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Does poor legal enforcement make households credit-constrained?

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Abstract

This paper analyzes the relation between the quality of the legal enforcement of loan contracts and the allocation of credit to households, both theoretically and empirically. We use a model of household credit market with secured debt contracts, where the judicial system affects the cost incurred by banks to actually repossess the collateral. The model shows that the working of the judicial system affects both the probability of being credit-constrained and the equilibrium amount of debt. In the empirical part, we test our predictions using data on Italian households and on the performance of Italian judicial districts. Controlling for household characteristics, unobserved heterogeneity at judicial district level and aggregate shocks, we document that an increment in the backlog of trials pending has a statistically and economically significant positive effect on the household probability of being turned down for credit. Furthermore, we show that moving a household from the high-cost judicial district (in southern Italy) to the low-cost judicial district would reduce his probability of being credit-constrained by 50% on average, other things being equal.

JEL classification: D12; G21; G33; K12; K41; K42
Keywords: Judicial enforcement; Borrowing restrictions; Collateral

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1. Introduction

In the last few years a new line of research has begun to investigate the economic implications of different legal systems. Most of this literature (see among others La Porta et al. (1997), Cristini et al. (1999), Bianco et al. (2000) and Fabbri (2001)) focuses on corporate credit and identifies two channels by which legal institutions may affect financial markets: the content of the law and the quality of its enforcement.

The goal of this paper is to measure the effect of differences in the degree of legal enforcement of creditor rights on the allocation of credit to households. More precisely, we test whether the behavior of courts in enforcing credit contracts is able to explain differences in the household credit market. To this end, we use data on Italian households drawn from the Survey of Household Income and Wealth (SHIW) and we combine them with data on Italian judicial districts. [2]

Three features make our analysis an original contribution to the literature. First, we focus on the household credit market and we use microeconomic data on households, while most of the related literature investigates the economic implications of different legal systems for the corporate sector, by using aggregate country level (see among others La Porta et al. (1997)) or regional (see for example Cristini et al. (1999) for evidence in Argentina, and Bianco et al. (2000) for Italy) data. The use of microdata has a clear advantage: it allows to obtain more robust results, as potential problems of endogeneity in our estimates are attenuated.

Second, our data set provides us with a direct proxy for credit rationing, which enables us to look at the effect of the legal variable on the household probability of being credit-constrained.

The third original aspect of our analysis is that our data set allows us to disentangle the enforcement effect from the legislative effect, by exploring the variability in the efficiency of judicial districts within the same legal framework. Italy, in fact, offers a useful if not unique natural experiment to isolate the economic effect of differences in the degree of legal enforcement since the rules on credit relations are the same nationwide, but enforcement differs considerably across judicial districts. This particular aspect of our analysis distinguishes us from all the existing related papers that investigate the effect of legal institutions on the household credit market. For example, Meador (1982) and Jaffee (1985) investigate how differences in the content of bankruptcy laws across United States affect the price of credit. Gropp et al. (1996), whose work is the most strictly related to our analysis, investigate how differences in the content of bankruptcy laws across United States affect the allocation of credit to American households, but without controlling for possible differences in

[2] Recently also Guiso et al. (2001) have used Italian data to investigate the institutional determinants of financial development. Unlike our work, they focus on the role of social capital, measured by the electoral turnout at the province level. They find that in areas of the country with higher level of social capital, households invest less in cash and more in stock, have easier access to the institutional credit market and make less use of informal credit. They also provide evidence that the effect of social capital is stronger where legal institutions are weaker.

the enforcement of laws. Using data coming from the Survey on Consumer Finance, they document that the size of asset bankruptcy exemptions, which varies across United States, has a statistically and economically significant, positive effect on the household probability of being turned down from the credit. They also find that an increment in asset bankruptcy exemptions reduces the volume of credit for households in the lower half of the the asset distribution, while it increases the availability of credit to households in the upper half of the asset distribution.

Unlike Gropp et al. (1996), we base our empirical analysis on a theoretical model, which is suitable to describe an economic mechanism through which courts may affect the credit market. We consider the household credit market with secured debt contracts and strategic default, where the judicial system affects the costs paid by creditors to enforce their right to repossess the collateral, by determining when the transfer of the assets takes place. The model identifies two main effects of weak judicial enforcement. First, households are more likely to be credit-constrained when judicial costs are high, i.e. the quality of enforcement is poor, because when contracts are weakly enforced the household's incentive to repay decreases and banks respond by rationing credit. Second, the higher the judicial costs, the smaller the amount of credit provided to households in equilibrium, because banks compensate for the lower net revenues from the liquidation of the collateral asset by charging higher interest rates.

We test the validity of these theoretical predictions by proxying the amount of legal costs (i.e. the degree of enforcement) with measures based on the backlog of civil trials. First, we investigate whether the probability of a given household's being credit-constrained depends on judicial costs. Second, we test whether the level of the household's debt is also sensitive to judicial costs. Controlling for household characteristics, unobserved heterogeneity at judicial district level and aggregate shocks, we document that a poorly functioning legal system does cause Italian households to be credit-constrained: households living in judicial districts where the quality of legal enforcement is poorer have a higher probability of being denied loans.

To quantify this distortion, we compute how much the probability of being credit-constrained would change if one moves an household from high-cost judicial districts (in southern Italy) to low-cost judicial districts. For example, endowing the households living in Reggio Calabria or Messina with the best quality of legal enforcement would reduce the probability of being credit-constrained by 73% and 69%, respectively.

We also empirically investigate the effect of legal enforcement on the household debt capacity, but we find only a weaker support for our theoretical predictions. A possible explanation for this result could be that we do not have information on the flow of credit granted each year and we are forced to use the stock of debt. Since this variable also reflects past choices of lenders and borrowers, it does not necessarily respond to the current quality of legal enforcement.

Although our analysis suggests that stronger legal enforcement seems to occur much more often in the wealthier northern part of Italy than in the less wealthy southern regions, there is no reason to suspect that the coefficient of the legal variable is indeed picking up regional differences in social or economic factors that are

correlated with our measures of legal enforcement. This is because in all the estimations we control for unobserved heterogeneity using judicial district dummies.

The paper is organized as follows. In Section 2, we develop a simple model of the households credit market and derive testable implications of the role of the judicial system. Section 3 describes the data and discusses the measures used to proxy the quality of legal enforcement. Section 4 presents the results of the empirical analysis. Section 5 concludes.

2. The model

We consider a credit market with secured debt contracts where households borrow and banks lend.

Each household lives for two periods and is endowed with an illiquid asset, A_i. The household works only in the second period, earning a stochastic positive wage, denoted by w_i in the good state of nature, which occurs with probability p_i, and zero otherwise.

Utility depends on consumption, c_i, and on the property of the illiquid asset A_i. It is time-additive and given by $U_i = [\log(A_i + c_{1i})] + \beta_i[\log(A_i + c_{2i})]$. Households want to smooth consumption over time. To finance first-period consumption, they can either borrow or dispose of the illiquid asset. Since we are interested in how the judicial system affects the credit market, we posit that the unit selling price of A_i, denoted by α, is low enough that it is always optimal not to sell but hold the asset as collateral in a credit contract. This assumption captures two different but common facts: first, the presence of transaction costs, which may sharply reduce the secondary market price of these goods; second, the personal value of goods to the owner that cannot be reflected in the market price. An example for the type of good that we have in mind is the house of residence.

The credit is provided by risk-neutral banks in a free-entry market. For simplicity, we assume a fixed interest rate, $\bar{r}$, on deposits.

Since the credit is provided in the first period and repayment is made only in the second, households face a commitment problem. According to the literature on credit rationing and imperfect information, [3] in this case it is optimal for both banks and households to sign a collateralized credit contract. Under the assumption of limited liability, the contract establishes that if the borrower fails to repay, the title to the asset A_i is transferred to the bank. The collateral requirement is fixed such that the bank breaks-even in equilibrium, taking into account that with a positive probability the household will have no money to repay the loan. However, posting collateral is not sufficient to guarantee that the borrower will repay the loan any time he receives a high income level. In fact, it may be the case that the consumer prefers to default even if he would be able to repay the loan. To induce him to repay, banks are forced to ration credit. Notice that, even if strategic default is ruled out from the

[3] See, among others, Bester (1987).

equilibrium through credit rationing, there still exists the possibility that banks ask the courts to enforce their right to repossess the collateral. This happens in case of involuntary default, when households are hit by a negative income shock.

A key assumption concerns the enforcement procedure. We assume that the judicial system determines when the collateral is transferred in case of default. The worse the performance of courts, the later the transfer, and hence the liquidation of the asset. From the lender's point of view, weak legal enforcement is a cost. This cost may consist in legal expenses that depend on the length of the trial or else in a decrease in the asset's value due to depreciation. In both situations, the effective liquidation value of the collateral asset, and hence the bank's total revenues, are lower the poorer the quality of legal institutions. If we denote the degree of legal enforcement by g, where $0 \leqslant g \leqslant 1$, the liquidation value of each unit of the asset is equal to αg. Conversely household's utility increases when legal institutions are weaker, since the defaulting borrower retains ownership of the asset until the court orders its transfer. Specifically, the borrower's utility is $(1-g)$ for each unit of collateral.

2.1. The optimal credit contract

Given the assumption of free entry into the banking industry, the rents generated by the transaction are kept by the borrower, and the expected profits of the bank are zero. This means that the optimal credit contract is a pair of debt and interest rate (b_i, r_i) that maximizes the household's utility under its incentive compatibility constraint and the participation constraint of the bank. The problem is thus described by

$$\max_{b_i r_i} EU_i = \log(A_i + b_i) + \beta_i p_i \log(A_i + w_i - b_i r_i) + \beta_i (1 - p_i) \log[A_i(1-g)]$$

$$\text{s.t.} \quad b_i \bar{r} \leqslant p_i b_i r_i + \alpha(1-p_i) g A_i, \tag{1}$$

$$\log[(1-g)A_i + w_i] \leqslant \log(A_i + w_i - r_i b_i). \tag{2}$$

The assumption of limited liability implies that the second-period consumption in the bad state is equal to zero.

Condition (1) is the participation constraint of the bank. The assumption of free entry implies that this condition always holds with strict equality. Since the credit is collateralized, the bank's expected return is given by the repayment of the debt and the collateral's liquidation value asset. As can be seen, this second term is affected by the quality of judicial enforcement, g. To be precise, in case of default the bank only gets the lesser between the liquidation value of the asset $(g\alpha A_i)$ and repayment of the debt $(b_i r_i)$. Since our subject is on how legal institutions affect borrowing restrictions, we focus on situations where the value of the collateral is not enough to cover the entire debt. In this case, the bank's participation constraint is defined by condition 1.

Condition (2) is the borrower's incentive compatibility constraint. It requires that the utility from strategic default (left-hand side) must be lower than that from repayment (right-hand side). The condition also tells us that the incentive to default in the second period is negatively related to the value of the collateral: as that value increases, the utility of repaying the loan increases more than that of defaulting.

Finally, it shows that the incentive to misbehave depends negatively on the legal variable: better legal enforcement rises the cost of default (the borrower loses the property sooner) but not the benefit.

In solving the maximization problem, we first assume that the incentive compatibility constraint is not binding. This may happen if, for instance, the household is wealthy enough so that the cost of strategic default (the loss of the asset) is always greater than the benefit. In this case, we obtain the optimal credit contract by solving the maximization problem neglecting Eq. (2). This yields the following levels of debt and interest rate: [4]

$$b_i^* = \frac{p_i w_i + [p_i + \alpha(1-p_i)g - \bar{r}\beta_i p_i]A_i}{\bar{r}\left(\beta_i + \frac{1}{p_i}\right)p_i}, \tag{3}$$

$$r_i^* = \bar{r}\left[\frac{w_i + [1-\alpha(1-p_i)g\beta_i - \bar{r}\beta_i]A_i}{p_i w_i + [p_i + \alpha(1-p_i)g - \bar{r}\beta_i p_i]A_i}\right]. \tag{4}$$

By substituting the two terms given by Eqs. (3) and (4) into the incentive compatibility constraint of the borrower, we find the condition under which the borrower's promise to repay is credible:

$$[gp_i + \alpha(1-p_i)g + \bar{r}]\beta_i A_i \geqslant w_i + (1-g)A_i. \tag{5}$$

Condition (5) tells us that the initial endowment of wealth, the discount factor, and the quality of enforcement all help to determine whether a consumer is rationed in the credit market. If this condition is not satisfied, then the debt–interest rate pair we found earlier is not the optimal credit contract. To find the optimal, we must maximize the household's utility function simultaneously under the bank's participation constraint and the borrower's incentive compatibility condition. This amounts to solving the system consisting of the two constraints (Eqs. (1) and (2)) in the two unknowns (b_i, r_i). The solution is given by

$$b_i^c = \frac{gA_i[p_i + \alpha(1-p_i)]}{\bar{r}}, \tag{6}$$

$$r_i^c = \frac{\bar{r}}{p_i + \alpha(1-p_i)}. \tag{7}$$

2.2. Comparative statics

This section derives testable implications on how the quality of judicial enforcement affects the household credit market. That is, we examine whether and to what extent the legal variable affects the probability of being credit-constrained and the amount of credit received by constrained and unconstrained consumers.

[4] Notice that the following two expressions are the true solutions only if they are positive. It is easy to show that this is satisfied for almost all reasonable parameter values.

To derive the probability of being credit-constrained, consider a population of heterogenous agents with different discount factors. Individuals with high β_i assign a greater weight to second-period consumption and thus have lower demand of credit, which is used to finance first-period consumption. From condition (5), we can derive the threshold value $\tilde{\beta}_i$ that splits households with the same characteristics (wage, wealth etc.) into two groups: those with high credit demand (β_i lower than the threshold), who will be credit-constrained, and those with low demand (β_i higher than the threshold), who will not be rationed:

$$\tilde{\beta}_i = \frac{w_i + (1-g)A_i}{A_i[gp_i + \alpha(1-p_i)g + \bar{r}]}. \tag{8}$$

Since β_i and some of its determinants may be unknown to us as econometricians, we treat it as a random variable and assume that it is distributed across the population of households according to a probability function. So, we can define the probability that a generic household is credit-constrained, after controlling for its observable characteristics, as the value of the cumulative distribution function at $\tilde{\beta}_i$.

With the Implicit Function Theorem it is easy to show that this threshold level is decreasing in the legal variable:

$$\frac{\partial \tilde{\beta}_i}{\partial g} = -\frac{1 + \beta_i[\alpha(1-p_i)]}{[gp_i + \alpha(1-p_i)g + \bar{r}]} < 0.$$

Since the threshold is lowered when the quality of judicial enforcement improves, the probability of being credit-constrained is a decreasing function of the quality of judicial enforcement. Furthermore, other things being equal, an increment in the collateral asset and in p_i (the probability of a household's receiving a positive income in the second period) lowers the threshold $\tilde{\beta}_i$, while an increment in the income has the opposite effect on $\tilde{\beta}_i$. [5]

Next, we consider the effects of the quality of legal enforcement on the optimal amount of debt. One can show that the derivatives of b_i^* and b_i^c with respect to the parameter g are both positive:

$$\frac{\partial b_i^*}{\partial g} = \frac{\alpha(1-p_i)A_i}{\bar{r}\left(\beta_i + \frac{1}{p_i}\right)p_i} > 0,$$

$$\frac{\partial b_i^c}{\partial g} = \frac{A_i[\alpha(1-p_i) + p_i]}{\bar{r}} > 0.$$

[5] If we calculate the derivative of the threshold $\tilde{\beta}_i$ with respect to A_i, p_i and w_i, we find the following expressions:

$$\frac{\partial \tilde{\beta}_i}{\partial A_i} = -\frac{w_i}{A_i^2[gp_i + \bar{r} + \alpha(1-p_i)g]} < 0, \quad \frac{\partial \tilde{\beta}_i}{\partial p_i} = -\frac{\tilde{\beta}_i(1-\alpha)g}{[gp_i + \bar{r} + \alpha(1-p_i)g]} < 0,$$

$$\frac{\partial \tilde{\beta}_i}{\partial w_i} = \frac{1}{A_i[gp_i + \bar{r} + \alpha(1-p_i)g]} > 0.$$

These results show that when the quality of judicial enforcement increases, so does the amount of credit received by constrained and unconstrained consumers in an unambiguous way. The intuition is that if the consumer is not credit-constrained an improvement in the quality of enforcement eases the bank's participation constraint by increasing effective liquidation values. Since collateral and interest rate are substitutes, and given free entry into the banking, the higher liquidation value induces the bank to reduce the cost of credit, which raises its availability in equilibrium. If the household is credit-constrained, a reduction in legal costs relaxes not only the bank's participation constraint but also the household's incentive compatibility constraint. Both effects work in the same direction and so enlarge the set of feasible solutions of the transaction. Again the result is that banks are willing to expand the availability of credit.

Finally, households with larger endowments of wealth or higher income have greater access to credit.

The testable implications derived in the theoretical analysis can be summarized as follows:

Proposition 1. *When legal enforcement improves, the probability of being credit-constrained decreases and the amount of credit received by constrained and unconstrained consumers increases.*

Section 3 checks whether the empirical evidence is consistent with these theoretical predictions.

3. Data

3.1. Household data

Household data come from the Survey of Household Income and Wealth (SHIW), which the Bank of Italy has conducted every other year since 1984. The SHIW is a representative national household survey providing data on income, consumption and households' characteristics. See Brandolini and Cannari (1994) for a detailed description of the survey.

Here we use data from three waves: 1989, 1995 and 1998, [6] a total of 23,556 observations.

This survey is an invaluable source of information for our inquiry, because self-reported measures allow us to identify households that are credit-constrained among those who actually apply for a loan, without requiring arbitrary identification restrictions. To do so, two separate questions are used. The first allows to split the sample in loan-applicants and non-applicants. This question asks households whether they applied for a loan in the twelve months before the interview. The wording of the

[6] The variables used in this paper are available only for these three waves; that is, only for these three years can we distinguish households that applied for a loan from those that did not.

Table 1
Self-reported variables definition and statistics

Definition of the variable	Wording of the question	Mean
Loan applicants	"During the year did you or a member of your household apply for a loan to a bank or other financial intermediary?"	6.24
Credit-constrained households	"During the year did you or a member of your household apply for a loan to a bank or other financial intermediary and have the application partially or totally rejected?"	11.22
No. of observations	23,556	

Note: Means are expressed in percentage points.

question is: "During the year did you or a member of your household apply for a loan to a bank or other financial intermediary?". Those who answer positively (6.24% of the sample) are routed in the second question: "During the year did you or a member of your household apply for a loan to a bank or other financial intermediary and have the application partially or totally rejected?". Around 11% of the applicants answer positively to this question and are so labelled as credit-constrained. [7] Table 1 reports the definition of the self-reported variables, the wording of the questions and the sample means.

These two questions allow one to know whether during the interview's year a household applies for a loan or not and whether he receives the credit. While being very helpful for identifying loan-applicants who are granted credit, the survey does not provide information on the amount of the credit granted. This forces us to focus on the stock of household liabilities rather than on the flow of credit, which would have been the most appropriate variable to investigate the effect of judicial costs on credit allocation.

The survey provides detailed information on the stock of household liabilities at the end of the year, since it allows us to identify the amount borrowed to finance the purchase of houses, real goods such as valuables and jewelry, cars, other durable good such as furniture and appliances, and non-durable consumption. Conditional on being actually indebted, the amount borrowed to finance these types of consumption were, respectively: €19,088, €2,698, €5,423, €2,204, and €4,258 at the end of the year. All this information refers to the stock of debt and not to the flow of credit received in the interview's year. The proportion of households who are indebted to finance these purchases were, respectively: 10.74%, 0.26%, 6.22%, 3.12%, and 0.96% at the end of the year. These figures together show that households borrow almost entirely to purchase houses, cars, and other durables.

The survey also gives data on real and financial wealth. This is quite important because it allows us to experiment with different proxies for the collateral, which is not observable. [8] The broadest measure of collateral that we use is total wealth

[7] A similar definition appears in Jappelli (1990) who uses an American survey, the Survey of Consumer Finances, with a structure similar to the SHIW to identify credit-constrained households in the US.

[8] As a rule, of course, mortgage contracts require the house being purchased to be used as collateral for the loan.

which includes real and financial assets and averages to €117,062 of 1995 prices. Real assets include houses, lands, valuables and the business, if any, owned by the households and average to €111,199 of 1995 prices. Around 64% of the sample own their primary residence, which is worth on average €109,190.

Table A.1 in Appendix A provides the sample means and standard errors of households assets and liabilities.

3.2. The quality of judicial enforcement

This section documents the differences between Italian judicial districts in the degree of legal enforcement of creditor rights. Before illustrating our measures and their geography, a brief discussion on how the judicial system works will be helpful.

Italy is a civil-law country. This implies that the main attribute of the judicial system is enforcing the law. Italian laws regulate criminal and civil offenses separately. Correspondingly, separate branches of the judicial system deal with them.

Civil trials can undergo three degrees of judgment. The first degree (lower court), a second degree (appeals court), and a third degree that can only deal with formal aspects of the summon issued in the former degrees. Readers familiar with the American system will recognize some similarities. This work concentrates on civil trials in the lower and appeals courts, which are the most relevant when households fail to honor their debts. [9] By law, the competent court is that of the borrower's district of residence.

We draw data on trials from an annual survey conducted by the National Institute of Statistics (ISTAT), for the years 1989–1998. The primary sample units are the judicial districts. Roughly, each district corresponds to a region. In some regions (Lombardy, Campania, Puglia, Calabria, Sicily and Sardinia) there is more than one judicial district, [10] while, Valle d'Aosta is in the Piedmont judicial district. Table A.2 reported in Appendix A shows the matching of judicial districts with regions and provinces.

Consistently with our model, we assume that the cost faced by a lender of enforcing the right to repossess the collateral in case of default depends on the degree of congestion of the judicial district. This is proxied by the backlog of trials pending. However, this variable depends on the size of the judicial district and does not necessarily reflect poor functioning. Accordingly, we normalize backlogs by using alternatively the number of incoming trials, the population, [11] the number of judges, and the number of judges plus the administrative staff. [12]

[9] The data used to construct our indicators of legal enforcement include all civil trials except labor and work-related cases.

[10] About 30% of the Italian population resides in those regions.

[11] Bianco et al. (2000) also proxy the degree of legal enforcement by using the backlog of trials pending divided by the population.

[12] Data on the number of judges and the size of the administrative staff of each judicial district come from the Italian Ministry of Justice. We thank Tullio Jappelli and Marco Pagano for providing these data.

Fig. 1 displays the backlog of trials pending divided by the number of incoming trials. Each of the four panels shows the evolution of this measure in different areas of the country, i.e. northern, central and southern Italy and the island regions. In Figs. 2–4 the number of trials pending is divided by the population, by the number of judges, and by the number of judges plus administrative staff, respectively.

All the measures trend upward in all districts: this means that the quality of judicial enforcement is worsening across the country. However, the differences between districts persist. The horizontal line in each graph is the country-wide average in the sample period. The backlog whether normalized by the number of incoming cases, the population, the number of judges or the size of the administrative staff plus judges is higher than the country-wide average in Southern Italy and in some of the districts in Sicily and Sardinia. For instance, in Catanzaro the stock of trials pending divided by incoming cases averages 2.9, ranging from 1.77 in 1989 to 4.74 in 1998. Trento is the best district: the stock of trials pending divided by incoming cases averages 1.7 and it was 1.22 in 1989 and 1.69 in 1998 with a peak of 1.87 in 1997. The pattern emerging from the other graphs is similar: the quality of judicial enforcement is worse in southern Italy and in the island regions.

This is consistent with the evidence provided in Table A.3 reported in Appendix A, which shows that the sample correlation among these four measures is high, ranging from 0.52 to 0.94. However, these coefficients conceal some important differences. Namely, the number of incoming trials is a better proxy of the demand for justice, because it responds to the business cycle more closely than does the

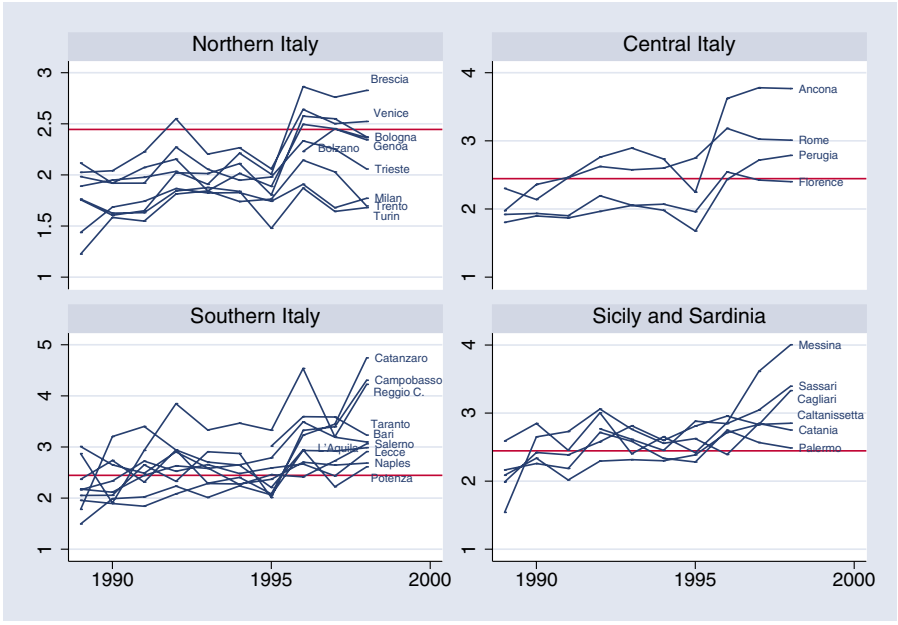

Fig. 1. Backlog of trials pending divided by incoming trials.

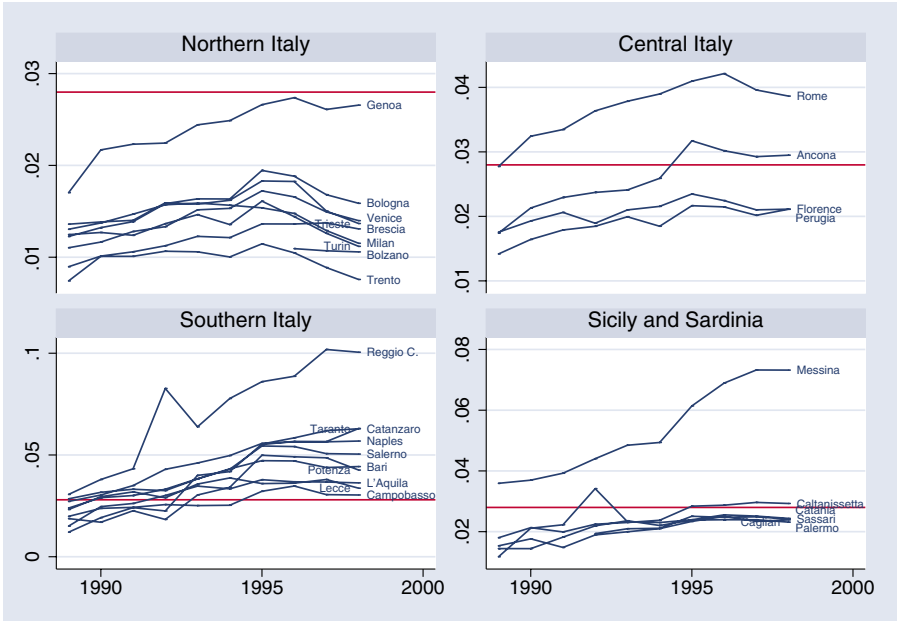

Fig. 2. Backlog of trials pending divided by population.

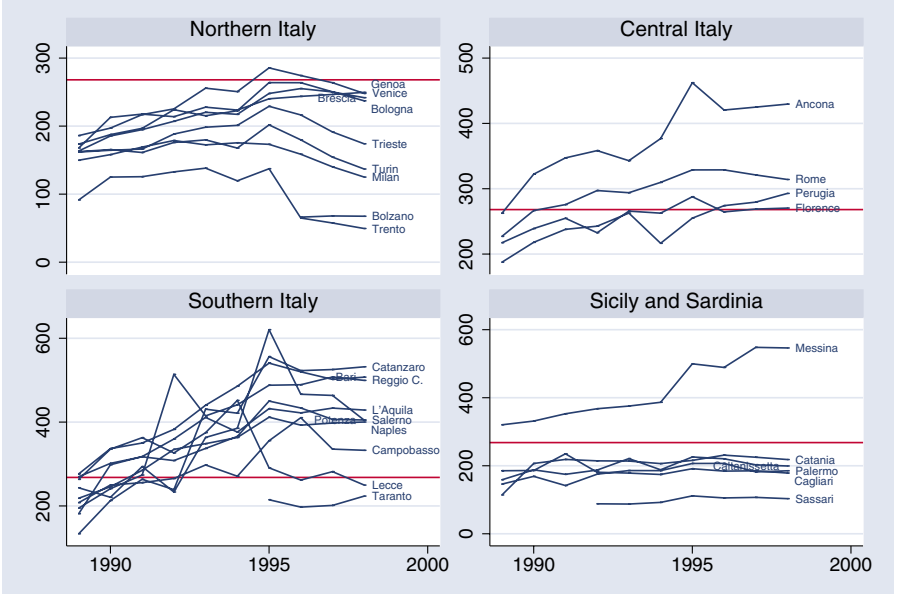

Fig. 3. Backlog of trials pending divided by judges.

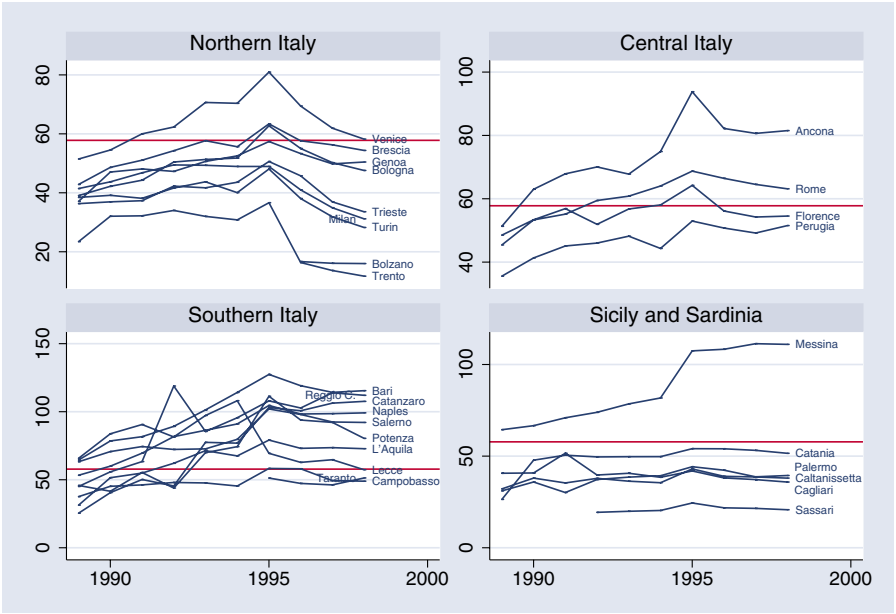

Fig. 4. Backlog of trials pending divided by judges and staff.

population, the number of judges or the size of the administrative staff. This is because the population is almost constant in the sample period and the number of judges and the size of the administrative staff are set according to the population of each district. [13] Moreover, the number of incoming trials reflects differences in the degree of litigation, which are not captured by population and judicial personnel. For instance, the number of judges in the judicial district of Naples is 10% greater than in Milan but the number of incoming trials is almost twice as large.

Therefore, in the empirical analysis our preferred proxy for the quality of judicial enforcement is the backlog of trials pending divided by the number of incoming cases.

4. Results

4.1. Law enforcement and borrowing restrictions

In this section, we explore the relation between the degree of legal enforcement and the probability of a household's being credit-constrained. We rely on two questions to identify credit-constrained households. The first is whether they applied for a

[13] The sample correlation coefficient between the number of judges and the population is 0.9; that between the size of the administrative staff and the population is 0.89.

loan to a bank or to another financial institution in the twelve months before the interview. Who answers positively to this question (the so-called loan-applicants) is routed into a second question and asked if the application has been partially or totally rejected. We label the rejected applicants as credit-constrained. Thus, credit-constrained households are those who apply for a loan and to whom the loan is denied totally or partially.

We split the sample in two sub-samples, loan-applicants and non-applicants, and then we focus only on loan-applicants in order to identify those who are credit-constrained. It follows that the sub-sample of loan-applicants is non-random (i.e. it is a selected sample) if the unobservable characteristics that drive the choice of applying for a loan are correlated with the unobservable characteristics that cause the loan to be denied.

To deal with this classical problem of sample selection, we estimate jointly the probability that a household applies for a loan and the probability that he is credit-constrained. This is similar to what one does for the linear model with sample selection, the difference being that the dependent variables in the two equations (the main equation of interest and the selection equation) are dichotomous. The probability of a household applying for a loan is estimated by defining an indicator variable that is equal to one for those who apply and zero otherwise, [14] while the probability of a household being credit-constrained is estimated by defining an indicator variable that is equal to one for those who are credit-constrained and zero otherwise. The model is estimated by maximizing its likelihood. More details on the derivation of the likelihood of such model are given in Appendix A. [15]

The probability of a household's being credit-constrained depends on individual as well as on institutional variables. We include among the set of explanatory variables those commonly supposed to affect the consumer's demand for credit and those that are used by banks in the screening process. As for the selection equation, we need to find at least one variable that affects the decision to ask for a loan, but not the probability of being credit-constrained. We choose the size of the city where the household resides, *City size*, since the coefficient of this variable turns out to be statistically significant in the decision to ask for a loan but not in the probit for credit-constrained households. Table 2 displays the probit estimation of the selection equation, where the dependent variable is a dummy that takes value one when the household asks for credit. Table 3 reports the results for the probability of being

[14] We do not include in the group of loans applicants those households who are already indebted and do not need additional credit in the interview's year. The reason is that credit constrained households are those whose application is rejected in the interview's year.

[15] The SHIW also allows to identify the so-called discouraged borrowers, i.e. those who do not apply for a loan because they anticipate the rejection of their application. In the model estimated here the discouraged borrowers fall in the sub-sample of those who do not apply for a loan. Estimating the alternative model where the discouraged borrowers are credit-constrained and fall in the sub-sample of those who apply for a loan leads to similar results. The results are again similar if one removes discouraged borrower from the sample.

Table 2
Probability of applying for a loan

	Total wealth	Real assets	Real estates	House of residence
Age of the household head	0.0048	0.0046	0.0047	0.0045
	(0.0086)	(0.0087)	(0.0086)	(0.0087)
Age squared of the household head	−0.0234	−0.0234	−0.0234	−0.0233
	(0.0086)**	(0.0086)**	(0.0086)**	(0.0086)**
Labor household income	0.0035	0.0037	0.0035	0.0034
	(0.0011)**	(0.0011)**	(0.0011)**	(0.0011)**
Collateral	0.0001	0.0001	0.0001	0.0002
	(0.0000)	(0.0001)*	(0.0000)	(0.0001)
Years of schooling	−0.0025	−0.0034	−0.0029	−0.0030
	(0.0053)	(0.0052)	(0.0053)	(0.0053)
Family size	0.0640	0.0626	0.0635	0.0636
	(0.0122)**	(0.0123)**	(0.0122)**	(0.0121)**
Retiree	−0.0635	−0.0582	−0.0640	−0.0649
	(0.0506)	(0.0509)	(0.0500)	(0.0498)
Unemployed	−0.1988	−0.1936	−0.1983	−0.1973
	(0.0908)*	(0.0911)	(0.0916)*	(0.0900)*
Marital status	0.0598	0.0581	0.0595	0.0587
	(0.0397)	(0.0400)	(0.0400)	(0.0397)
City size	0.1158	0.1166	0.1163	0.1163
	(0.0390)**	(0.0392)**	(0.0389)**	(0.0392)**
Per-capita gross domestic product	−0.0815	−0.0809	−0.0813	−0.0812
	(0.0500)	(0.0497)	(0.0498)	(0.0496)
Judicial costs	−0.0746	−0.0720	−0.0730	−0.0725
	(0.0623)	(0.0620)	(0.0622)	(0.0611)
No. of observations	23556	23556	23556	23556

Note: The dependent variable is a dummy equal to one if the household responds positively to the question: "During the year did you or a member of your household apply for a loan or to a bank or other financial intermediary?". In the first column the collateral is proxied by the total household wealth, in the second column by the amount of real assets, in the third by the stock of land and houses, in the fourth by the value of the house of residence. All the specifications include a full set of judicial district and year dummies.

*Significant at 5% level.

**Significant at 1% level.

credit-constrained. Here, the dependent variable is a dummy that takes value one if the household is credit-constrained. [16]

Each column of Tables 2 and 3 refers to a particular measure of the collateral asset. We experiment with different measures because we cannot observe the asset that is actually pledged. We use as first proxy of collateral (in the first column) the broadest measure of wealth available in the survey, total wealth, which includes real and financial wealth. In the last three columns we use the amount of real assets, the stock of land and houses and the value of the house of residence, respectively.

[16] See the data Appendix A to know which questions were used to define these two dummy variables.

Table 3
Law enforcement and the probability of being credit-constrained

	Total wealth	Real assets	Real estates	House of residence
Age of the household head	−0.0587	−0.0590	−0.0593	−0.0583
	(0.0340)	(0.0338)	(0.0336)	(0.0319)
Age squared of the household head	0.0733	0.0738	0.0738	0.0729
	(0.0300)*	(0.0298)**	(0.0297)**	(0.0283)**
Labor household income	−0.0184	−0.0188	−0.0182	−0.0178
	(0.0052)**	(0.0051)**	(0.0051)**	(0.0047)**
Collateral	−0.0003	−0.0004	−0.0006	−0.0013
	(0.0003)	(0.0003)	(0.0005)	(0.0010)
Years of schooling	−0.0336	−0.0328	−0.0337	−0.0330
	(0.0188)	(0.0186)	(0.0182)	(0.0179)
Family size	0.0646	0.0674	0.0696	0.0695
	(0.0758)	(0.0743)	(0.0794)	(0.0746)
Retiree	−0.2409	−0.2521	−0.2387	−0.2325
	(0.1755)	(0.1723)	(0.1725)	(0.1623)
Unemployed	0.5845	0.5779	0.5934	0.5896
	(0.3174)	(0.3165)	(0.3165)	(0.3114)
Marital status	−0.5210	−0.5225	−0.0534	−0.5305
	(0.1923)**	(0.1893)**	(0.1909)**	(0.1817)**
Per-capita gross domestic product	0.0600	0.0594	0.0570	0.0560
	(0.0511)	(0.0494)	(0.0525)	(0.0506)
Judicial costs	0.2899	0.2885	0.2886	0.2905
	(0.0952)**	(0.0945)**	(0.0931)**	(0.0921)**
No. of observations	23556	23556	23556	23556

Note: The dependent variable is dummy equal to one if the household is credit-constrained, i.e. responds positively to the question: "During the year did you or a member of your household apply for a loan to a bank or other financial intermediary and have the application rejected partially or totally?". In the first column the collateral is proxied by the total household wealth, in the second column by the amount of real assets, in the third by the stock of land and houses, in the fourth by the value of the house of residence. All the specifications include a full set of judicial district and year dummies.
*Significant at 5% level.
**Significant at 1% level.

All the specifications include a full set of dummies at judicial district level to control for unobserved heterogeneity, and a full set of year dummies, because households coming from different waves are pooled together. Furthermore, standard errors are corrected for clustering at the judicial district level.

Before analyzing the determinants of the probability of being credit-constrained, let us briefly describe the variables that affect the decision to apply for a loan. From Tables 2, we can see that this decision is positively correlated with the age of the household head in a non-linear way: the coefficient of age is positive and that of age squared is negative. This is in line with the intuition that the demand for credit increases with age but at a decreasing pace. Consistently with the fact that the probability to engage in financial transitions increases with income (this is documented, for instance, in Guiso and Jappelli (2002)), higher income households are more likely to apply for a loan.

The probability of applying for a loan also increases with household size, which can be considered as a proxy for family needs, and is higher for people living in a city of more than 200,000 population. The reason why the variable *City size* shows a positive coefficient could be that family networks, which often provide an alternative to the formal credit market, are weaker in larger cities.

The same table also shows that the probability of asking for credit does not strongly depend on the collateral, educational attainment or the marital status of the household head. Similarly, whether the household head is retired or not does not affect the decision to ask for a loan.

We also find that unemployed individuals are less likely to ask for credit. This is not surprising, given that loosing the job reduces income and hence the desired level of consumption.

Finally, per capita GDP and the quality of legal enforcement in the district do not appear to affect the probability of asking for credit. One possible reason why the GDP is not significant may be that the heterogeneity has already been captured by the dummies at judicial district level. That the decision to ask for a loan is independent of the quality of legal institutions is reasonable, since it is presumed to be affected by individual more than by aggregate variables.

Let us now concentrate on the determinants of the probability of a household's being credit-constrained. From Table 3, this appears to decrease non-linearly with age: young individuals are more likely to be rejected, but the probability of rejection decreases more early in life.

Households with higher income are less likely to be credit-constrained. At first sight this evidence might seem to contradict the prediction of the model derived in Section 2.2, where we show that $\frac{\partial \tilde{\beta}_i}{\partial w_i} > 0$. However, in our model the consumer gets a positive income only in the second period. Hence, w_i is not only a measure of the income but also of the difference in the individual income levels over time. Given this and given the individual preferences for consumption smoothing, an increment in w_i always increases expected consumption and hence the demand for credit, which tightens borrowing restrictions. This would not be the case if we were to increase the income equally in both periods.

Households able to pledge more collateral are less likely to be credit-constrained. This result is in line with the predictions of the model (in Section 2.2 we show that the threshold $\tilde{\beta}_i$ is decreasing in the collateral value), but not statistically significant, and it is also consistent with the evidence provided by Jappelli (1990) and Cox and Jappelli (1990) for the American household credit market. Also, married couples are less likely to be credit-constrained, perhaps because they can underwrite the loans jointly.

The other individual characteristics appear not to be correlated with the likelihood of being credit-constrained. For instance, we find that being educated or having a large family has no apparent effect. Similarly, the coefficients of *Unemployed* and *Retiree* are rightly signed but not significant at the standard levels.

The variable *Unemployed* can be interpreted, according to our model, by relating it to the probability of receiving an income, p_i. Under this interpretation, unemployed individuals are the ones with a low p_i, and the converse for employed. From the comparative statics performed in Section 2.2, we know that the effect of p_i on the

threshold $\tilde{\beta}_i$ is negative. The intuition behind this result is that an increment in p_i increases the bank's expected repayment (in the good state of nature) and so relaxes its participation constraint. Given the assumption of free entry, this induces the bank to increase the availability of credit, which reduces the probability of liquidity-constraints. This is in line with our evidence, since the positive coefficient suggests that being unemployed increases the probability of being credit-constrained. Conversely, the coefficient on the variable *Retired* is negative, since households headed by retiree individuals are more likely to enjoy a more stable income profile.

Having examined the effects of the individual variables, let us now consider the role played by macroeconomic and institutional variables. To account for macro-effects, we added regional per capita GDP, which has a coefficient that is positive but not statistically significant. Again, this may be because the heterogeneity has been already captured by the dummy variables for judicial districts, which broadly corresponds to the regions.

Finally, we come to the variable *Judicial costs*, which proxies the quality of legal enforcement of credit contracts by measuring the backlog of pending trials divided by incoming trials in each judicial district. This is posited to capture the legal costs that the lender sustains to recover his credit if the borrower defaults. In line with our theoretical predictions, we find that the coefficient of *Judicial costs* is positive and significant, meaning that the weaker the legal enforcement the more likely households are to be credit-constrained. The results are similar if one normalizes the backlog of trials pending by the population, by the number of judges, or by the number of judges plus the administrative staff. The coefficients of the three alternative proxies of judicial costs are positive and statistically significant at 1% independently of the proxy of collateral used. [17]

To appreciate the importance of this distortion, we compute how much the probability of being credit-constrained changes if we endow the average household in the sample with the highest, the mean and the lowest quality of judicial enforcement in the sample in a given year. [18] This experiment amounts to give the same degree of legal enforcement (the maximum, the mean and the minimum in 1989) to households that are equal in all respect but the judicial district of residence. The results are reported in Table 4. Rows refer to judicial districts sorted from north to south and columns to different degrees of legal enforcement. In the first column, we set the quality of judicial enforcement equal to the maximum in the sample, in the second to the mean and in the third to the minimum. Each entry is computed as the ratio of the probability of being credit-constrained given the column's degree of legal enforcement (maximum, mean, minimum) to that in the row's judicial district minus one.

Table 4 shows that endowing all households with the best legal enforcement would reduce the probability of being credit-constrained. The decrease is generally

[17] The coefficient of the backlog of trials pending divided by population is 14.8298 with standard error 3.7178; the coefficient of trials pending divided by judges is 0.0018 with standard error 0.0005; the coefficient of trials pending divided by judges plus administrative staff is 0.0092 with standard error 0.0023. All these coefficients refer to the estimated equation where the collateral is proxied by total wealth.

[18] This is 1989. Choosing another year leads to qualitatively similar results.

Table 4
Changes in the probability of being credit-constrained

Judicial district	Enforcement equal to the sample:		
	Max	Mean	Min
Turin	−0.2183	0.1608	1.0598
Genoa	−0.3285	−0.0665	0.4916
Milan	−0.2173	0.1441	0.9797
Brescia	−0.4631	−0.1732	0.5551
Bolzano	−0.5331	−0.2520	0.4989
Trento	−0.1764	0.2247	1.1782
Venice	−0.4156	−0.1409	0.5000
Bologna	−0.3336	−0.0267	0.6822
Ancona	−0.5531	−0.3282	0.2157
Trieste	−0.3257	−0.0627	0.4976
Florence	−0.3886	−0.0706	0.7118
Perugia	−0.3880	−0.0987	0.5783
Rome	−0.4944	−0.2929	0.1407
Naples	−0.3425	−0.1460	0.2268
Salerno	−0.3811	−0.2286	0.0400
L'Aquila	−0.3358	−0.1165	0.3171
Campobasso	−0.4727	−0.3041	0.0247
Bari	−0.4854	−0.2732	0.1908
Taranto	−0.5860	−0.4161	−0.0455
Lecce	−0.3958	−0.1873	0.2329
Potenza	−0.4586	−0.2142	0.3445
Reggio C.	−0.7265	−0.5774	−0.2009
Catanzaro	−0.4567	−0.2807	0.0646
Palermo	−0.3504	−0.1405	0.2707
Messina	−0.6910	−0.5163	−0.0660
Caltanissetta	−0.3580	−0.1727	0.1741
Catania	−0.2678	−0.0510	0.3588
Sassari	−0.5857	−0.4118	−0.0285
Cagliari	−0.4690	−0.2401	0.2712

Note: Rows refer to judicial districts sorted from north to south and columns to different qualities of legal enforcement. In the first column, we set the quality of judicial enforcement to the sample maximum, in the second to the mean and in the third to the minimum. Each entry is computed as the ratio of the probability of being credit-constrained taking the degree of legal enforcement corresponding to the column (maximum, mean, minimum) to that in the row's judicial district minus one.

more pronounced for southern judicial districts. For instance, endowing the households living in high-cost southern districts such as Reggio Calabria and Messina with the best quality of legal enforcement would reduce the probability of being credit-constrained by 73% and 69%, respectively. These are the largest and second largest reductions in the sample. The smallest (around 18%) corresponds to households in the Trento judicial district. [19] In the second column of the table, when all households

[19] The reason the probability of being credit-constrained changes even for households in Trento, which is the best judicial district, is that the probability of being credit-constrained in each district has been found by taking the average across periods, while the top quality of legal enforcement is the highest value in 1989.

are assigned the mean value for legal enforcement, the probability of being credit-constrained increases in the best performing judicial district, such as Trento, Turin and Milan. Finally, in the third column, where all the households are given the lowest degree of enforcement, the probability increases in all districts, except for Taranto, Reggio Calabria, Messina and Sassari. [20] As expected, the increase is greater in the best districts such as Trento, Turin, and Milan (in northern regions), and smaller in southern regions.

A look at Table 4 also suggests that stronger legal enforcement seems to occur much more often in the wealthier northern part of Italy than in the less wealthy southern regions. This could induce the suspect that the coefficient of the legal variable is indeed picking up regional differences in social or economic factors that are correlated with our measures of legal enforcement. [21] However, micro-data allowed us to control for regional effects by including a full set of judicial district dummies to disentangle the quality of judicial enforcement from influences operating at regional level. Furthermore, the use of micro-data allows to satisfy the assumption that the quality of judicial enforcement is not affected by whether or not a household is credit-constrained, an assumption that would be much less tenable with macro-data, if the proportion of credit-constrained households affected the quality of judicial enforcement.

Hence, these empirical results support the thesis that the poor performance of legal institutions can entail substantial social costs for Italian households by restricting the access to credit. These results are robust not only to different measures of collateral but also to different proxies of judicial costs.

The effect on the probability of being credit-constrained is not the only welfare implication of poor legal enforcement. As the model suggests, there could also be a welfare effect on the volume of credit of all households, via the cost of finance. We now turn to this issue.

4.2. Law enforcement, collateral and the availability of credit

This section investigates how the relation between household debt and collateral is affected by the quality of law enforcement.

The collateral is used by banks to guard against accidental default. If a household does not repay, the bank repossesses the collateral, at a cost that depends crucially on the quality of judicial enforcement. The poorer the enforcement, the higher the cost of acquiring ownership of the asset. This lowers the effective liquidation value of the collateral and induces banks to compensate by charging a higher interest rate. Therefore, according to our model, we should expect that if the quality of judicial enforcement improves, other things being equal, the equilibrium amount of debt increases. This holds true whether or not households are credit-constrained.

[20] The quality of legal enforcement in these districts is lower than the minimum in 1989.

[21] It is well known that Italy displays enormous interregional differences in social and economic indicators.

Table 5
Law enforcement, collateral and households debt

	Total wealth	Real assets	Real estates	House of residence
Age of the household's head	0.6527	0.6104	0.6020	0.4871
	(0.1433)**	(0.1427)**	(0.1426)**	(0.1416)**
Age squared of the household's head	−1.1047	−1.0795	−1.0714	−0.9917
	(0.1461)**	(0.1456)**	(0.1454)**	(0.1443)**
Labour family income	0.2898	0.3012	0.2876	0.2716
	(0.0266)**	(0.0265)**	(0.0264)**	(0.0261)**
Collateral	0.0033	0.0086	0.0108	0.0434
	(0.0009)**	(0.0010)**	(0.0012)**	(0.0028)**
Years of schooling	0.4289	0.3660	0.3587	0.2331
	(0.0674)**	(0.0667)**	(0.0668)**	(0.0668)**
Family size	1.4485	1.3447	1.3700	1.2363
	(0.2646)**	(0.2634)**	(0.2631)**	(0.2607)**
Retiree	−1.9626	−1.6207	−1.9267	−1.9041
	(0.9550)*	(0.9500)*	(0.9475)*	(0.9381)*
Unemployed	−7.6752	−7.3098	−7.4955	−6.9350
	(1.7135)**	(1.7051)**	(1.7033)**	(1.6869)**
Marital status	3.7267	3.5610	3.5714	3.1286
	(0.7944)**	(0.7904)**	(0.7899)**	(0.7832)**
Per-capita gross domestic product	2.1106	2.0012	1.9970	1.7394
	(0.4489)**	(0.4467)**	(0.4467)**	(0.4424)**
Judcial costs	−0.8108	−0.7850	−0.7269	−0.6594
	(0.9297)	(0.9253)	(0.9248)	(0.9154)
No. of observations	23556	23556	23556	23556

Note: The dependent variable is households debt. Standard errors are reported in parentheses. In the first column the collateral is proxied by the total household wealth, in the second column by the amount of real assets, in the third by the stock of land and houses, in the fourth by the value of the house of residence. All the specifications include a full set of judicial district and year dummies.
*Significant at 5% level.
**Significant at 1% level.

To test this theoretical prediction, we estimate a tobit model, since the data are censored to the left. Table 5 shows the results of the estimation. As in Table 3, columns differ in the measure of collateral used. In the first column, we take total household wealth and in the second real wealth, which includes land, houses and the business, if any, owned by the household. In the third column, we restrict the measure to land and houses, while the fourth column proxies collateral by the value of the house of residence.

All the specifications include a set of year dummies, because households coming from different waves are pooled together, and judicial district dummies to control for unobserved heterogeneity at the judicial district level.

Consistent with previous evidence, debt volume is positively related to the age of the household head in a non-linear way: the coefficient of *Age* is positive and that of *Age squared* is negative. Moreover, households able to pledge more collateral and higher-income have a larger amount of debt. The collateral positively affects

the individual's credit rating because it provides better insurance for the bank. An increment in income has two effects: first, it increases the demand for consumption in the first period and, other things being equal, the demand of credit. Second, it relaxes the bank's participation constraint and increases the availability of finance. Therefore, in equilibrium at least a positive share of the new household demand is satisfied.

We also find that *Family size* and *Marital status* are positively related to debt while being unemployed is negatively related. This is in line with expectations. Family-size proxies for needs and debt is likely to increase with needs. Married couple are more likely to hold mortgages, which explains why the overall debt is higher for them. On the other hand, this is lower for unemployed, which typically cannot borrow to buy a house.

The coefficient of the variable *Retiree* is negative, which is consistent with the idea that retiree people mostly use their saving to finance their needs, instead of borrowing. More educated individuals held more debt, as witnessed by the positive coefficient of the variable *Years of schooling*. This might be capturing the fact that, as mentioned, the better-educated have a steeper income profile, which is typically associated with higher desired consumption and higher demand for credit early in life.

The effect of regional *Per-capita gross domestic product* is positive, which tells that in wealthier regions the amount of debt held by households is higher.

Finally, let us focus on the role played by judicial institutions. In line with our theoretical predictions, we find that the coefficient of the variable *Judicial costs* is negative. Recalling that we are measuring the cost of a badly functioning judicial system, the negative coefficient means that if the quality of the judicial enforcement worsens, the amount of household debt decreases. However, the coefficient is not statistically significant. The lack of statistical significance of the *Judicial costs* variable does not mean per se that the quality of enforcement does not affect the household's debt capacity. Notice that the regression controls for the effect of the business cycle at the regional level, trough the *Per-capita gross domestic product*, and for that of omitted influences operating at the provincial level. This implies that our results are unable to disentangle the effect of judicial costs from the business cycle at regional level and other influences operating at the judicial district level. [22]

Similar results are obtained if we normalize the stock of trials pending by using the population size or the number or judges or judges plus administrative staff: the coefficient is negative but not statistically significant. [23]

A possible reason behind the absence of statistically significance of the legal variable has to do with the dependent variable. Given the lack of information on the flow of credit granted to each household during the interview's year, we are forced

[22] Indeed, if one removes form the regression the *Per-capita gross domestic product* and the provincial dummies, the *Judicial costs* variable turns out to be significant at the 1% level.

[23] The coefficient of the backlog of trials pending divided by population is −79.3431 with standard error 61.3144; that of the backlog of trials pending divided by judges is −0.0128 with standard error 0.0066; that of the backlog of trials pending divided by judges plus administrative staff is −0.0649 with standard error 0.0313. In this last case the coefficient is significant at the 5% level.

to use the stock of debt. This reflects also past choices of lenders and borrowers and does not necessarily respond to the current quality of judicial enforcement, as the amount of credit granted would possibly do.

5. Conclusions

In this paper, we have analyzed the relation between the quality of judicial enforcement of creditors' rights and the allocation of credit to households, both theoretically and empirically.

The model identifies two main effects of poor enforcement. First, households are more likely to be credit-constrained because whenever contracts are weakly enforced, the household's incentive to repay is reduced and banks respond by rationing credit. Second, the quality of enforcement also affects household debt, through its effect on the cost of debt. We show that when enforcement is weak, banks tend to compensate for the lower liquidation value of the pledged collateral by raising interest rates, which reduces the equilibrium amount of debt.

To test our theoretical predictions we use data on Italian households drawn from the Survey of Household Income and Wealth, and data on the performance of judicial districts. An important characteristic of our data set is that it has a self-reported indicator of credit-constrained households. To be consistent with our model, where the working of the legal system is supposed to affect the costs of repossession, we proxy the quality of legal enforcement by using measures based on the backlog of trials pending.

Our theoretical predictions are supported by the data. Controlling for household characteristics, unobserved heterogeneity at judicial district level and aggregate shocks, we document that better quality of judicial enforcement reduces the probability of being credit-constrained: households in judicial districts where enforcement is poorer are more likely to have a loan application denied.

The paper also provides support, though weaker, for the idea that if the quality of judicial enforcement improves the availability of credit to households increases.

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Appendix A

A.1. The data

Household data are drawn from the 1989, 1995 and 1998 waves of the Survey of Household Income and Wealth, a national sample survey conducted by the Bank of Italy.

Data on the performance of judicial districts, the number of judges and the size of the administrative staff are available for the same years for 29 judicial districts. Each district is defined by the jurisdiction of an appeals court. Roughly, each district corresponds to a region. In a few regions (Lombardy, Campania, Puglia, Calabria, Sicily and Sardinia) there is more than one judicial district. In one case a district (denominated as Turin) comprises two different regions (Valle d'Aosta and Piedmont). Finally, the judicial district of Genoa includes not only all the provinces of Liguria but also one province of Tuscany. Table A.2 shows the matching of judicial districts with provinces and regions.

Below, find the definition and source of the variable used in the estimation.

Loan application, by household. Dummy variable that takes value equal to one if the household responds positively to the question: "During the year did you or a

Table A.1
Summary statistics

	Mean	Standard error
Total wealth	117.062	1.682
Real assets	111.199	1.593
House of residence	109.190	1.838
Percentage of home-owners	63.29	
Debt for house purchase	19.088	0.605
Debt for purchase of valuables	2.698	0.862
Debt for car purchase	5.423	0.223
Debt for other durables purchases	2.204	0.144
Debt for non-durable consumption	4.258	0.963
Percentage of households holding debt for house purchase	10.74	
Percentage of households holding debt for purchase of valuables	0.26	
Percentage of households holding debt for car purchase	6.28	
Percentage of households holding debt for other durables purchases	3.12	
Percentage of households holding debt for non-durables consumption	0.96	

Note: Figures are in 1995 euro except for those that are explicitly cited as percentage. Debt is measured as the amount of end-of-year household liabilities. The figures for debt are computed including only those households that are actually indebted. For continuous variable also the standard error is reported. The means are computed using the sample weights. These are the inverse of the sample-inclusion probability.

Table A.2
Matching of judicial districts with regions and provinces

Judicial districts	Corresponding regions and provinces
Turin	*Piedmont* (all provinces), *Valle d' Aosta* (all provinces)
Genoa	*Liguria* (all provinces) and *Tuscany* (Massa Carrara)
Milan	*Lombardy* (Milan, Como, Varese, Pavia, Sondrio, Lecco, Lodi)
Brescia	*Lombardy* (Brescia, Bergamo, Cremona, Mantua)
Trento	*Trentino-Alto Adige* (Trento)
Bolzano	*Trentino-Alto Adige* (Bolzano)
Venice	*Veneto* (all provinces)
Trieste	*Friuli-Venezia Giulia* (all provinces)
Bologna	*Emilia Romagna* (all provinces)
Ancona	*Marche* (all provinces)
Florence	*Tuscany* (all provinces excluding Massa Carrara)
Perugia	*Umbria* (all provinces)
Rome	*Lazio* (all provinces)
Naples	*Campania* (Naples, Avellino, Benevento, Caserta)
Salerno	*Campania* (Salerno)
L'Aquila	*Abruzzo* (all provinces)
Campobasso	*Molise* (all provinces)
Bari	*Puglia* (Bari, Foggia)
Lecce	*Puglia* (Lecce, Brindisi)
Taranto	*Puglia* (Taranto)
Potenza	*Basilicata* (all provinces)
Catanzaro	*Calabria* (Catanzaro, Cosenza, Crotone, Vibo Valentia)
Reggio Calabria	*Calabria* (Reggio Calabria)
Palermo	*Sicily* (Palermo, Agrigento, Trapani)
Messina	*Sicily* (Messina)
Caltanissetta	*Sicily* (Caltanissetta, Enna)
Catania	*Sicily* (Catania, Ragusa, Siracusa)
Cagliari	*Sardinia* (Cagliari, Oristano)
Sassari	*Sardinia* (Sassari, Nuoro)

Note: The table matches judicial districts with Italian regions and provinces. The names of the regions are italicized, those of provinces bracketed. Roughly, each district corresponds to a region. In a few regions (Lombardy, Campania, Puglia, Calabria, Sicily and Sardinia) there is more than one judicial district. Provinces located in two different regions (Valle d'Aosta and Piedmont) belong to one judicial district, called Turin. Finally, the judicial district of Genoa includes not only all the provinces located in Liguria but also one province in Tuscany. The source is ISTAT: "Annuario delle Statistiche Giudiziarie Civili".

Table A.3
Matrix of correlation among the measures of legal enforcement

	(1)	(2)	(3)	(4)
Backlog of pending/incoming trials	1.0000			
Backlog of trials pending/population	0.6834	1.0000		
Backlog of trials pending/judges	0.6229	0.8243	1.0000	
Backlog of trials pending/judges plus staff	0.5245	0.8138	0.9445	1.0000

Note: The table shows the sample correlations among the four measures of legal enforcement. The first column refers to the backlog of pending/incoming trials, the second to the trials pending/population, the third to the trials pending/judges and the fourth to the trials pending/judges plus staff.

member of your household applies for a loan or a mortgage to a bank or other financial intermediary?''. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

Credit rationing, by household. Dummy variable that takes value equal to one if the household is credit-constrained, i.e. responds positively to the following question: ''During the year did you or a member of your household apply for a loan to a bank or other financial intermediary and have the application rejected partially or totally?''. Source: *Survey of Household Income and Wealth*, years: 1989, 1995 1998, Bank of Italy.

Debt, by household. Total amount of debt (i.e. amount borrowed to purchase houses, valuables, vehicles and other durable goods and to finance non-durable consumption) at the end of the year. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

Age of the household head, by household. Age in years. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

Labor household income, by household. Sum of labor incomes of all members of the household who worked at least part of the year. It does not include pension income of retired members, income from capital and transfers. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

Collateral, by household. We use the following four proxies for collateral: the stock of total wealth, which includes real and financial assets, the stock of real assets, which includes houses, lands, valuables and the business owned by the households, the stock of lands and houses (also called real estates) and the value of the house of residence. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

Years of schooling, by household. The variable is originally coded in the following classes: no education (0 years), completed elementary school (5 years), completed junior high school (8 years), completed high school (13 years), completed university (18 years), graduate education (20 years). In the regressions the variable is coded according to the values given in parenthesis. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

Family size, by household. Number of the members of the household. Source: *Survey of Household Income and Wealth*, years: 1989, 1995 1998, Bank of Italy.

Retiree, by household. Dummy variable that takes value equal to one if the head of the household is retired. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

Unemployed, by household. Dummy variable that takes value equal to one if the head of the household is unemployed. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

Marital status, by household. Dummy that takes value equal to one if the head of the household is married. Source: *Survey of Household Income and Wealth*, years: 1989, 1995, 1998, Bank of Italy.

City size, by household. Dummy that takes value equal to one if the household's city of residence has more than 200,000 inhabitants. Source: *Survey of Household Income and Wealth*, years: 1989, 1995 1998, Bank of Italy.

Per capita gross domestic product, by region. Gross domestic product divided by population. Source: *Conti Economici Regionali*, years 1989–1998, National Institute of Statistics (ISTAT).

Backlog of trials pending, by judicial district. Backlog of civil trials pending at the first and the second degree of judgement (lower and appeals court). Source: *Annuario delle Statistiche Giudiziarie Civili*, years 1989–1998, National Institute of Statistics (ISTAT).

Number of incoming trials, by judicial district. Number of incoming civil trials at the first and the second degree of judgement (lower and appeals court). Source: *Annuario delle Statistiche Giudiziarie Civili*, years 1989–1998, National Institute of Statistics (ISTAT).

Population, by judicial district. Source: *Annuario delle Statistiche Giudiziarie Civili*, years 1989–1998, National Institute of Statistics (ISTAT).

Number of judges, by judicial district. Number of civil court judges of jurisdiction assigned to each judicial district. Source: *Italian Ministry of Justice*, years 1989–1998.

Size of the administrative staff, by judicial district. Number of administrative officers assigned to each judicial district. Source: *Italian Ministry of Justice*, years 1989–1998.

A.2. The econometric model

This section describes how the probability of being credit-constrained is derived and estimated. To do so we run a probit model that allows for endogenous selection due to the fact that the household decision to apply for a loan and the household probability of being credit-constrained may depend upon the same set of unobservable factors.

A household is credit-constrained if it is rejected for credit. This involves two logical steps in the construction of the model. First, we focus on the decision to apply for a loan. Household i applies for a loan if

$$y_{i1}^{*} = x_{i1}\beta_1 + u_{i1} \geqslant 0,$$

where y_{i1}^{*} is the utility of applying for a loan net of the costs and depends on observable (i.e. x_{1i}) and unobservable (i.e. u_{1i}) factors.

Second, among those that apply for a loan we distinguish constrained from unconstrained house-holds. Household i is not credit-constrained if

$$y_{i2}^{*} = x_{i2}\beta_2 + u_{i2} \geqslant 0,$$

where x_{2i} and u_{2i} are, respectively, observable and unobservable variables.

We define:

$$y_1 = \begin{cases} 1 & \text{if } x_1\beta_1 + u_1 \geqslant 0, \\ 0 & \text{otherwise,} \end{cases}$$

and

$$y_2 = \begin{cases} 1 & \text{if } x_2\beta_1 + u_2 \geqslant 0, \\ 0 & \text{otherwise.} \end{cases}$$

Thus, y_1 and y_2 take value 1 for those that participate in the credit market and for unconstrained households, respectively.

We assume that u_1 and u_2 are jointly normal with mean zero and variance given by

$$\Sigma_{12} = \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}.$$

The probability of being credit-constrained is thus specified as

$$P(y_2 = 0 | y_1 = 1) = \frac{\int_{-x_1\beta_1}^{+\infty} \int_{-\infty}^{x_2\beta_2} f(u_1 u_2)\, \mathrm{d}u_1\, \mathrm{d}u_2}{\int_{-x_1\beta_1}^{+\infty} f(u_1)\, \mathrm{d}u_1},$$

where

$$f(u_1 u_2) = \frac{1}{2\pi\sqrt{1-\rho^2}} \exp\left[-\frac{1}{2(1-\rho^2)}(u_1^2 - 2\rho u_1 u_2 + u_2^2) \right]$$

and

$$f(u_1) = \frac{1}{\sqrt{2\pi}} \exp\left[-\frac{1}{2} u_1^2 \right].$$

The estimation is carried out using maximum likelihood.

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