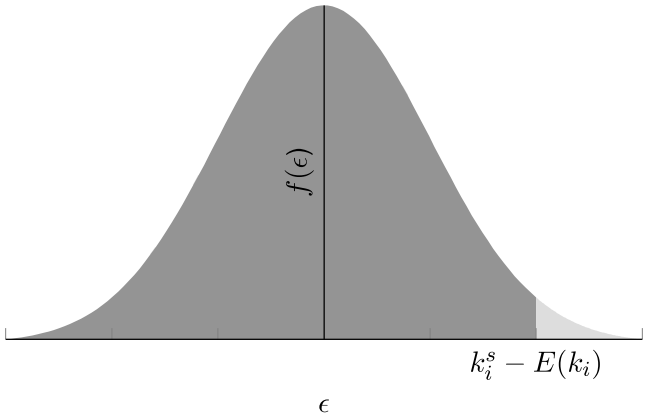
A decrease in $E(k_i)$ will decrease (a), increasing discouragement. Similarly, an increase in $E(r_i)$ reduces (b) and (c), but increases (d), thereby increasing discouragement. We can interpret each of these components as the one that drives discouragement. Accordingly, component (a) is related to the probability that the firm meets the collateral requirement requested by the bank, or in other words, to the probability of the firm obtaining bank credit. We classify discouragement driven by this component as Type (A) discouragement and call it *High probability of rejection*. Components (b) and (c) are related to the probability of the cost of credit being such that the project is not worth undertaking. We classify discouragement due to this component as Type (B) discouragement, and we term it as *Cost of credit too high and unfavourable credit conditions*. Finally, component (d) is related to the cost of application, Ω. We classify discouragement related to this component as Type (C) discouragement, and we term it *High cost of application*. In summary,

- Type (A) - *High probability of rejection*.
- Type (B) - *Cost of credit too high and unfavourable credit conditions*.
- Type (C) - *High cost of application*.

This classification allows us to derive empirical predictions regarding the extent to which changes of $E(k_i)$ and $E(r_i)$ affect the types of discouragement. Consider discouragement Type (A) - *High probability of rejection*. Firms reporting they are discouraged because they fear being rejected by the bank or because of too high collateral requirements is interpreted as firms having insufficient collateral, thus unable to post the amount requested by the bank to finance the project. Such a case implies that the firm's participation constraint does not hold because part (a) of equation (17) is too small; that is, the probability of being denied is high. In other words, the difference $k_i^s - E(k_i)$ is located on the right tail of the idiosyncratic component ϵ distribution, as depicted in figure 1. In such a situation, the higher is the probability of being denied, i.e. the more $k_i^s - E(k_i)$ is on the right tail, the smaller is the impact of changes of $E(k_i)$ on this probability, and thus, on discouragement.

Consider now how changes of $E(r_i)$ will impact Type (A) discouragement. Given that the firm expects to be rationed with a high probability because it does not meet the collateral requirements, marginal changes in the expected interest rate should not impact discouragement.

Figure 1: Distribution of ϵ in case A (too high collateral requirement)



Consider discouragement Type (B) - *Cost of credit too high and unfavourable credit conditions*. Firms that report being discouraged by unfavourable credit conditions are interpreted as firms that expect the cost of credit to be such that the project is not worth undertaking. Thus, by looking at the participation constraints, equation (17), firms are discouraged from borrowing because $E(r_i)$ affects (b), (c) and (d). First, high values of $E(r_i)$ imply that the difference $r_i^s - E(r_i)$ is small, and therefore, the higher $E(r_i)$, the further this difference is to the left tail of the distribution of μ (figure 2). Thus, marginal changes of $E(r_i)$ affect discouragement; the more so, the greater the difference $r_i^s - E(r_i)$.

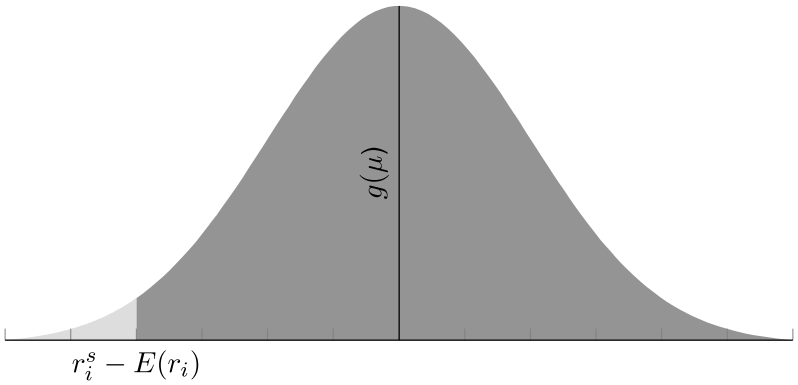
Consider now how changes of $E(k_i)$ will impact Type (B) discouragement. As collateral requirements do not represent the main reason for discouragement, other things equal, the probability of being denied, part (a) of equation (17), is greater than in Type (A). We expect marginal changes of $E(k_i)$ to have an impact on Type (B) discouragement, with the effect being greater than Type (A) discouragement.

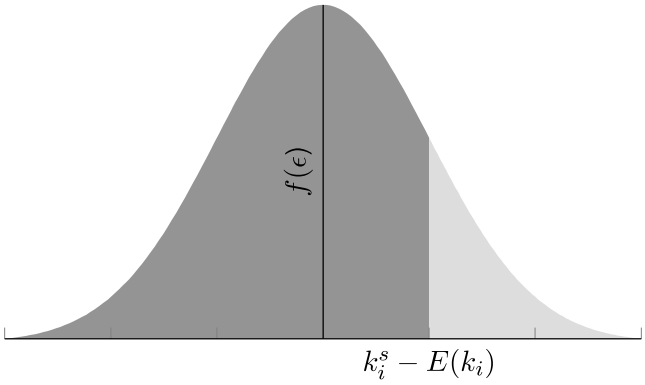
Consider discouragement Type (C) - *Application cost too high*. If a firm is discouraged because the application cost is too high, then equation (17) does not hold because $d > a \times b \times c$. In such a case, we cannot derive any prediction on marginal effects of $E(k_i)$ and $E(r_i)$ as we do not have any prior on the distribution of ϵ and μ.

Accordingly, based on the above discussion, we summarise the empirical predictions as follows:

- **Prediction 1.** $E(r_i)$ is positively correlated with all types of discouragement.
- **Prediction 2.** $E(k_i)$ is negatively correlated with all types of discouragement.
- **Prediction 3.** The marginal effect of $E(k_i)$ on discouragement of type (B) is larger than on type (A).

Figure 2: Distribution of μ and ϵ in case B (too high cost of credit)





- **Prediction 4.** Marginal changes of $E(r_i)$ affect discouragement of type (B), while they do affect discouragement of type (A).

Our central analysis focuses on the hypothesis that firms form expectations on $E(k_i)$, the loan-to-collateral ratio required by the bank, and $E(r_i)$, loan interest rate, based on the statistical model (2)-(3). The parameter ϵ_i represents the firm's uncertainty about the predicted loan-to-collateral ratio the bank would request. Similarly, the parameter μ_i represents the uncertainty about the loan rate the bank would charge in case the firm applies for a loan. Thus, based on this hypothesis, it is possible to assess the extent to which $E(k_i)$ and $E(r_i)$ affect discouragement.

3 Empirical Analysis

The empirical analysis is conducted by using the BEEPS (Business Environment and Enterprise Performance Survey), which contains firm-level data collected by the World Bank. The Survey contains several variables, such as firm performance, labour force, innovation, financing, and management practices. In the finance section of the Survey, respondents are asked whether they applied for a loan in the last fiscal year, and, in case they did not, they are asked what was the main reason why the firm did not apply for any line of credit or loan. We consider the respondents to this last question as firms being *discouraged* from applying for bank credit. A firm needing credit but not applying could indicate one among eight reasons for being discouraged, listed in Table 1.

Table 1: Firms that need credit: applicants and discouraged firms by type

	freq.	percent	predicted
1. Applied for loan	3,583	58.23	56.45
Did not apply because			
2. Application procedures were complex	443	7.2	7.34
3. Interest rates were not favorable	1,254	20.38	20.88
4. Collateral requirements were too high	326	5.3	6.44
5. Size of the loan and maturity were insufficient	96	1.56	1.92
6. It is necessary to make informal payments to get bank loans	21	0.34	0.39
7. Did not think it would be approved	187	3.04	2.85
8. Other reasons	243	3.95	3.73
Total	6,153	100	100

To reconcile these reasons for discouragement with the types stemming from the theoretical framework, we map these eight reasons with the Types of discouragements (A), (B) and (C) discussed in section **??**. Specifically, reasons 2, "Application procedures were complex" and 6, "It is necessary to make informal payments to get bank loans," are related to the cost of the application, Ω_i. Reasons 3, "Interest rates were not favourable", and 5, "Size of loan and maturity were insufficient," relate to the expected NFV being too low for the firm to apply, other things being equal.

Reasons 4, "Collateral requirements were too high" and 7, "Did not think it would be approved" relate to the firm's uncertainty about the probability of access credit. We group these two reasons as, in our framework, the probability of being denied credit resulting from a gap between the value of the collateral the firm is willing to provide and the value of the collateral the firm expects the bank to require, $k_i^s - E(k_i)$. Finally, we introduce a fourth category of discouragement, Type (D) - *Other reasons* to account for the residual motive "Other reasons" reported in the Survey. Thus, based on the above mapping, we end up with the following four categories of discouragement, also reported in Table 3, that we use to test the empirical predictions (1)-(4) of 2.1.

A. *High probability of rejection* which reflects the firm's expectation about how likely the bank will finance the project (reasons 4 and 7);

B. *Cost of credit too high and unfavourable credit conditions* which relates to the profitability of the investment project given the credit market conditions (reasons 3 and 5);

C. *High cost of application* which is related to the cost of application (reasons 2 and 6);

D. *Other reasons* (reason 8).

3.1 Estimation strategy

We test the empirical predictions (1)-(4) on the expected collateral requirements, $E(k_i)$, and the expected cost of credit, $E(r_i)$ discussed in subsection 2.1, using the four categories of discouragement, (A)-(D) presented above, by using a multinomial logit model. Specifically, we estimate the probability of a firm being discouraged for any of the four discouragement reasons, (A)-(D), by regressing the four categories of discouragement and the decision to apply for a loan on $E(k_i)$ and $E(r_i)$, which represent the key explanatory variables, conditional on the set of controls. Before proceeding with the estimation of the multinomial logit model, based on the statistical model (2)-(3), we estimate by OLS the determinants of the firm-specific values of the loan-to-collateral ratio and the loan interest rate. We then use the predicted values of such estimations as the proxies for the firm i's expected loan to collateral requirement, $E(k_i)$, requested by the banks, and of the expected loan interest rate, $E(r_i)$, respectively.

Firms that need credit are discouraged because of four main reasons, corresponding to the mutually exclusive options discussed above and reported in table 3. We estimate the determinants of the probability that each of the possible outcomes occurs using the following multinomial logit model.

$$Prob(Y_i = j|\boldsymbol{Z}_i) = \frac{e^{\beta_j' \boldsymbol{Z}_i}}{\sum_{l=1}^{5} e^{\beta_l' \boldsymbol{Z}_i}} \qquad i = 1, ..., n \qquad j = 1, ..., 5. \tag{18}$$

where $Prob(Y_i = j|\boldsymbol{Z}_i)$ is the probability that firm i chooses the option j, where value 1 corresponds to the baseline decision to apply for the loan, while values from 2 to 5 corresponds to the decision not to apply for the corresponding four categories (reasons) of discouragement, given $\boldsymbol{Z}_i$

a $N \times R$ matrix of R firm specific regressors. β_j is set to zero for $j = 1$, i.e. the base category is the decision to apply for a loan (Greene, 2003). With the normalization the model becomes

$$Prob(Y_i = j|\boldsymbol{Z}_i) = \frac{e^{\beta_j' \boldsymbol{Z}_i}}{1 + \sum_{l=2}^{5} e^{\beta_l' \boldsymbol{Z}_i}} \qquad i = 1, ..., n \qquad j = 1, ..., 5, \qquad \beta_1 = 0 \qquad (19)$$

Equation (19) is estimated using the BEEPS and the Global Financial Development database over the years 2011-2015 for 26 countries. The list of countries is in table 2, while the list of the variables employed in the estimation and its descriptive statistics are displayed in table 4. The explanatory variables $\boldsymbol{Z}_i$ include the predicted values of the loan-to-collateral ratio obtained from the OLS estimation shown in table 5, $E(k_i)$ and the expected loan rate, $E(r_i)$, obtained from the OLS estimation reported in table 6. Control variables and country fixed effect are also included. To account for the possibility that discouragement is influenced by the availability of other sources of finance, we include among the regressors the percentage of trade credit in the firm's working capital. We expect that more trade credit increases the probability of loan applications. The age of a firm is typically regarded as a variable that positively influences the firm's access to credit. A longer history of operation in the market is typically associated with a longer credit history, which, in turn, reduces the probability of a firm being rejected by the bank when applying for credit. However, longer experience may also correspond to a better understanding of financial market conditions and one's probability of being financed at these conditions. Therefore, older firms may be more likely to be discouraged from applying for credit. The ratio of costs to sales significantly impacts the net present value of an investment project. An increase in the ratio of labour costs to sales, which is used as an indicator of firms' quasi-fixed costs, is expected to increase firms' discouragement.

Finally, we include the following set of dummies. We include a dummy equal one if the firm receives subsidies and another one if the firm is controlled by another firm. We expect public support and being part of a group to improve the firm's and the bank's relationship. In addition, we include a dummy equal one if a firm anticipates a decrease in sales. This variable is expected to be positively correlated with discouragement. Two more dummies are included to account for firm innovation. Specifically, a dummy equals one if the firm introduces new goods and another if the firm introduces organizational innovation, which we expect to be negatively correlated with discouragement. Finally, we control the informal sector's presence by introducing a dummy for firms that report competing with informal firms. The effect on the discouragement is uncertain. A large informal sector may increase unfair competition and reduce the profitability of formal firms, thereby increasing discouragement. On the other hand, informal firms do not have access to the formal financial market, which increases the financing scope for formal firms. Country-fixed effects are also included.

3.2 Results

The multinomial logit estimation allows us to test Predictions 1 and 2. According to Prediction 1, an increase of $E(k_i)$ is associated with an increase in discouragement and a decrease in the prob-

ability of applying. According to Prediction 2, increasing the loan rate increases the probability that a firm is discouraged from applying. To test Prediction 3 and 4, we compute the marginal effects of $E(k_i)$ and $E(r_i)$ on the probability of each type of discouragement.[4]

The estimates of the parameters of the multinomial model of equation (19) are reported in table 7. In contrast, the marginal effects of $E(k_i)$ and $E(r_i)$ are reported in table 9. Our sample consists of 6153 firms that need credit. Among these, 3583 applied for a loan in the last fiscal year, while 2570 did not apply. Missing values reduce the estimation sample to 3228. Hausman test for the Independence of Irrelevant Alternatives (Hausman and McFadden, 1984) confirms that the IIA assumption is not violated for all the outcomes. Wald test of joint significance of the variables in table 8 shows that firm age, labour cost-to-sales ratio, and the dummy controlling for informal competition are not jointly significant. For all other variables, we cannot reject the null hypothesis that parameters are all jointly equal to zero.

The expected loan-to-collateral ratio, $E(k_i)$, is significant at 1% in all outcomes. The expected loan rate, $E(r_i)$, is significant at 1% in Type B and D discouragement, at 5% in Type C discouragement, and not significant in Type A. The signs of these two variables confirm Prediction 1 and 2. As the expected loan-to-collateral ratio increases (i.e. less collateral is required per unit of loan), the probability of a firm being discouraged for the four main reasons decreases relative to the probability of a given firm applying for a loan. As the expected loan rate increases, the probability of a firm being discouraged decreases relative to the probability of a firm applying for a loan. The signs of the coefficient estimates of the control variables are as expected.

The marginal effects offer interesting insights into the phenomenon of discouragement. The marginal effect of the expected loan-to-collateral ratio is significant in all types of discouragement. On the contrary, the marginal effect of the expected loan rate is significant only for Type B discouragement. A marginal increase of the expected loan-to-collateral ratio reduces the probability of Type A - *High probability of rejection* by 25 percentage points and the probability of Type B - *Cost of credit too high and unfavourable credit conditions* by 29 percentage points. The difference between these two marginal effects, which is significant at the 5% level, confirms Predictions 3. The marginal effects of $E(k_i)$ on the probability of Type C - *High cost of application* and D - *Other reasons*, for which we have no specific prediction, are smaller than those of Type A and B, equal to 21 and 16 percentage points respectively. The results on the marginal effect of $E(r_i)$ confirm Prediction 4. It is not significant in Type A discouragement, while this marginal effect is significant for the probability of Type B discouragement. Moreover, the effect on Type B is greater than in Type A and in Type C ~~and B~~. The above results confirm the multidimensional nature of the discouragement phenomenon.

[4]Notice that in a multinomial logit estimation, a marginal change of one variable and its statistical significance depends on the subvector of the estimated $\boldsymbol{\beta}$ and the probabilities of each of the outcomes

$$\frac{\partial P_j}{\partial z_i} = P_j[\boldsymbol{\beta_j} - \sum_{k=0}^{J} P_k \boldsymbol{\beta_k}]. \tag{20}$$

4 Conclusions

We study firm discouragement from applying for loans by using a simple theoretical framework as a guide. According to this framework, discouragement is a multidimensional phenomenon where collateral requirements and the expected loan rate plays a fundamental role. The channels through which they influence discouragements include the cost of application, the profitability of investments to be financed, and uncertainty about the bank's evaluation, which in turn affects the probability of loan approval. Accordingly, we classify discouragement into four types: the probability of rejection, the probability of unfavourable credit conditions, the cost of application, and a residual category. Four empirical predictions on the effect of the loan-to-collateral ratio and the loan rate on the types of discouragement are also derived. We then use the BEEPS dataset to identify the four types of discouragement in the data and to test the predictions by means of a multinomial logit estimation, in which the expected loan-to-collateral ratio and the expected loan rate are the key explanatory variables. Results show that the expected loan-to-collateral ratio is highly significant in all types of discouragement. Moreover, marginal increments in the loan-to-collateral ratio, i.e. more favourable collateral requirements, reduce the probability of being discouraged by 25 percentage points when firms expect their loan application to be rejected and by 29 percentage points when firms expect unfavourable credit conditions in case of application. With regard to the expected loan rate, we show that the marginal effect is significant only when the firm expects unfavourable credit conditions. Specifically, a marginal increase in the expected loan rate reduces discouragement by 1.8 percentage points. These findings confirm our predictions and corroborate that discouragement is a multidimensional phenomenon.

References

Cole, R., and T. Sokolyk (2016): "Who needs credit and who gets credit? Evidence from the surveys of small business finances," Journal of Financial Stability, 24, 40–60.

Ferrando, A., and K. Mulier (2022): "The real effects of credit constraints: Evidence from discouraged borrowers," Journal of Corporate Finance, 73, 102171.

Freel, M., S. Carter, and M. Tagg, S. (2012): "The latent demand for bank debt: characterizing discouraged borrowers," Small Business Economics, (38), 399–418.

Greene, W. H. (2003): Econometric analysis. Pearson Education India.

Han, L., S. Fraser, and D. Storey (2009): "Are good or bad borrowers discouraged from applying for loans? Evidence from the US small business credit markets," Journal of Banking and Finance, (33), 415–424.

Hausman, J., and D. McFadden (1984): "Specification tests for the multinomial logit model," Econometrica: Journal of the econometric society, pp. 1219–1240.

Jappelli, T. (2009): "Who is credit constrained in the U.S. economy?," Quarterly Journal of Economic, (55), 219–234.

Levenson, A., and K. Willard (2000): "Do firms get the financing they want? Measuring credit rationing experienced by small business in the US," Small Business Economics, (14), 83–94.

Wernli, R., and A. Dietrich (2022): "Only the brave: improving self-rationing efficiency among discouraged Swiss SMEs," Small Business Economics, 59(3), 977–1003.

Tables

Table 2: Country list and frequencies

country	freq.	percent
Albania	360	3.05
Armenia	360	3.05
Azerbaijan	390	3.3
Belarus	360	3.05
Bulgaria	293	2.48
Croatia	360	3.05
Cyprus	360	3.05
Estonia	273	2.31
Georgia	360	3.05
Greece	323	2.74
Hungary	310	2.63
Kazakhstan	600	5.08
Kosovo	202	1.71
Latvia	336	2.85
Lithuania	270	2.29
Moldova	360	3.05
Mongolia	360	3.05
Montenegro	150	1.27
Poland	542	4.59
Romania	540	4.58
Russia	1,326	11.24
Serbia	360	3.05
Slovenia	270	2.29
Turkey	1,344	11.39
Ukraine	1,002	8.49
Uzbekistan	390	3.3
Total	11,801	100

Table 3: Classification of discouragement

Types of discouragement	reasons for not applying
A. High probability of rejection	4 and 7
B. Cost of credit too high and unfavorable credit conditions	3 and 5
C. High cost of application	2 and 6
D. Other reasons	8

Table 4: Descriptive statistics

	N	mean	s.d
loan-to-collateral ratio (k_i)	1921	0.62	0.37
predicted loan-to-collateral ratio, $E(k_i)$	3228	0.65	0.08
loan rate (r_i)	3060	11.41	8.35
predicted loan rate, $E(r_i)$	3228	12.08	3.31
trade credit (% on working capital)	3228	12.75	23.56
firm age	3228	16.28	13.93
labor cost on sales	3228	0.25	0.41
dummy=1 if firm received public subsidies	3228	0.12	0.32
dummy=1 if firm competes against informal firms	3228	0.43	0.49
dummy=1 if firm expect sales decrease	3228	0.14	0.34
dummy=1 if firm is controlled by other firm	3228	0.07	0.26
dummy=1 if firm introduced new goods	3228	0.27	0.44
dummy=1 if firm introduced organizational innovations	3228	0.23	0.42
dummy=1 if court system perceived corrupted	3228	0.65	0.48
dummy=1 if court system is perceived slow	3228	0.73	0.45
% of sales payed for security	3214	0.61	0.49
% held by largest owner	3228	80.76	25.47
years of manager experience	3187	17.54	10.08
firm legal status other than partnership	3228	0.02	0.13
dummy=1 if firm purchased fixed asset in the last fiscal year	3228	0.44	0.50
concentration rate of bank system at country level	3228	53.54	22.30
lending rate at country level	3228	12.35	4.94
return on equity of bank system at country level	3228	4.53	10.88

Table 5: Loan-to-collateral ratio determinants

OLS estimation - Dependent variable: loan on collateral	
dummy=1 if court system perceived corrupted	-0.0605***
dummy=1 if court system is perceived slow	0.0497**
% held by largest owner	-0.0012***
dummy=1 if firm competes against informal firms	-0.0372**
firm legal status other than partnership	0.2697***
dummy=1 if firm purchased fixed asset in the last fiscal year	0.0314*
R^2	0.77
N	1647
Sectors fixed effects	YES

* p< 0.10, ** p< 0.05, *** p< 0.01

Table 6: Loan rate determinants

OLS estimation - Dependent variable: loan rate	
country's lending interest rate	0.5381***
country's banks Return on Equity	0.0259**
country's bank concentration rate	-0.0316***
dummy=1 if firm has an overdraft	-1.6754***
total sales	3.52E-11***
number of workers	-0.0008
R^2	0.68
N	2493
Sectors fixed effects	YES
Clustered standard errors by country	YES

* p< 0.10, ** p< 0.05, *** p< 0.01

Table 7: Probability of discouragement: multinomial logit

Variables name	Types of discouragement			
	A	B	C	D
predicted loan to collateral ratio, $E(k_i)$	-5.0919***	-3.7240***	-5.3718***	-6.2553***
predicted cost of credit, $E(r_i)$	0.0918	0.1594***	0.1364**	0.1697***
trade credit (% on working capital)	0.0083*	0.0010	0.0036	0.0058
firm age	-0.0074	-0.0031	-0.0033	0.0094*
labor cost on sales	0.5590	0.5451	0.5562	0.6526
dummy=1 if firm received public subsidies	-1.0203***	-1.0002***	-0.9472***	-0.5225
dummy=1 if firm competes against informal firms	-0.2735	-0.1687	-0.5457**	-0.4256**
dummy=1 if firm expect sales decrease	0.3479*	0.5690***	-0.0580	0.3859
dummy=1 if firm is controlled by other firm	0.0144	-0.0318	-0.8531**	0.1448
dummy=1 if firm introduced new goods	-0.0824	0.0381	-0.5924***	0.1621
dummy=1 if firm introduced organizational innovations	-0.4429*	-0.5312***	-0.0540	-0.7748***
Numb. obs.	3228			

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The estimation is carried out in the sample of firms that need credit, excluding all the firms that declares that they do not need it. All firms in the sample either apply for a loan or, in case they do not apply, they choose one reason for not applying. The dependent multinomial variable is made of 5 possible mutual exclusive outcomes. The normalization of the equation 19 is obtained by taking the outcome 'apply for a loan' as the base category. The types of discouragement obtained by grouping the reasons for not applying, as specified in the table 3, are the following:

A. High probability of rejection;

B. Cost of credit too high and unfavorable credit conditions;

C. High cost of application;

D. Other reasons

Estimation includes countries fixed effect. Standard error are clustered by country.

Table 8: Wald joint test of significance of the parameters for estimation

	$\chi^2_{(4)}$	$prob > \chi^2$
predicted loan-to-collateral ratio, $E(k_i)$	57.63	0.000
predicted loan rate, $E(r_i)$	18.14	0.001
trade credit (% on working capital)	11.16	0.024
firm age	6.56	0.161
labor cost-to-sales ratio	2.92	0.571
dummy=1 if firm received public subsidies	30.42	0.000
dummy=1 if firm competes against informal firms	11.07	0.025
dummy=1 if firm expect sales decrease	23.67	0.000
dummy=1 if firm is controlled by other firm	5.15	0.27
dummy=1 if firm introduced new goods	12.56	0.013
dummy=1 if firm introduced organizational innovations	17.91	0.001

The Wald test is carried out under the following constraints:
$H_0 : \beta_{r,j} = 0$; $H_1 : \beta_{i,j} \neq 0$ for $r = 1, ..., 11$ regressors, and $j = 1, ..., 5$ outcomes

Table 9: Probability of discouragement: marginal effects of $E(k_i)$ and $E(r_i)$

Variables name	Types of discouragement				
	A	B	C	D	apply
predicted loan to collateral ratio, $E(k_i)$	-0.2503***	-0.2924***	-0.2120***	-0.1632***	0.9178***
predicted cost of credit, $E(r_i)$	0.0018	0.0184***	0.0043	0.0041**	-0.0286***
Observations			3228		

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Marginal effects of predicted loan to collateral ratio and predicted cost of credit resulting from the estimation in table 7. The normalization of the equation 19 is obtained by taking the outcome 'apply for a loan' as the base category. The types of discouragement obtained by grouping the reasons for not applying, as specified in the table 3, are the following:
A. High probability of rejection;
B. Cost of credit too high and unfavorable credit conditions;
C. High cost of application;
D. Other reasons
Estimation includes countries fixed effect. Standard error are clustered by country.

Ultimi Contributi di Ricerca CRENoS

I Paper sono disponibili in: http://www.crenos.unica.it

24/16 *Giampiero M. Gallo, Ostap Okhrin, Giuseppe Storti,* "Dynamic tail risk forecasting: what do realized skewness and kurtosis add?"

24/15 *Stefano Borgioli, Giampiero M. Gallo, Chiara Ongari,* "Financial Returns, Sentiment and Market Volatility: a Dynamic Assessment"

24/14 *Vincenzo Candila, Oguzhan Cepni, Giampiero M. Gallo, Rangan Gupta,* "Influence of Local and Global Economic Policy Uncertainty on the volatility of US state-level equity returns: Evidence from a GARCH-MIDAS approach with Shrinkage and Cluster Analysis"

24/13 *Ester Rita Lucia Sanna, Marta Meleddu,* "Integrating justice and ecological economics: a theoretical framework and indicator toolkit for analysing conflict in protected areas"

24/12 *Federico Aresu, Emanuela Marrocu, Raffaele Paci,* "EU funds and TFP growth: how the impact changed over time and space"

24/11 *Ivan Etzo, Raffaele Paci, Cristian Usala,* "Brain gain vs. brain drain. The effects of universities' mobile students on territorial inequalities"

24/10 *Giommaria Spano,* "Financial frictions, common ownership and firms' market power in a general equilibrium model"

24/09 *Roberto Saba, Anna Pireddu,* "Energy and Environmental Synergy: Cooperative Strategies for the Euro-Mediterranean Transition"

24/08 *Maria Grazia Pittau, Francesco Politano, Roberto Zelli,* "Educational divide between voters: A nationwide trend?"

24/07 *Federico Atzori, Vittorio Pelligra,* "Framed norms. The effect of choice-belief information on tax compliance"

24/06 *Simone Nobili,* "Concentration, Market Power and International Tax Competition"

24/05 *Maria Grazia Pittau, Pier Luigi Conti, Roberto Zelli,* "Inference for deprivation profiles in a binary setting"

24/04 *Edoardo Otranto,* "A Vector Multiplicative Error Model with Spillover Effects and Co-movements"

24/03 *Luca Serafini, Emanuela Marrocu, Raffaele Paci,* "Smart Strategies, Smarter Performance: the Impact of S3 and Industry 4.0 on Firms' Outcomes"

24/02 *Hugues Champeaux, Elsa Gautrain, Karine Marazyan,* "Men's premarital migration and marriage payments: Evidence from Indonesia"

24/01 *Pablo Álvarez-Aragón, Hugues Champeaux,* "Measuring Norms and Enumerator Effects: Survey Method Matters"

23/15 *Fabio Cerina, Xavier Raurich,* "Saving Behaviour and the Intergenerational Allocation of Leisure Time"

23/14 *Leonardo Vargiu, Bianca Biagi, Maria Giovanna Brandano, Paolo Postiglione,* "Research Infrastructures and Regional Growth: the case of Europe"

23/13 *Alberto Tidu,* "Dissecting inequality: conceptual problems, trends and drivers"

23/12 *Luciano Mauro, Francesco Pigliaru,* "Italy's National Recovery and Resilient Plan: Will it Narrow the North-South Productivity Gap?"

23/11 *Fabrizio Antolini, Samuele Cesarini, Giorgio Garau,* "The economic impact of the tourism sector on the overall Italian economy: An Input-Output Approach"

23/10 *Giorgio Garau, Andrea Karim El Meligi,* "The Impact of the Pandemic and War on Surplus Redistribution Mechanisms: A Sectoral Analysis of France and Italy"

23/09 *Maria Giovanna Brandano, Alessandra Faggian, Adriana C. Pinate,* "The impact of COVID-19 on the tourism sector in Italy: a regional spatial perspective"

www.crenos.unica.it

ISBN 9788868515447