CENTRO STUDI IN ECONOMIA E FINANZA

CENTRE FOR STUDIES IN ECONOMICS AND FINANCE

WORKING PAPER NO. 57

The Legal Enforcement of Credit Contracts and the Level of Investment

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April 2001

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Abstract

This paper analyses the effect of the degree of the legal enforcement of credit contracts on the level of private investment. We use a model of corporate finance with moral hazard and collateralized asset. We introduce in the model a third agent: the government, which is responsible for the enforcement of credit contracts.\ In particular we consider the right to repossess two different types of assets in case of default: inside collateral and outside collateral. We show that the existence of credit constraints and their level depend on the degree of enforceability of creditor rights, provided by the public sector. Moreover, we find the optimal degree of legal enforcement and we investigate how it depends on the firms' wealth endowment.

Keywords: moral hazard, collateral, corporate finance, legal enforcement.

JEL Classification. G30, K1, K4

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1 Introduction

Recent events in Eastern Europe and Asia have demonstrated the central role played by the legal system in economic activity. Policy makers and regulators are convinced that enterprises cannot raise sufficient capital without corporate and bankruptcy laws. At the same time, markets for goods and services require well-specified laws and, at the same time, efficiently functioning courts to enforce them in the best way.

The legal system influences corporate finance decisions because it shapes the degree of protection of outside investors (creditors and shareholders) and through this, their willingness to finance projects. The legal system does this through two different channels: the first is the *content of the laws* which define rights and powers of outside investors; the second one is the effectiveness of the judicial *enforcement of the laws.*

When investors finance firms, they typically receive certain rights or powers. Creditors get the right to repossess collateral or to force a reorganization of the firm, when some conditions, such as the payment of interests or the adherence to particular covenants, are violated. All outside investors, whether shareholders or creditors, also have the right to obtain some corporate information, and indeed many of their other rights can be exercised only when they have such information.

However, any sort of law is intrinsically useless, if not supported by an enforcement structure responsible for how well the rights contained in the laws are protected. The enforcement is as crucial as the content of the laws in shaping the investor protection. In most countries laws and regulations are enforced in part by regulatory agencies, such as Securities and Exchange Commissions, and in part by public institutions as courts. Lack of transparency, misbehaving of Courts, corruption are some variables affecting the quality of law enforcement and therefore the effectiveness of investor protection.

In this paper we focus our attention on the role of the legal enforcement of the investor's rights for the availability of credit to the corporate sector.

An important lesson about the relevance of the legal enforcement comes from Russia. Despite the fact that Russia, according to most criteria, has good security laws, good bankruptcy and company laws, the protection of outside investors has been very poor due to the ineffectiveness of the mechanisms of enforcement[1]. This has kept Russia's financial development significantly behind that of most East European Countries.

The same conclusion can be derived by looking the results of a recent empirical literature. La Porta, Lopez-de-Silanes, Shleifer and Vishny (1997) show that countries which better protect creditors have a higher ratio of private debt to GDP. Using Italian data, Bianco, Jappelli and Pagano (2000) test the hypothesis that weak legal enforcement is associated with low credit availability and high credit constraints to the corporate sector. They find that the enforcement variables are always significant and with the expected sign: judicial inefficiency

[1] This was found by La Porta, Lopez-de-Silanes, Shleifer and Vishny (1999).

reduces the amount of loans granted by banks to the corporate sector and increases the likelihoods of credit rationing. Cristini, Moya and Powell (1999) find strong evidence about the importance of an efficient legal system for the development of the credit market in Argentina. In any case, the explanatory power of legal variables is frequently strong, suggesting an important role of the legal sector. Gropp, Sholz and White (1996) analyze how cross state differences in US personal bankruptcy rules affect the supply and the demand for household credit, using data from the 1993 Survey of Consumer Finances. They find that generous state bankruptcy exemptions reduce the amount of credit available to low-asset households, conditioning on their observable characteristics (while the effect is the opposite for high-asset households), and increase the interest rate on automobile loans for low-asset households. In the housing mortgage market, there is also some evidence that the cost of legal enforcement affects the cost of credit. In the United States, Meador (1982) and Jaffe (1985) find that mortgage interest rate were generally higher in states where the law extended the length and expenses of the foreclosure process.

Even if all these results seem to suggest that a bad functioning of the judicial system can have high social costs, whenever it makes more difficult the access to the credit market, so far the theoretical literature has been silent on this issue. The two papers which discuss, from a theoretical point of view, the relationship between legal institutions and credit availability are focusing on the content of the laws, and not on the legal enforcement. Berglof, Roland and von Thadden (2000) as well as Bisin and Rampini (2000) show that the introduction of a bankruptcy law in a framework of asymmetric information can increase the debt capacity of the firm.

The purpose of this chapter is to fill this gap, by providing a theoretical framework able to rationalize the empirical evidence showing a positive relationship between the degree of legal enforcement of the creditor's rights and the level of external finance. In particular, we concentrate our attention to the corporate credit market to answer to the following question: *Are differences in the quality of the legal enforcement of creditor rights able to explain differences in private investment levels?*

In order to provide an answer for this, we use a model of corporate finance with a collateralized debt contract. We use the moral hazard argument in order to explain why some borrowers are constrained by fixed lines of credit [2] and we introduce in the credit contract the possibility to pledge two different types of assets to the lenders. As most of the research has emphasized, pledging some asset can be used to mitigate informational problem: collateral and guarantees are powerful tools that allow financial institutions to offer credit on favorable term to businesses whose informational opacity might otherwise result in either credit rationing or the extension of credit only on relatively unfavorable terms. We distinguish between *inside* and *outside collateral.* Inside collateral is an asset

[2] Credit rationing is actually considered as an equilibrium phenomenon, driven by asymmetric information between borrowers and lenders. Economists have used both moral hazard and adverse selection arguments, to explain why a lender would not like to raise the interest rate even if the borrower were willing to pay higher interest rates.

owned by the firm. This typically reorders the claims of the firm's creditors by giving one of them priority via a security interest on a specific asset. Outside collateral is an asset owned outside the firm, typically an asset belonging to the firm's owner. Outside collateral guarantees the protection of the claim of a single creditor without diminishing the claims of the other creditors in the event of bankruptcy. These types of credit contract are typically used among small-medium size firms, because they are characterized by more informational opacity.

We introduce in the model a public sector which is responsible for the enforcement of the credit contracts. So far in the literature, the government has been considered as an agent able to affect the behavior of the private sector in two different ways: on the one hand, public services can enter directly the utility function of consumers; on the other hand they can enter the production function of firms. In this second case, it is usually assumed that the marginal productivity of the private inputs is increasing in the level of public good[3]. In our model, the public good affects the marginal productivity of the capital input indirectly, by mitigating the market imperfectness due to asymmetric information.

We show that the existence of credit constraints and their level depend on the degree of legal enforcement of the creditor rights. Governments can increase the level of private investment whenever there are credit constraints due to moral hazard problems, by investing a larger amount of public expenditure in the legal system. If the collateralizable fraction of the investment goods is sufficiently high, governments can completely eliminate the credit rationing. Otherwise, public expenditure in justice can only reduce the distortion in the credit market. In this second case, we show that there exists an optimal level of public expenditure, which is increasing in the level of inside equity and outside collateral.

The paper is organized as follows. In section 2, we describe the model. In section 3, we find the optimal credit contract and we investigate the role of the legal protection in the credit market. In section 4, we allow the level of legal protection to be optimally chosen by a social planner. We find the optimal level of legal enforcement and we investigate how it depends on the firms' wealth endowment and on the characteristics of the project. Section 5 concludes.

2 The Model

We consider an economy with three agents: entrepreneurs (firms), intermediate sector (banks) and government.

There is a continuum of entrepreneurs with dimension equal to 1. Each entrepreneur is endowed with an initial amount of money (A) which he can use in two different ways: he can employ it as own personal resources in a project

[3] For more details and references, see Barro and Sala-i-Martin (1995), specifically the "Public goods model of productive government services" and the "Congestion model of productive government services".

(equity) or he can use it for consumption. To implement the project (I), the entrepreneur must borrow the quantity $(I - A)$ from the lender[4].

There are constant returns to scale in the investment technology: an investment $I \epsilon [0, \infty)$ yields a verifiable income cI, if the project succeeds, and no income in case of failure. The probability of success is denoted by p. The project is subject to moral hazard. The entrepreneur can "behave" (exercising positive effort) or "misbehave" (shirking). Behaving yields a probability $p = p_h$ of success and no private benefits to the entrepreneur. Misbehaving yields a probability $p = p_l < p_h$ of success and private benefits $BI > 0$[5]. This implies that default is more probable when the borrower decides to exert the lower level of effort.

The *default* we are considering is the *accidental* one: a borrower defaults because he is unable to repay the loan. There is another type of default, called *strategic*, in which the borrower, though potentially solvent, is unwilling to repay the loan. Besides being intrinsically different, inability to repay and unwillingness to repay depend on totally different factors. A borrower is unable to repay if his project fails, which might be due either to bad luck, incompetence or low effort in managing the project, or to a combination of these factors. A solvent borrower may be unwilling to repay if the benefits of defaulting are greater than the perceived cost of sanctions associated with default. Both types of defaulting may depend on the legal system and its enforcement.

The borrower has the possibility to pledge some assets as collateral to the lender in case of failure. We consider two different types of assets. The first is the investment good (*inside collateral*), having a positive market value after the production activity. We define (αI) the amount of investment goods which can be collateralized. The parameter α, which takes values in the closed interval $[0, 1]$, defines the share of each unit of investment transformed into physical assets with positive market value. This parameter reflects the properties of *technology* used in the project and the *degree of redeployability* of the assets. Firms using a capital intensive technology and with low running costs have a larger α than firms with labor intensive production function. Moreover, the value of the asset depends on the presence of a market for it. The resale price depends on whether there are buyers willing to repurchase the asset. This in turn depends on whether other firms that would be potential candidates have indeed accumulated the knowledge necessary to manage the assets. If this is the case, then there will be a liquid market and hence selling the asset will be quite easy in case of default of firms. This increases the value of α[6]. The second type

[4] The model we use is taken from Holmostrom-Tirole *(1997)*.

[5] We can interpret private benefits as a disutility of effort saved by the entrepreneur when he shirks. We assume, as in Holmostrom-Tirole *(1997)*, that private benefits are increasing in the size of the project. We could also assume that private benefits are constant; the qualititative results of the analysis would not change.

[6] This point is deeply analyzed by Shleifer and Vishny (1992). They show that the equilibrium investment level depends on the collateral value, which also depends on the level of investment of other firms. The main idea is that assets are fairly specialized and have value only for the firms in the industry which have invested in the same type of knowledge. The larger the redeployability of equipments pledged as collateral, the larger the investment level

of collateral is an asset endowment (H), which is not part of the investment goods but has a positive market value (*outside collateral*). Typically it will be an asset belonging to the firm's owner.

As emphasized by the literature on credit rationing, we also assume that there is a difference between the collateral value for the borrower ($\alpha I + H$) and the collateral value for the lender, given by $(\alpha I + H)b$ where $0 \leq b \leq 1$[7]. There are different reasons for this: there may be *transactions costs* of selling the asset to third parties, such as fee, taxes or informational costs. Alternatively, the borrower may derive benefits from the ownership that a third party would not enjoy or he may be risk averse. In this case, pledging the remaining resources in case of default may inflict too large costs on the borrower.

We are focusing on the first type of explanation. In particular, we interpret transaction costs as *legal costs,* that investors have to pay in order to obtain the property right on the asset pledged as collateral.

Both, the borrower and the lender are risk neutral.

The borrower is protected by limited liability. This implies that in case of failure, which occurs with probability $(1 - p_h)$ if the entrepreneur behaves and with probability equal to $(1 - p_l)$ if he shirks, the entrepreneur obtains a net pay-off equal to $(-A)$ if he behaves and a net pay-off equal to $(BI - A)$, if he shirks. In both situations, the collateralized investment goods (αI) and the outside collateral (H) are kept by the lender. Then, in case of failure, the lender obtains a net income equal to $[b(\alpha I + H) - (I - A)]$ independent of whether the borrower behaves or shirks. The reason why it is optimal to pledge an asset to the lender, is that incentive considerations require that the borrower is punished in case of poor performance. Moreover, if poor performance means no or little income, the only possible punishment is the seizing of the asset[8]. In case of success, the two parties share the total income cI: R_b goes to the borrower and R_l goes to the lenders. Then, the borrower's net pay-off is equal to $(R_b - A + \alpha I + H)$ if he behaves and he has success and it is equal to $(R_b - A + I\alpha + H + BI)$ if the borrower shirks but he has success. The lender's net pay-off is equal to $[R_l - (I - A)]$, in both cases, but with two different probabilities.

We assume that the population of lenders has unit size and there is free entry in the credit market. This implies that each lender makes zero expected profits.

The third agent in the economy is the government which is expected to be responsible for the enforcement of credit contracts. He is able to do this, by providing a public good, which is the activity of enforcement carried out by public institutions like *judicial system.* We assume that the amount of public good affects the terms of the credit contract under which borrowers are able

in the industry.

[7]Some papers from this literature are Bester (1985,1987), Besanko-Thakor (1987) and Chan-Kanatas (1985).

[8]Lacker (1992) finds conditions under which the optimal credit contract between a borrower and lenders is debt contract with collateralized asset, assuming in particular that borrower values the collateral good more than the lenders.

to obtain external funds. In particular, the amount of the public good shapes the value of the asset pledged as collateral in case of default for the lender. The idea is the following: if it takes a lot of time to obtain the transfer of the property right and the liquidation value of the collateral asset, because of the misbehaving of Courts, investors have to incur a high cost to exercise the right to repossess collateral in case of default. These costs reduce the value of the asset from the investor's point of view[9]. We can express what we said, by assuming that the parameter b is an increasing function in the amount of public expenditure $G : b = f(G)$, where the function f has the following properties: $f(G)$ is defined on the interval $[0, \infty)$ with range the interval $[0, 1]$, with $f > 0$, and $f' > 0$ for any value of G and also concave ($f'' < 0$).

3 Optimal Credit Contract Analysis

The first step is to analyze the optimal credit contract, which defines the optimal investment level (I), and the optimal sharing rule (R_b, R_l). Following Tirole (1997), we consider the case where the project is viable only if the borrower behaves. This implies that we are running our analysis under the following hypothesis:

Assumption 1 $p_l c + [p_l + (1 - p_l) f(G)] [\alpha + H] + B - 1 < 0$

Assumption 2 $p_h c + [p_h + (1 - p_h) f(G)] \alpha + B > 1$

Assumption 1 guarantees that the project has a negative net present value (NPV) in case of misbehavior of the entrepreneur[10]. Assumption 2 guarantees that the net present value of the project is positive in case of good behavior[11]. As we see, an increment in the lender's value of the assets makes the project more likely to have a positive net present value.

Assumption 3 $\left(c - \frac{B}{(p_h - p_l)}\right) > 0$

Assumption 3 is introduced to make our analysis interesting. It guarantees that the return of the lender in good state (R_l) is larger than the maximum one that he might get in bad state $f(G)(\alpha I + H)$.

To find the optimal investment size (I) and the optimal sharing rule (R_b, R_l), the borrower has to maximize his utility level, being careful to preserve enough of the stake for himself, in order to have the incentive to good behave

[9] We could alternatively assume that the behavior of judicial system affects the time before the payment takes place also for the borrower. We consider this case in Appendix 6.1.

[10] The NPV of the project in case of low level of effort is given by $\{p_l c I + [p_l + (1 - p_l) f(G)] [\alpha I + H] + BI\} - I$. If we consider the case where the endowmnet of liquid wealth is sufficient large ($A > 1$), a condition that guarantees a negative NPV for each level of investment is the following: $p_l c + [p_l + (1 - p_l) f(G)] [\alpha + H] + B - 1 < 0$

[11] The NPV of the project in case of good behavior is given by $\{p_h c I + [p_h + (1 - p_h) f(G)] [\alpha I + H] + BI\} - I$. A sufficient condition for that is the following: $p_h c + [p_h + (1 - p_h) f(G)] \alpha > 1$.

and a sufficiently high income for the lender, who must at least break even, in order to be willing to finance the project. The entrepreneur takes the parameter G as given.

We can find the optimal credit contract, by solving the following maximization problem:

$$\underset{I,R_b,R_l}{Max}\, EU_b = p_h(R_b + \alpha I + H)$$

$$(R_b + \alpha I + H)p_h \geq p_l(R_b + \alpha I + H) + BI \tag{1}$$

$$p_h R_l + (1 - p_h)f(G)(\alpha I + H) = (I - A) \tag{2}$$

$$cI = (R_b + R_l) \tag{3}$$

Inequality (1) is the Incentive Compatibility constraint for the borrower. He will behave if the net expected income, deriving from the good behavior, (left hand side), is larger or equal to the one in case of shirking (right hand side). It can be rewritten in a more intuitive way: $R_b \geq \left[\frac{BI}{(p_h - p_l)} - (\alpha I + H)\right]$. The left hand side is called agency rent. It is the minimum amount of income that must be left to the entrepreneur to preserve his incentive to behave. As we can see, the agency rent is increasing in the level of private benefits, but it is decreasing in the collateral. In fact, the possibility to pledge inside or outside collateral assets mitigates the informational problem by increasing the cost of the misbehaving for the borrower.

Equation (2) represents the Participation Constraint for the lender, which holds with equality given the hypothesis of free entry. The expected income from the repayment of the loan in case of success ($R_l p_h$) and the expected liquidation value of the two assets, $[f(G)(1 - p_h)(\alpha I + H)]$, must be sufficiently high to repay the cost of financing $(I - A)$. We are assuming that the entrepreneur pledges to the lender the full amount of the assets.

Equation (3) is a feasibility condition. It tells us that it is unfeasible to give to the two parties of the contract more than what the project produces.

Substituting the feasibility condition and the zero profit condition in the objective function and in the incentive compatibility constraint, we can rewrite the maximization problem in the following way:

$$\underset{I}{Max}\left\{\left[p_h c + \alpha(1 - p_h)f(G) + \alpha p_h - 1\right] I + \left[f(G)(1 - p_h) + p_h\right] H\right\}$$

$$p_h cI - \left(\frac{Bp_h I}{(p_h - p_l)} - \alpha I p_h - H p_h\right) + [f(G)(1 - p_h)(\alpha I + H)] \geq (I - A) \tag{4}$$

Inequality (4) requires that the total expected income pledgeable to the lender (left hand side) is larger than the total cost of the investment (right hand side). The total expected pledgeable income for the lender is the sum of two parts. The first one is the expected income in case of success of the project, which is given by the difference between the total income from the project (cp_hI) and the share of this to be left to the borrower to preserve his incentive to behaving $\left(\frac{Bp_hI}{(p_h-p_l)} - \alpha Ip_h - Hp_h\right)$. The second term of the left hand side is the expected income in case of failure $[f(G)(1-p_h)(\alpha I + H)]$.

We introduce the following two assumptions:

Assumption 4 $[p_h c + \alpha(1-p_h)f(G) + \alpha p_h - 1] > 0$

Assumption 5 $p_h\left[c - \left(\frac{B}{(p_h-p_l)} - \alpha\right)\right] + \alpha f(G)(1-p_h) < 1$

As we can see by looking at the objective function in the previous maximization problem, assumption 4 guarantees that the expected utility function of the entrepreneur is increasing in the investment level. If we compare assumptions 2 and 4, we can easily see that the second one implies the first one. This means that whenever the utility function is increasing it is also true that the net present value of the project is positive under the high level of effort. Assumption 5 defines the space of parameters for which the maximization problem has a finite solution. Given the linearity of the production function and of the expected utility of the borrower, this conditions implies the existence of a credit rationing. Note that assumption 5 depends on the collateralizable fraction of investment goods (α), as well as on the legal enforcement variable $f(G)$. Large values of collateralizability and enforceability make this condition more stringent.

Proposition 1 *The debt capacity of the firm* ($L = I - A$) *is a linear combination of the entrepreneur's equity invested in the firm* (A) *and his outside collateral* (H) *with two positive and generally different coefficients:*

$$L = \left\{\frac{p_h(c-\frac{B}{(p_h-p_l)})+\alpha[p_h+(1-p_h)f(G)]}{1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)}\right\}A + \left\{\frac{[p_h+(1-p_h)f(G)]}{1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)}\right\}H$$

Proof. From assumption 4, we know that the objective function of this maximization problem is increasing in the investment level. Since the utility is linear in this variable, the optimal decision should be invest as much as possible. It follows that inequality (4) is binding. Its upper bound defines the solution of the maximization problem: $I = \frac{A+[p_h+(1-p_h)f(G)]H}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)\right]}$. From this expression, we can easily derive the maximum amount of external financing (L). After some algebra, it can be written as a linear combination of the initial equity (A) and the outside collateral (H) with coefficients two different functions of the parameters of the model. Let us call the first coefficient *multiplier of inside equity* (d_1) and the second one *multiplier of outside collateral* (d_2). Assumption 3 guarantees that the numerator of d_1 is positive and assumption

5 guarantees that the denominator of both multipliers is also positive. From these two considerations it follows that both multipliers are larger than zero. ■

The next step of the analysis is understanding whether and to what extend the degree of legal enforcement of the credit contracts affects the amount of credit received by firms.

3.1 Legal Enforcement and the Level of Credit Rationing

Proposition 2 *The multiplier of the entrepreneur's equity invested in the firm* (d_1) *and the multiplier of his outside collateral* (d_2) *depend positively on the degree of legal enforcement of creditor rights and on the collateralizable fraction of the firm's asset base.*

Proof. We will prove proposition (7), by showing that the partial derivatives of the two multipliers with respect to α and G are positive:

$$\frac{\partial d_1}{\partial G} = \frac{\alpha(1-p_h)f'(G)}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)\right]^2} > 0$$

$$\frac{\partial d_2}{\partial G} = \frac{(1-p_h)f'(G)\left[1-p_h(c-\frac{B}{(p_h-p_l)})\right]}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)\right]^2} > 0$$

$$\frac{\partial d_1}{\partial \alpha} = \frac{[p_h+(1-p_h)f(G)]}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)\right]^2} > 0$$

$$\frac{\partial d_2}{\partial \alpha} = \frac{[p_h+(1-p_h)f(G)]^2}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)\right]^2} > 0$$

■

The economic intuition behind proposition 2 is that the more effective the enforcement of creditor rights is and the larger the collateralizable fraction of the inside collateral, the higher will be the expected income that lenders can obtain from financing the project. Let us consider the determinants of the two multipliers.

The multiplier of the initial equity (d_1) depends positively on the lender's expected pledgeable income per unit of investment. This arises from two different sources. First of all, the possibility to pledge inside collateral increases the share of total return which can be transferred to the lender in case of success of the project $\left[p_h(c-\frac{B}{(p_h-p_l)}+\alpha)\right]$, through a reduction in the agency rent of the borrower. Second, the presence of the inside collateral increases the income of the lender in case of default $[\alpha(1-p_h)f(G)]$: if the borrower is unable to repay the loan, the lender can exercise his property right on the collateral asset in order to obtain the liquidation value. The liquidation value of the asset depends positively not only on the share of the investment goods (α), but also on the level of enforceability of creditor rights $f(G)$.

Similar comments hold for the *multiplier of the outside collateral* (d_2). As before, the maximum amount of credit that the borrower is able to obtain for any unit of outside collateral depends positively on the lender's expected pledgeable income per unit of investment. The term which appears at the numerator of

d_2 captures the role of pledging the outside collateral. The first term (p_h) represents the effect of pledging this type of asset on the agency rent. The decision to exert the lower level of effort, implies not only the possibility to obtain a zero income from the project with a larger probability than in case of good behavior $(1-p_l) > (1-p_h)$, but also the possibility to loose the property on this asset (H) with the same probability $(1-p_l)$. Pledging an asset means loosing a lot of utility in case of default. This consideration reduces the incentive of the borrower to misbehaving. In terms of our analysis, pledging the asset H reduces the expected agency rent of the borrower by the quantity $(p_h H)$. The second term $[(1-p_h)f(G)]$ represents the lender's expected income in case of default per unit of outside collateral. In fact, in this case the lender can exercise his property right on the asset (H), from which he can obtain an expected liquidation value equal to $[(1-p_h)f(G)H]$, which again depends on the quality of the legal protection to creditor rights.

In the next part of the analysis we want to investigate the different role of inside and outside asset. First, we wonder if there is some difference between investing one equity in the project and pledging one unit of the outside collateral. Second, let us consider an increment in the legal enforcement of creditor rights. We know from proposition 2 that the multiplier of the inside equity as well as the multiplier of the outside collateral increase, due to a larger liquidation value of the inside and the outside collateral. The question is: is the size of the increment the same for both multipliers or one of them is more sensitive to the degree of legal protection than the other one?

Proposition 3 *If the collateralizable fraction of the investment goods is sufficiently high, then the amount of external finance obtained on each unit of equity is larger than the amount generated by pledging one unit of outside collateral; i.e. there exists an* α^**, such that if* $\alpha > \alpha^*$ *then* $d_1 > d_2$*, and if* $\alpha < \alpha^*$ *then* $d_1 < d_2$*.*

Proof. In order to prove proposition 3, we consider the ratio between the two multipliers $\frac{d_1}{d_2} = \left[\frac{p_h(c-\frac{B}{(p_h-p_l)})+\alpha[p_h+(1-p_h)f(G)]}{[p_h+(1-p_h)f(G)]}\right]$. This ratio is monotonic in the parameter α. We can find the value of α which makes equal the two multipliers $\alpha^* = \left[1-\frac{p_h(c-\frac{B}{(p_h-p_l)})}{[p_h+(1-p_h)f(G)]}\right]$. If $\alpha > \alpha^*$, $d_1 > d_2$. In this case, the increment in the debt amount from pledging one more unit of inside equity is larger the one obtained from pledging one more unit of outside collateral. The contrary occurs when $\alpha < \alpha^*$. ■

The economic intuition behind proposition 3 is the different nature of equity and outside collateral in the credit contract. Equity is money invested in the project. Therefore, through the production activity, it produces a positive return for the lender given by $\left[p_h(c-\frac{B}{(p_h-p_l)})\right]$. Moreover, after the production activity, it becomes inside collateral. This type of asset produces a new positive stream of income in both states of nature, which depends on the share of collateralizable fraction $\alpha\left[p_h+(1-p_h)f(G)\right]$. Outside collateral is an asset not

used in production activity, thereby it produces only the second type of income, but independently of the fraction of collateralizable asset $[p_h + (1-p_h)f(G)]$. If the liquidation value of the inside collateral is very small, it can happen that the expected income from one more unit of outside collateral is larger than the total income from one more unit of equity.

Proposition 4 *If the collateralizable fraction of the investment goods is sufficiently high, an increment in the provision of the legal enforcement increases the multiplier of the entrepreneur's equity more than the multiplier of his outside collateral; i.e. there exists an* $\overline{\alpha}$*, such that if* $\alpha > \overline{\alpha}$ *then* $\frac{\partial d_1}{\partial G} > \frac{\partial d_2}{\partial G}$*, and if* $\alpha < \overline{\alpha}$ *then* $\frac{\partial d_1}{\partial G} < \frac{\partial d_2}{\partial G}$*.*

Proof. Let us consider the difference between the derivatives of the two multipliers with respect to the enforcement variable:

$$\left(\frac{\partial d_1}{\partial G} - \frac{\partial d_2}{\partial G}\right) = \frac{\alpha(1-p_h)f'(G) - (1-p_h)f'(G)\left[1-p_h(c-\frac{B}{(p_h-p_l)})\right]}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha) - \alpha(1-p_h)f(G)\right]^2}$$

This difference is negative if $\alpha < \left[1-p_h(c-\frac{B}{(p_h-p_l)})\right]$. We call this term $\overline{\alpha}$. It follows that if $\alpha < \overline{\alpha}$, then $\frac{\partial d_1}{\partial G} < \frac{\partial d_2}{\partial G}$. This means that the legal protection is more important for firms pledging outside collateral. If instead, $\alpha > \overline{\alpha}$, then $\frac{\partial d_1}{\partial G} > \frac{\partial d_2}{\partial G}$. In this second case, the right to repossess inside collateral in case of default is more important than the right to repossess outside collateral. If we compare the levels of $\alpha^*$and $\overline{\alpha}$, we see that $\alpha^* \leq \overline{\alpha}$, because the term $[p_h + (1-p_h)f(G)]$ is lower than 1. It follows that, if the multiplier of the inside equity is larger than the one of the outside collateral $(d_1 > d_2)$, then it also true that the legal protection of the right to repossess the inside collateral has a larger economic value $\left(\frac{\partial d_1}{\partial G} > \frac{\partial d_2}{\partial G}\right)$. Moreover, there are values of the parameter α $(\alpha^* \leq \alpha \leq \overline{\alpha})$, such that the multiplier of the inside equity is lower than the multiplier of the outside collateral, but the inside collateral is still more sensitive to the legal protection than the outside one. ■

One way to better understand the role of the three assets used in this model (A, I, H) and the implications of having different degree of legal protection is to compare this model with the Tirole's one (1997). We can obtain the original Tirole's model as a specific case of this more general set-up, by assuming that the borrower has no outside collateral $(H = 0)$ and all the investment is used to pay running costs $(\alpha = 0)$. Under these hypothesis, from proposition 1, we know that the debt capacity of firms depends only on equity: $L = A\left\{\frac{p_h(c-\frac{B}{(p_h-p_l)})}{1-p_h(c-\frac{B}{(p_h-p_l)})}\right\}$. Moreover, since the investment goods have no residual value after the production activity, the multiplier of equity (d_1) does not depend on the supply of the public good (G). This means that there is no role for government intervention: the degree of the legal protection of creditors rights does not affect the level of credit.

From proposition 1 and proposition 2, it follows that increasing values of the parameters α and H, increase the debt capacity (L). This means that the debt capacity derived from the Tirole's model is the lower bound.

3.2 Legal Enforcement and the Existence of Credit Rationing

So far, we have seen that the level of the legal protection provided by the public sector to the creditor rights affects the debt capacity and therefore the *level of credit constraints,* that firms face in the credit market. In this section, we wonder if the enforcement variable can also affect the *existence of credit constraints.*

Assumption 6 $\alpha \geq 1 - p_h \left(c - \frac{B}{(p_h - p_l)} \right)$

Assumption 6 guarantees that there is a positive amount of public good such that assumption 5 can not be satisfied. Assumption 6 is derived taking into account the properties of the function $f(.)$[12].

Proposition 5 *Under assumption 6, if the public sector is able to provide a sufficiently high degree of legal enforcement of the credit contracts, the credit constraints disappear. The threshold level of public good* $\left(\overline{G}\right)$ *is implicitly defined by the following condition:*

$$f(\overline{G}) - \frac{1}{\alpha(1-p_h)} + \frac{p_h}{\alpha(1-p_h)} \left(c - \frac{B}{(p_h - p_l)} + \alpha \right) = 0 \qquad (5)$$

Proof. Take assumption 4 and define $\overline{G}$, as the level of public good which makes assumption 4 holding with equality. ■

From proposition 5, it is clear that only if the collateralizable fraction of the investment goods is sufficiently high, the public sector is able to eliminate the rationing in the credit market, by providing more legal protection to the creditor rights. In fact, let us suppose that the degree of collateralizability is equal to zero ($\alpha = 0$). In this case the condition supporting the credit constraints does not depend on the provision of public good: $\left[1 - p_h \left(c - \frac{B}{(p_h - p_l)} \right)\right] > 0$. In fact this condition is satisfied for each value of $f(G)$. Even with perfect enforceability of creditor rights $[f(G) = 1]$, the maximum amount of investment is finite, $I = \frac{(A+H)}{\left[1 - p_h \left(c - \frac{B}{(p_h - p_l)} \right)\right]}$.

Proposition 6 *The level of public good able to remove the inefficiency due to asymmetric information depends on the technology of the project and on the seriousness of the moral hazard problem. The government has to provide a lower*

[12] Assumption 6 is derived by imposing that $f(G) \leq 1$. The other important property of the function f, $f(G) \geq 0$, would require the following assumprion: $\alpha \leq \frac{1}{p_h} - \left(c - \frac{B}{(p_h - p_l)} \right)$, which is always satisfied under assumption 5.

level of public good whenever the probability of success (p_h)*, the marginal productivity of the project* (c) *and the degree of capital intensity or asset specialization* (α) *are higher and a larger amount of public good whenever the level of private benefits* (B) *is larger.*

Proof. Let us consider equation (5). It defines the threshold level $\overline{G}$. Applying the Implicit Function Theorem, we are able to find the sign of the partial derivatives of $\overline{G}$ with respect to the parameters:

$$\begin{aligned}
\frac{\partial \overline{G}}{\partial B} &= \left[\frac{1}{(p_h - p_l) f'(\overline{G})}\right] > 0 \\
\frac{\partial \overline{G}}{\partial c} &= -\left[\frac{p_h}{\alpha(1-p_h) f'(\overline{G})}\right] < 0 \\
\frac{\partial \overline{G}}{\partial \alpha} &= \left[\frac{p_h\left(c - \frac{B}{(p_h - p)}\right) - 1}{\alpha^2(1-p_h) f'(\overline{G})}\right] < 0 \\
\frac{\partial \overline{G}}{\partial p_h} &= \left\{\frac{1 - \left[c - \frac{B(p_h^2 - p_l)}{(p_h - p_l)} + \alpha\right]}{\alpha(1-p_h) f'(\overline{G})(p_h - p_l)^2}\right\} < 0
\end{aligned}$$

Note that, by hypothesis $f'(\overline{G}) > 0$. From this consideration, it follows that $\overline{G}$ is increasing in the marginal productivity (c) and decreasing in the private benefits (B). Let us consider the other two derivatives. From assumption 4, it follows that the term $\left[p_h\left(c - \frac{B}{(p_h - p)}\right) - 1\right]$ is lower than zero, which implies that $\left(\frac{\partial \overline{G}}{\partial \alpha}\right)$ is negative. Finally, let us consider the last derivative. Since $(p_h^2 - p_l) \leq 1$, from assumption 5 it follows that the term $\left\{1 - \left[c - \frac{B(p_h^2 - p_l)}{(p_h - p_l)} + \alpha\right]\right\}$ is negative[13]. This implies that the public good is also decreasing in the probability of success in case of high level of effort. ■

4 Welfare Analysis

In this section we want to find the optimal supply of legal protection and to investigate how it depends on the firm's wealth endowment. We assume that public expenditure are financed by lump-sum taxes paid by lenders. We could also consider the case in which public expenditure are financed by proportional taxes on the total returns of the project. As we show in Appendix 6.2, the result does not change.

From the previous section, it follows that if there exists a level of legal enforcement able to remove the credit constraints $\left(\overline{G}\right)$ and it can be financed, then it will be the optimal one. If this is the case, then we end out with an economy where everything goes to infinitive. In order to make the analysis more interesting, we consider the case in which there is no a positive amount of

[13] From assumption 5, we know that $\left[1 - p_h\left(c - \frac{B}{(p_h - p_l)}\right) - \alpha\right] \leq 0$ and therefore it is also true that $\left[1 - \left(c - \frac{B}{(p_h - p_l)}\right) - \alpha\right] \leq 0$.

public expenditure which is able to completely eliminate the credit rationing. This means that we run our analysis under the following assumption:

Assumption 7 $\alpha < 1 - p_h \left(c - \frac{B}{(p_h - p_l)} \right)$[14]

We choose as social welfare indicator the sum of the utility level of borrowers and lenders:

$$SW = [p_h U_b^s + (1 - p_h) U_b^u + p_h U_l^s + (1 - p_h) U_l^u]$$

where p_h is the proportion of borrowers managing a successful project and also the proportion of lenders getting back the loan, while $(1 - p_h)$ is the proportion of unsuccessful borrowers and also the proportion of lenders receiving the liquidation value of the collateral assets. U_b^s is the utility levels of borrowers managing a successful project while U_b^u is the utility level of borrowers defaulting; U_l^s is the utility level of lenders providing funds to successful entrepreneurs and U_l^u is the utility levels of lenders who are forced to liquidate the collateral assets, due to the default of entrepreneurs. Due to the hypothesis of free entry in the credit market, the sum of the utility levels of both types of lenders $[p_h U_l^s + (1 - p_h) U_l^u]$ is equal to zero. Then, we obtain that the social welfare function coincide with the expected utility of each borrower:

$$SW = p_h U_b^s + (1 - p_h) U_b^u = p_h (R_b + \alpha I + H)$$

In order to make the analysis interesting, we assume that there exists a level of public expenditure such as the total level of surplus generated by the project under this degree of legal protection is high enough to allow the lenders to finance it. If there exists a such level of public expenditures, then also the level chosen optimally by the social planner will be positive. This will allow us to neglect the corner solution in which the optimal degree of legal protection is equal to zero.

The optimal level of legal protection corresponds to the solution of the maximization problem in which the social planner chooses the level of pubic expenditure (G) in such a way to preserve the incentive of the borrower to good behave and to induce the lender to finance the project:

$$\underset{I, R_b, R_l, G}{Max} SW = p_h (R_b + \alpha I + H)$$

$$(R_b + \alpha I + H) p_h \geq p_l (R_b + \alpha I + H) + BI \tag{6}$$

[14] Assumption 7 is the opposite with respect to assumption 6.

$$p_h R_l + (1 - p_h) f(G) (H + \alpha I) = (I - A) + T \tag{7}$$

$$cI = (R_b + R_l) \tag{8}$$

$$T = G \tag{9}$$

With respect to the analysis in section 3, we have two different constraints and a new choice variable (G). Equation (7) is the new participation constraint for the lender. Given the hypothesis of free entry in the financial market, the lender's total expected revenues from the project must cover not only the cost of the project ($I - A$), but also the payment of taxes to the government (T). Equation (9) is the budget balance condition for the public sector.

Substituting the participation constraint for the lender, the budget balance condition and the feasibility condition in to the objective function and in to the incentive compatibility constraint of the borrower, we can rewrite the social welfare problem in terms of the level of public expenditures (G) and the level of investment (I):

$$\underset{I,G}{MaxSW} = [cp_h + \alpha p_h + \alpha(1 - p_h) f(G) - 1] I + [p_h + (1 - p_h) f(G)] H - G$$

$$I \left[1 - p_h \left(c - \frac{B}{(p_h - p_l)} + \alpha \right) - f(G)(1 - p_h)\alpha \right] \leq A + H [p_h + f(G)(1 - p_h)] - G \tag{10}$$

Looking at the objective function, we might clearly see that the social welfare level is increasing in the level of investment (I). Not completely clear is the role of the public good, because it has two different effects on the welfare level. On the one hand, a larger degree of legal protection increases the social marginal productivity per unit of investment by $[\alpha(1 - p_h) f(G)]$ and the social value of each unit of outside collateral by $[(1 - p_h) f(G)]$. On the other hand, a better legal protection introduces a social cost because the taxes reduce the amount of private resources which can be shared between borrowers and lenders.

Proposition 7 *The optimal level of public expenditure (G^*) is the one that equalizes the expected marginal increment in the liquidation value of the collateral assets to the marginal cost of taxation i.e.:*

$$(1 - p_h) f'(G^*) [\alpha I(G^*) + H] = 1 \tag{11}$$

Proof. After having substituted the optimal level of investment, given by the upper bound of inequality (10), into the social welfare function, we can find the condition for the optimal supply of legal enforcement:

$$\frac{\partial SW}{\partial G} = 0 \Leftrightarrow \frac{\left[(1-p_h)f'(G)[\alpha I(G)+H]-1\right]\left[\frac{Bp_h}{(p_h-p_l)}\right]}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)\right]} = 0$$

Since the term $\left\{\frac{\frac{Bp_h}{(p_h-p_l)}}{1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G)}\right\}$ is positive, then the optimal level of pubic expenditure (G^*) is defined by the following two equations:

$$G^* : (1-p_h)f'(G^*)\left[\alpha I(G^*)+H\right] = 1 \tag{12}$$

where $I(G^*)$ is the level of investment chosen optimally by the private sector when the public sector is supplying the optimal level of legal protection, $I^* = I(G^*) = \frac{(A-G^*)+[p_h+(1-p_h)f(G^*)]H}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G^*)\right]}$ ■

Let us interpret the equation (11). The left hand side is the social marginal benefit of one further unit of public good. It is equal to the expected marginal increment in the liquidation value of collateral assets. This term depends on the properties of the function $f(.)$ and on the total stock of assets which are affected by the public good. The right hand side is the social marginal cost of taxation. Given the hypothesis of lump-sum taxation it is constant and equal to 1. We can interpret the function $f(.)$ as the production function of the public sector using taxes as input and producing the legal protection as output. Similarly, the partial derivative $f'()$ can be interpreted as the marginal productivity of the public sector in providing the public good. Following this interpretation, condition (11) tells us something about the goodness of having a public sector. It seems to suggest that the ability of a public sector to increase the welfare level of the society, by mitigating the negative effect of the asymmetric information on the credit market, depends on the marginal productivity of the judicial system.

Proposition 8 *The optimal level of public expenditure* (G^*) *is increasing in the level of inside equity* (A) *and in the degree of asset collateralizability* (α)*, while it is decreasing in the borrower's private benefits* (B)*.*

Proof. Substituting the optimal level of investment in to equation (11), we find the optimal level of public expenditure as an implicit function of the parameters of the model: $g(p_h, p_l, \alpha, B, A, H, G^*) = 0$

$$(1-p_h)f'(G^*)\alpha\frac{(A-G^*)+[p_h+(1-p_h)f(G^*)]H}{\left[1-p_h(c-\frac{B}{(p_h-p_l)}+\alpha)-\alpha(1-p_h)f(G^*)\right]} + (1-p_h)f'(G^*)H - 1 = 0$$

Using the Implicit Function Theorem, we can find how the optimal level of public expenditure depends on the inside equity, the degree of asset collateral-

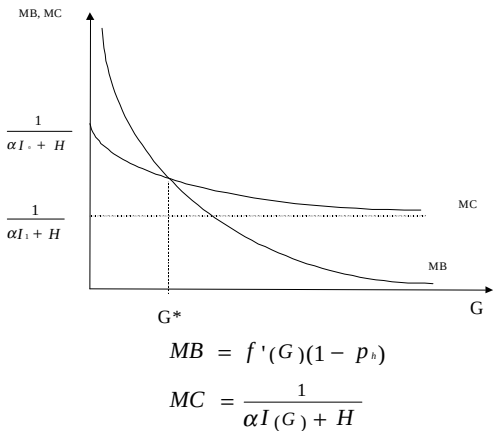

Figure 1: The optimal level of public expenditure in justice

izability and the borrower's private benefits:

$$\frac{\partial G^*}{\partial A} = -\frac{(1-p_h)f'(G^*)\alpha}{f''(G^*)[\alpha I(G^*)+H]\left[1-p_h\left(c-\frac{B}{(p_h-p_l)}+\alpha\right)-\alpha(1-p_h)f(G^*)\right]} > 0$$

$$\frac{\partial G^*}{\partial \alpha} = -\frac{f'(G^*)I(G^*)[1+\alpha p_h+\alpha(1+p_h)f(G)]}{f''(G)[\alpha I(G^*)+H]} > 0$$

$$\frac{\partial G^*}{\partial B} = \frac{f'(G^*)\alpha p_h I(G^*)}{f''(G^*)[\alpha I(G^*)+H](p_h-p_l)\left[1-p_h\left(c-\frac{B}{(p_h-p_l)}+\alpha\right)-\alpha(1-p_h)f(G^*)\right]} < 0$$

From the hypothesis $f'(G^*) > 0$ and $f''(G^*) < 0$ for any G. It follows that the sign of the first two derivatives is positive while the last one is negative. ■

In order to understand the economic intuition behind this result, we can consider figure 1, where we have drawn the marginal benefit per unit of collateral $[MB = (1-p_h)\,f'(G)]$ and the marginal cost per unit of collateral $\left[MC = \frac{1}{[\alpha I(G)+H]}\right]$, as functions of the level of public expenditure (G). As we can see, the marginal benefit of the legal protection per unit of collateral is decreasing in the level of public expenditure, given the hypothesis of decreasing returns to scale in the judicial system. The marginal cost of the public good is also decreasing in the level of public expenditure, because more legal protection implies an higher amount of collateral assets through the increment in the investment level.

Given the properties of the function $f(.)$, we are sure that there exists an intersection point between the two curves. Any change in the parameters of the model which reduces the marginal cost or increases the marginal benefit, corresponds to an increment in the optimal level of public expenditure and viceversa. Let us consider an increment in the level of inside equity (A). From proposition 1, it follows that each entrepreneur receives a larger amount of

external finance from the bank and therefore he can buy a larger amount of assets (I). The increment in the level of private investment decreases the marginal cost faced by the public sector below the marginal benefit. This implies that the public sector has the incentive to invest in the judicial system a larger amount of public expenditure. Due to the larger availability of public resources, the judicial system starts providing a better enforcement, which again increases the level of external finance and the amount of private investment. Therefore, not only the marginal benefit but also the marginal cost decreases. The economy converges to a new equilibrium point where the level of public expenditure is larger than before but still finite, because the marginal benefit falls down faster than what the marginal cost does, given the hypothesis of decreasing return to scale in the public sector. What we observe during the transition is a sort of *positive multiplier of the fiscal policy.* We obtain the same conclusion if we consider an increment in the degree of asset collateralizability (α). To the contrary, a larger amount of private benefits (B) shifts up the marginal cost and decreases the optimal amount of public expenditure.

5 Conclusions and Policy Implications

We have investigated the role of the legal enforcement of the right to repossess a collateral asset for the credit market. We have shown that the existence of credit constraints to the corporate sector and their seriousness depend on the degree of legal protection provided by the judicial system. In particular a more effective legal enforcement of the creditor's rights is associated with lower credit rationing and larger levels of private investment.

We have also found the condition that implicitly defines the optimal level of public expenditure in Justice. From this, it follows that the public provision of legal enforcement is welfare improving whenever the marginal benefit of one further unit of public good is larger or equal to the marginal cost of taxation. Moreover, we have shown that there is a positive relationship between the level of inside equity and the optimal degree of legal enforcement.

This chapter provides a new theoretical setting able to rationalize some recent empirical evidence showing a positive correlation between better legal institutions and amount of external finance to the corporate sector.

At the same time, it allows us to derive some new testable implications. For example, if we let the level of inside equity to be a measure of the firm's size, proposition 8 seems to suggest that countries, where the firms are bigger (larger inside equity) or where the degree of redeployability of the capital assets is larger, should provide better legal institutions (more efficient judicial system) because the marginal benefits of one further unit of public good is larger. This result is related to the one found by Kumar, Rajan and Zingales (1999). They argue that, other things equal, firms in countries with better creditor protection should be larger, since they can expand more through external finance and they provide evidence of this positive correlation. What we have shown is that also the opposite direction of causality can be applied: we could find that better

legal institutions are associated with larger firm's size because there is a virtuous circle behind: a stronger legal protection of the investors' allows the firms to expand, but this increases also the incentives of the public sector to invest more resources in the judicial system.

Appendix 1

In this appendix we want to investigate how the optimal credit contract analysis changes, if we assume that in case of default the borrower can still enjoy from the property of the collateral. We are considering the situation in which the firm makes default but the assets belong to the entrepreneur until the judicial civil trial is over. If the tribunal is very fast, then the collateral assets are immediately transferred to the lender. Otherwise, the entrepreneur might enjoy from the property of the asset even in case of default. In this new set up, it follows that the expected utility of the borrower depends on the legal enforcement variable not only through the return of the investment in the good state but also through the property of the assets in the bad state.

The new maximization problem is the following:

$$\underset{I,R_b,R_l}{Max}\, EU_b = \{p_h(R_b + \alpha I + H) + (1 - p_h)(\alpha I + H)\,[1 - f(G)]\}$$

$$R_b \geq \left[\frac{BI}{(p_h - p_l)} - (\alpha I + H)f(G)\right] \tag{13}$$

$$p_h R_l + (1 - p_h)f(G)(\alpha I + H) = (I - A) \tag{14}$$

$$cI = (R_b + R_l) \tag{15}$$

As we can see, the new hypothesis modifies the objective function of the borrower and his incentive compatibility constraint. As before, the possibility of pledging some collateral decreases the agency rent of the borrower, but now the magnitude of this effect depends on the quality of the judicial system. Since we assume that the public sector is not perfectly efficient, the borrower has a lower incentive to good behave than before, because he is loosing the asset only with a probability lower than one. Therefore, the lender has to transfer to the borrower a larger share of the total return in order to induce him to put the high level of effort into the project.

From the solution of this problem we obtain a new optimal level of loan:

$$L = \left\{ \frac{p_h(c - \frac{B}{(p_h - p_l)}) + \alpha f(G)}{1 - p_h(c - \frac{B}{(p_h - p_l)}) - \alpha f(G)} \right\} A + \left\{ \frac{f(G)}{1 - p_h(c - \frac{B}{(p_h - p_l)}) - \alpha f(G)} \right\} H \qquad (16)$$

If we compare equation (4) with that one in proposition (1), we see that the new optimal amount of loan is lower than the previous one. This means that, for the same endowment of wealth and the same quality of the judicial system, each firm is able to obtain a lower amount of loan. The intuition is that the entrepreneur has less incentive to good behave and this reduces the lender's ex ante incentive to provide funds.

Appendix 2

In this section, we investigate how the credit contract analysis changes, if we assume that the public sector finances the activity of the judicial system through proportional taxes on the total revenues of the project. We denote the tax rate by τ. Under this new hypothesis, the social planner has to chose the optimal tax rate (τ), the optimal investment level (I) and the optimal sharing rule (R_b, R_l), being careful to preserve the incentive of the borrower to exert the high level of effort, to induce the lender to finance the project and to satisfy the budget balance condition:

$$\underset{I, R_b, R_l, G, \tau}{Max} SW = p_h(R_b + \alpha I + H)$$

$$(R_b + \alpha I + H)p_h \geq p_l(R_b + \alpha I + H) + BI$$

$$p_h R_l + (1 - p_h) f(G)\,(H + \alpha I) = (I - A)$$

$$cI(1 - \tau) = (R_b + R_l)$$

$$p_h(\tau c I) = G$$

From the previous analysis, we know that the incentive compatibility constraint of the borrower is binding, if we consider the optimal credit contract. Substituting the four constraints in the objective function, we can rewrite the maximization problem in the following way:

$$\begin{aligned} \underset{G}{MaxSW} \quad = \quad & \frac{[cp_h+\alpha p_h+\alpha(1-p_h)f(G)-1]\{A-G+H[p_h+(1-p_h)f(G)]\}}{\left[1-p_h\left(c-\frac{B}{(p_h-p_l)}+\alpha\right)-\alpha(1-p_h)f(G)\right]}+ \\ & -G+H\left[p_h+f(G)(1-p_h)\right] \end{aligned}$$

Now we have a new problem where the only choice variable is the level of public spending. We can easily find the condition for a maximum:

$$\frac{\partial SW}{\partial G}=0 \Leftrightarrow \frac{\left[(1-p_h)f'(G)[\alpha I(G)+H]-1\right]\left[\frac{Bp_h}{(p_h-p_l)}\right]}{\left[1-p_h\left(c-\frac{B}{(p_h-p_l)}+\alpha\right)-\alpha(1-p_h)f(G)\right]}=0$$

where $I(G)=\frac{\{A-G+H[p_h+(1-p_h)f(G)]\}}{\left[1-p_h\left(c-\frac{B}{(p_h-p_l)}+\alpha\right)-\alpha(1-p_h)f(G)\right]}$.

Since the term $\left\{\frac{\frac{Bp_h}{(p_h-p_l)}}{1-p_h\left(c-\frac{B}{(p_h-p_l)}+\alpha\right)-\alpha(1-p_h)f(G)}\right\}$ is positive, then the optimal degree of legal protection G^* and the optimal level of investment I^* are defined by the following two equations:

$$\begin{aligned} G^* \quad : \quad & (1-p_h)f'(G^*)\left[\alpha I(G^*)+H\right]=1 \\ I^* \quad = \quad & I(G^*)=\frac{(A-G^*)+[p_h+(1-p_h)f(G^*)]H}{\left[1-p_h\left(c-\frac{B}{(p_h-p_l)}+\alpha\right)-\alpha(1-p_h)f(G^*)\right]} \end{aligned}$$

where $I(G^*)$ is the level of investment optimally chosen by the entrepreneurs when the public sector is supplying the level of public good equal to G^*.

If we compare these two equations with those ones found in case of lump-sum taxation (equation 12), we might see that they are equal. This means that the decision to use proportional taxes instead of lump-sum taxes does not introduce distortions in the economy. Since the two maximization problems are the same, all the results we obtained in the paper hold also in case of proportional taxation. It follows that any increment in the level of inside equity increases the optimal amount of legal protection, as we have found in case of lump-sum taxation.

The equivalence between the two types of taxation comes from the hypothesis of linearity in the technology of the project.

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