INSOLVENCY INSTITUTIONS AND EFFICIENCY: THE SPANISH CASE

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Abstract

The paper warns about the potential efficiency losses associated with low business bankruptcy rates (number of firms filing for bankruptcy as a proportion of the total stock of firms) and shows that welfare could be improved by increasing the protection of creditors in the bankruptcy system. These ideas are illustrated with the Spanish case. The paper also predicts a positive correlation between welfare and bankruptcy rates, a finding that seems consistent with the empirical evidence. The argument, analysed with an incomplete contracts model à la Bolton and Scharfstein (1996), is as follows. The low efficiency and low creditor protection of the Spanish bankruptcy system relative to those of an alternative insolvency institution, namely the mortgage system, mean that firms and their creditors mainly deal with credit provision and eventual insolvency through the latter. However, in order to use the mortgage system, some firms must overinvest in capital assets (real estate, equipment) since those are the assets that can be pledged as mortgage collateral. This overinvestment leads to productive inefficiencies, which may be very costly for industries that require a high level of other factors of production (e.g. R&D). Furthermore, the mortgage system is too creditor friendly, in the sense that it always grants the control of the firm's assets to creditors in the event of default. Since creditors are inherently biased towards liquidation, this leads to some inefficient liquidations.

Keywords: bankruptcy, mortgage, insolvency, efficiency.

JEL classification: D6, G21, G33, K0.

Resumen

El presente trabajo alerta sobre las potenciales pérdidas de eficiencia asociadas a bajas tasas de concursos empresariales (número de empresas que solicitan concurso de acreedores dividido por el total de empresas) y muestra que el bienestar podría mejorar al incrementar la protección de los acreedores en el concurso. Estas ideas son ilustradas con el caso español. También se predice una correlación positiva entre bienestar y tasas de concursos, un resultado que parece coherente con la evidencia empírica. El argumento, analizado con un modelo de contratos incompletos que parte del de Bolton y Scharfstein (1996), es el siguiente. La baja eficiencia y la baja protección a los acreedores en el sistema concursal español en comparación con los de una institución de insolvencia alternativa, el sistema hipotecario, provocan que las empresas y sus acreedores generalmente canalicen el crédito y resuelvan sus problemas de insolvencia mediante esta segunda. Sin embargo, para poder usar el sistema hipotecario, algunas empresas deben sobreinvertir en capital (inmuebles, bienes de equipo), puesto que estos son los activos que pueden ser usados como garantía hipotecaria. Dicha sobreinversión lleva a ineficiencias productivas, las cuales pueden ser muy costosas para industrias que requieren un alto nivel de otros factores de producción (p. ej., I+D). Además, el sistema hipotecario es muy proacreedor, en el sentido de que siempre concede el control de los activos de la empresa a los acreedores en caso de impago. Dado que los acreedores están inherentemente sesgados a la liquidación, esto lleva a algunas liquidaciones ineficientes.

Palabras clave: concursos de acreedores, hipotecas, insolvencia, eficiencia.

Códigos JEL: D6, G21, G33, K0.

1 Introduction

This paper warns about the potential efficiency losses associated to low business bankruptcy[1]rates (number of firms filing for bankruptcy over the total stock of firms), and illustrates this idea with the Spanish case. It also predicts a positive correlation between welfare and bankruptcy rates, a finding that is consistent with the available cross-country empirical evidence when the former is proxied by per capita GDP (Claessens and Klapper, 2005, Celentani, García-Posada and Gómez, 2010).

Spain has traditionally had one of the world's lowest business bankruptcy rates. For instance, Table 1, which shows bankruptcy rates for 30 countries -both developed and emerging economies-, reveals that Spain had the second lowest bankruptcy rate in 2006, just after Poland.[2] An even more striking observation is the difference in the orders of magnitude between Spain and other developed economies: for instance, while there were around 179 bankruptcies per 10,000 firms in France, 115 in the U.K. and 96 in Germany, there were less than 3 in Spain.[3]

Table 1: Business bankruptcy rates around the world, 2006

Business bankruptcy rates are computed as the number of business bankruptcies per 10,000 firms. Source: authors' computations with data from Euler Hermes (2007).

Country	Bankruptcy rate	Country	Bankruptcy rate
Poland	1.79	Ireland	53.39
Spain	2.56	Sweden	67.13
Czech Republic	5.43	Denmark	67.61
Singapore	5.95	Netherlands	79.60
Brazil	5.95	Japan	86.59
Greece	6.81	Norway	95.51
South Korea	7.78	Germany	96.31
Hong Kong	8.10	Finland	96.64
Taiwan	10.02	Belgium	107.24
China	11.17	UK	114.69
Portugal	15.01	Hungary	134.96
Italy	25.48	Switzerland	151.58
Canada	29.83	France	178.59
Slovak Republic	32.66	Luxembourg	231.62
USA	33.46	Austria	239.81

[1]By "bankruptcy" we mean a legal procedure that imposes external supervision over the financial affairs of a firm or individual that has broken its promises to creditors (i.e., default) or honours them with difficulty.

[2]This finding is robust to controlling for business exit rates, which turn out to be somewhat low in Spain (García-Posada and Mora-Sanguinetti, 2012).

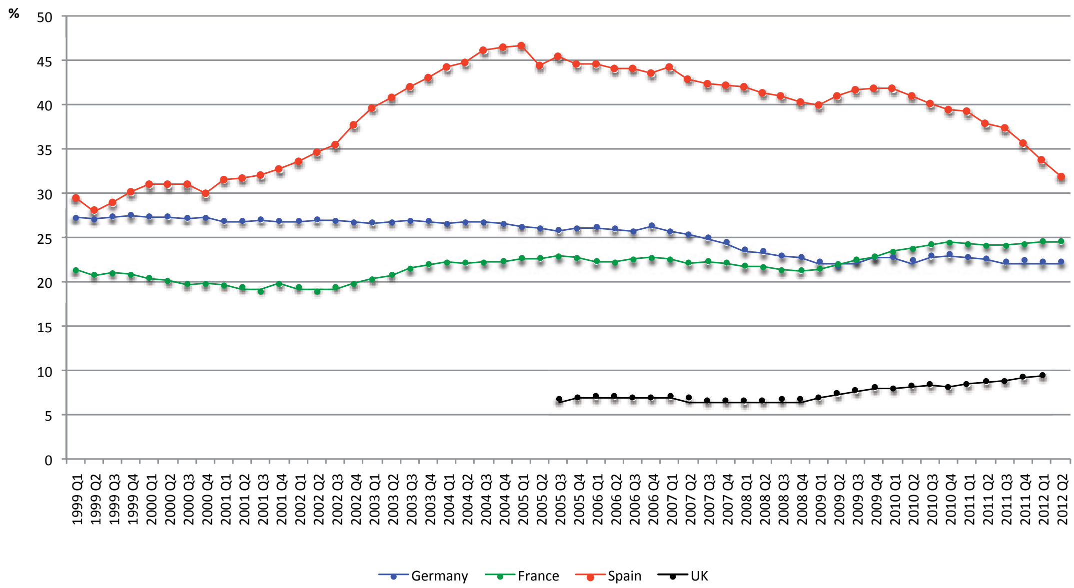
[3]Only the deep economic crisis that Spain is currently experiencing has modestly increased the number of bankruptcies, but the Spanish rates are still very low relative to those of most developed economies (Euler Hermes, 2011).

This means that Spanish firms rarely file for bankruptcy, which may suggest that economic agents regard the system as inefficient and try to deal with insolvency in alternative ways.[4] The wider use of mortgage debt by Spanish firms relative to those of other European countries, as shown in Figure 1, suggest that foreclosure proceedings –which allow creditors to seize the assets that serve as collateral for the loan- may play a major role as an alternative mechanism to bankruptcy in the case of Spain.[5] The findings of Celentani, García-Posada and Gómez (2010, 2012) and García-Posada and Mora-Sanguinetti (2012) point at the same direction. Celentani, García-Posada and Gómez (2010, 2012) find that Spanish firms have a higher proportion of tangible fixed assets (land, buildings, plant and machinery) than French, German and Italian companies, even when controlling by size and industry. Since tangible fixed assets are the only assets that can be used as *mortgage* collateral, they expect Spanish firms to hold a higher proportion of mortgage debt as well. García-Posada and Mora-Sanguinetti (2012), using a sample of more than 1 million firms from Spain, UK and France, find that in Spain holding tangible fixed assets reduces the probability of filing for bankruptcy much more than in the other two countries.

[4] As in Garoupa and Morgado (2006) the term "insolvency" means "financial distress", i.e., the firm cannot pay its debts as they fall due.

[5] The increase in the Spanish series in the available period, 1999-2012, is likely to be explained by the housing boom that the Spanish economy experienced during most of that period. However, two remarks are worth making. One is that the level of the series at the beginning of the period, when the housing boom was just starting, was already substantially higher than the French one. The other one is that the British economy also experienced a strong housing boom-bust cycle, but the UK series -only available from 2005q3- is flat. In other words, the increase and subsequent decrease in the price of real estate and, in turn, in the collateral value of mortgage loans has not changed the weight of these loans in the total value of the loans received by British firms, unlike the Spanish case, which corroborates our hypothesis that the mortgage system plays a much more important role in Spain than in the UK.

Figure 1: Mortgage loans to total bank loans granted to firms (%), 1999-2012.



The hypothesis on the low business bankruptcy rates in Spain, which draws from Celentani, García-Posada and Gómez (2010), can be exposed as follows. The Spanish bankruptcy system is very inefficient due to lengthy and costly procedures, yielding low creditors' recovery rates. Moreover, it does not protect creditor rights enough, hence not providing lenders with the correct incentives to provide credit. By contrast, there is an alternative insolvency institution, the mortgage system, whose procedures are speedier and cheaper, and it grants a high degree of protection to creditors. This institutional framework makes firms and their creditors mainly deal with credit provision and eventual insolvency through the mortgage system. However, this is not necessarily a unique feature of the Spanish institutional framework. For instance, according to Morrison (2008b), who studies the case of small US firms, businesses and creditors may find it cheaper and speedier to liquidate the firm's assets using procedures based on the law of secured transactions such as a foreclosure proceeding rather than filing for bankruptcy, among other alternatives.

But this paper's main contribution is to point at the potential efficiency losses associated to those low business bankruptcy rates. The Spanish institutional framework, in which only one of the insolvency institutions –the mortgage system- is widely used, while the other one–the bankruptcy system- is relegated to marginal cases, may generate several inefficiencies. The reason is that the mortgage system is not well suited for some industries, which incur in several costs when using it.

First, in order to use the mortgage system, some firms must *overinvest* in capital assets (real estate, equipment)[6] since they are the ones that can be pledged as mortgage collateral[7]. Evidence of such an overinvestment is reported in Celentani, García-Posada and Gómez (2012). The overinvestment in capital leads to productive inefficiencies, which may be very costly for industries that require a high level of other production factors (e.g., R&D). Furthermore, the mortgage system is too creditor-friendly, in the sense that it always grants the control of the firm's assets to creditors in the event of default. Since creditors are inherently biased towards liquidation, this leads to some inefficient liquidations. This dead-weight loss will be greater for firms with low liquidation values but high going-concern ones, such as those from technologically innovative industries, which are normally characterised by high levels of human capital and firm-specific assets. Therefore, the rare use of the bankruptcy system may be associated to low levels of welfare.

The above argument is analysed in a model à la Bolton and Scharfstein (1996) within an incomplete contracts framework and an agency problem in the credit market. Credit contracts can be signed -and, if necessary, enforced- under the bankruptcy institution or under the mortgage institution. The mortgage institution is more efficient, in the sense that the liquidation proceedings from seizing the project's assets are higher under that institution than under bankruptcy. However, it may be too creditor-friendly, in the sense that the creditor takes control of the assets with certainty following default, which he will always liquidate even if the project's continuation value is higher than its liquidation value, leading to inefficient liquidations. By contrast, under the bankruptcy institution the creditor takes control of the assets with some probability less or equal to 1, reducing the chances of an inefficient liquidation. Finally, firms can overinvest in capital in order to reduce funding costs, but at the expense of costs of productive inefficiencies.

In this set up it is shown that the economy's welfare is a non-monotonic function of the creditor's liquidation rights under bankruptcy, whose maximum is achieved at their optimal level. More interestingly, welfare is higher when creditor rights exceed their optimal level than when they do not reach it. The reason is that, when creditor rights are lower than the optimal, all projects must be implemented under the mortgage institution, so that the bankruptcy institution is not used at all. By contrast, when creditor rights are equal or higher than the optimal, both institutions can be used, so that each firm will choose the one that suits it the best. This goes in line with Hart (2000) and Ayotte and Yun (2007), which suggest that allowing for a menu of insolvency options that differ in aspects such as their debtor/creditor orientation can increase efficiency. In our model this is achieved by setting creditor rights under bankruptcy high enough.

[6]From now on we will use the term "capital assets" or just capital rather than "tangible fixed assets", which is an accounting term.

[7]Such overinvestment can take place by, for instance, substituting labour for capital or purchasing machinery instead of renting it, since in the first way it can be included in the mortgage contract.

The model's conclusions can be applied to the Spanish case, in which the current institutional framework may lead to low business bankruptcy rates and low welfare. The model also suggests, as a policy recommendation, to increase the protection of creditors under bankruptcy since this would increase both welfare and bankruptcy rates. Ideally, these should be set at the optimal level predicted by the model. If, in practice, this is not feasible, it is better to set the level "too high" (i.e., too creditor-friendly) than "too low" (i.e., too debtor-friendly), since the potential welfare losses from the latter are much greater than those from the former.

Another contribution of the paper is that it endogeneizes firms' asset structure, making it depend on the design of insolvency institutions, while most papers in the literature take it as given. This theoretical development may have relevant empirical implications. For instance, Djankov *et al.* (2008) designed a survey to provide a quantitative measure of the efficiency of insolvency institutions around the world. The survey is based on a hypothetical case study on a firm for which they assume *exogenous* capital and asset structures that do not vary across countries. The firm's financial distress can be solved via bankruptcy o via foreclosure. However, their study finds somewhat puzzling results for the Spanish case. First, it predicts that the firm will end up filing for bankruptcy, while bankruptcy is rarely used in Spain -as it was illustrated in Table 1. Second, it attributes quite a high degree of efficiency to the Spanish bankruptcy system, well above those of other European countries such as Germany or France, unlike what the available evidence suggests (García-Posada and Mora-Sanguinetti, 2012). One of the factors that may explain those contradictions is that firms adjust their asset structures to the specific features of their country's insolvency institutions, as shown by Davydenko and Franks (2008).

The rest of the paper is organised as follows. Section 2 presents the base model. Section 3 solves for the optimal credit contracts under each insolvency institution, the bankruptcy and the mortgage systems. Section 4 analyses the choice of insolvency institution by a representative firm. Section 5 generalises to a set of heterogenous firms in order to study the impact of the institutional design on welfare and bankruptcy rates. Section 6 draws some policy implications for the Spanish case. Section 7 concludes and indicates potential extensions. Appendix A explains the Spanish institutional framework. Appendix B discusses some of the model's parametric assumptions. Proofs of lemmas and propositions are in Appendix C, while Appendices D and E study two generalisations of the model.

2 Base Model: Distress Resolution via Private Workouts.

2.1 Model setup

In principle, individuals can deal with financial distress themselves -i.e., without the use of an insolvency institution- via a private workout.[8] A firm and its creditors may write their own insolvency procedure by specifying as part of a debt contract what should happen in a default state.

Consider a three-period model[9] (t=0,1,2) in which there is a wealthless manager and a perfectly competitive lender. Both players are risk-neutral and there is no time discounting. Market interest rates are normalised to zero. The manager owns an investment project, which requires an initial outlay of I at t=0 for the purchase of some productive assets. Notice that the assumption of perfect competition in the credit market is only made for analytical simplicity. Appendix E shows a version of the model that relaxes this assumption, proving that the model's conclusions are robust to different degrees of competition in the credit market.

If the manager had I available (first-best), she would undertake the project. The project cash flows would be $\tilde{\pi_1}$=π with probability θ or $\tilde{\pi_1} = 0$ with probability $1 - \theta$ at t=1, and $\tilde{\pi_2}$=π with probability ϕ or $\tilde{\pi_2} = 0$ with probability $1 - \phi$ at t=2, where $\tilde{\pi_1}$ and $\tilde{\pi_2}$ are independently distributed. We assume $I \leq \theta\phi\pi$ for lending to be feasible under very general circumstances (see below). If for some reason the project is liquidated, it yields proceedings equal to αl, where $0 \leq \alpha \leq 1$ captures the transaction costs incurred in liquidating the assets (i.e., the higher the α, the more efficient the liquidation tecnology) and l is the project's liquidation value.

We depart from the existing literature in the nature of the liquidation value l . While it has always been treated as an exogenous parameter, in this model it is an endogenous variable. The project can be undertaken with different combinations of productive assets, namely capital and labour, which determines the project's liquidation value. Specifically, the liquidation value l will be proportional to the share γ of the initial outlay I spent in the purchase of capital: $l = \gamma I$ where $0 \leq \gamma \leq 1$. Hence $l \in [0, I]$.

There is only a proportion of capital, and hence a liquidation value l, which is efficient from the point of view of the production process, i.e., a combination of capital and labour that minimises costs by equatting the marginal rate of technical substitution to the ratio of input prices. Let us call this first-best liquidation value by l^{FB}. The rest of the proportions lead to productive

[8] A workout is a private reorganisation process in which the major financial creditors of the distressed company act in a coordinated manner to either restructure its debt, so that the company can be kept as a going concern, or to liquidate the company's assets in a orderly manner.

[9] The model is an adaptation of Bolton and Scharfstein (1996) who use a model of non-verifiable cash flows to analyse the optimal debt structure as a function of the number of creditors.

inefficiencies. Since there is a direct mapping between the proportion of the investment spent in capital γ and the liquidation value l, we can express the cost from productive inefficiencies as a function of l, i.e, $D(l)$, where $D(l = l^{FB}) = 0$. If the manager deviates from the optimal proportion of capital, then the cash flow at t=1 would be $\tilde{\pi_1}$=$\pi - D(l)$ with probability θ or $\tilde{\pi_1} = 0$ with probability $1 - \theta$.

For simplicity we assume $D(l) = nl$ where $n > 0$. A justification of the use of this function can be found in Appendix A. In this function $l^{FB} = 0$, so that $l > 0$ means over-investment in capital. The parameter n is the marginal cost from overinvestment. Different investment projects may have different values of n. For instance, an R&D project may have a higher n than a construction project, which implies a higher cost from productive inefficiencies for the same level of over-investment in the former case.

Cash flows are observable to both parties but nonverifiable to a third party such as a court of law. This can result from direct expropriation of cash flows or from managerial perquisite consumption. This assumption allows for moral hazard in the form of strategic default. By contrast, loan repayments, as well as the project's assets and the proceeds from the sale of liquidated assets, are verifiable.[10] In this setting, credit contracts based on realised cash flows are not feasible because they cannot be enforced, but they can be based on repayments made by the firm, since the relevant judge or court can verify that the manager has defaulted and enforce the assets' repossession and subsequent liquidation. The threat to repossess the assets by the lender, thus depriving the manager from some or all of the project's cash flows at t=2, provides the incentive for the manager to repay at t=1. The nonverifiability of cash flows also implies that long-term credit contracts (i.e., contracts payable at t=2) are not feasible. Since the manager does not face any repossession threat at t=2, she would always default and the lender could only recover $\alpha l \leq I$ of the loan.

2.2 Optimal contract.

Within this framework let us analyse the following credit contract. In exchange for borrowing I at t=0, the manager promises a repayment R at t=1. If she repays R, she keeps control of the project's assets throughout t=2. If she does not repay, the lender assumes control of the firm's assets with probability β. In such a case, the lender will always liquidate the firm because he will obtain $\alpha l \geq 0$ through the sale while obtaining zero if keeping it as a going concern, since he lacks the managerial skills to make the project generate any cash flow at t=2. The assumption that the lender makes zero cash flows from managing

[10]The assumption that the project's assets are verifiable is based on the idea that it is harder to divert productive assets than to divert cash flows, but what matters for the analysis is that part of the project's value is verifiable. As expressed by Hart and Moore (1998, page 7): "In practice, the distinction between cash flows (which can be diverted) and physical assets (which cannot) may not be as stark as we assume. What is important for the analysis that follows is that the investor can get her hands on something of value in a default state: the physical assets represent this source of value. Obviously, if the entrepreneur can divert everything, including the assets that generate future cash flows, then the investor has no leverage at all."

the assets by himself is just a normalisation: the key point is that he gets more by selling the assets, which captures the classic idea that creditors are inherently biased toward liquidation.[11] Since the lender is perfectly competitive, the manager has all the bargaining power and she makes a take-it-or-leave-it offer to the lender $\{R, \beta, l\}$ at t=0.

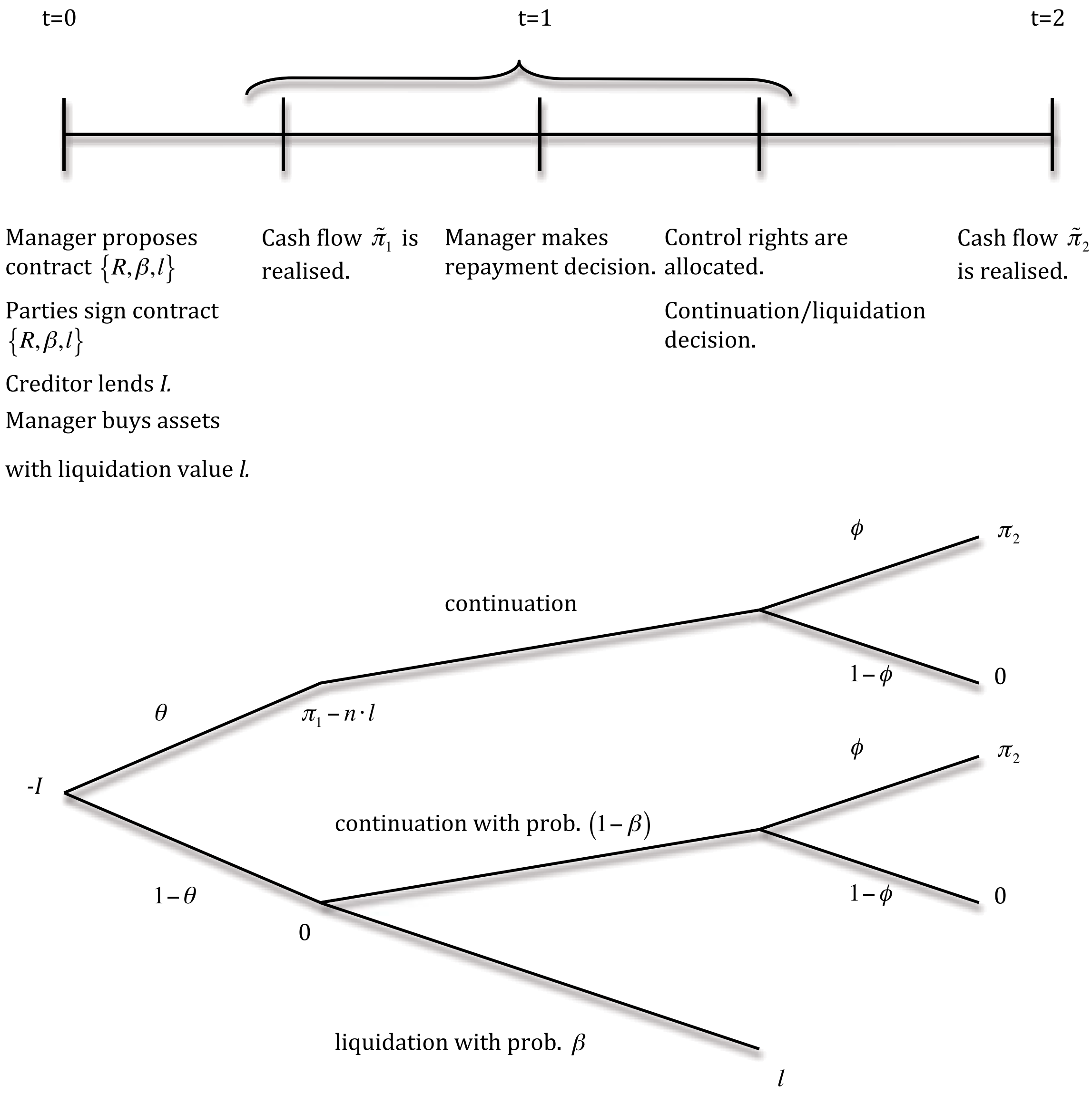
We assume that liquidations are *ex-post* inefficient, i.e., the liquidation value is lower than the continuation value: $\alpha l \leq \phi\pi \forall l$. This implies that, if the manager does not default at t=1 -hence keeping control over the assets- she will want to continue the project throughout t=2, therefore obtaining $\phi\pi$, instead of liquidating it herself, which would yield αl.

Notice that, since cash flows are nonverifiable, the manager can always choose whether to repay R when the cash flow at t=1 is positive or to repay nothing and default (the so-called strategic default). If the cash flow at t=1 is zero, then the firm must default on its debt. We abstract from renegotiation issues by assuming full commitment. The timeline of the model, as well as the cash flows contingent on the liquidation or continuation of the project -provided there is no strategic default- are shown in Figure 2.

It is worthwhile mentioning that a more general contracting space does not change the results. In the current setup we analyse probabilistic all-or-nothing liquidations, in which *all* assets are seized and sold by the creditor. In Bolton and Scharfstein (1996) probabilistic liquidations are combined with the possibility of partial liquidations, where only a fraction z of the assets is liquidated. However, they show that partial liquidations are never optimal, while probabilistic liquidations (i.e., $\beta < 1$) are optimal, so the former case can be ruled out. The contract could also be generalised by allowing creditors to take control of the assets even if there is repayment with probability β_π, but it is straightforward to show that the solution for the optimal contract yields $\beta_\pi^* = 0$ (i.e., it is never optimal to liquidate when the manager repays). Finally, one could set a repayment schedule for both states of nature, i.e., R_π and R_0 but, since the manager is wealthless, we need to set the feasibility condition $R_0 \leq 0$, which it is easy to show that leads to $R_0^* = 0$.

[11] Creditors are normally considered to be biased toward liquidation because the nature of their claims makes their payoff functions concave, so that they would not fully enjoy the upside potential but they would suffer from the downside risk if keeping the firm as a going concern. See, inter alia, Hart (2000), Ayotte and Yun (2007), Acharya *et al.* (2009) and Acharya *et al.* (2011).

Figure 2: model's time line and cash flows (no strategic default)



The optimal contract maximises the manager's expected utility EU -which is just the project's expected profits- subject to the following constraints: (1) the manager does not default strategically (incentive compatibility); (2) the lender decides to provide credit (individual rationality); (3) since the manager is wealthless, the repayment cannot exceed the cash flow at t=1 in the good state of nature (first feasibility constraint); (4) the liquidation probability β lies in the interval $[0, 1]$ (second feasibility constraint). Formally, the maximisation problem is the following:

$$\underset{\{R,\beta,l\}}{MAX}\ EU = \theta\left[\pi - nl - R + \phi\pi\right] + (1-\theta)(1-\beta)\,\phi\pi$$

subject to:

$$\pi - nl - R + \phi\pi \geq \pi - nl + (1-\beta)\,\phi\pi \tag{1}$$

$$\theta R + (1-\theta)\,\beta\alpha l \geq I \tag{2}$$

$$R \leq \pi - nl \tag{3}$$

$$0 \leq \beta \leq 1 \tag{4}$$

Equation (1) shows the repayment decision of the manager after having observed the cash flow at t=1. Since the manager is wealthless, this decision only takes place when the cash flow is non-zero, i.e., $\tilde{\pi_1}$=$\pi - nl$. The left-hand side of (1) shows the expected payoff when the manager decides to repay, while its right-hand side shows the expected payoff when she decides to default strategically. If she chooses to repay R, she keeps the control of the firm with certainty and obtains the expected cash flow $\phi\pi$ at t=2. If instead she chooses to default, she repays nothing and keeps the cash flow at t=2 with probability $(1-\beta)$. An alternative interpretation of the incentive-compatibility constraint comes from simplifying and rearranging (1):

$$\beta\phi\pi \geq R \tag{5}$$

Equation (5) shows that, for the contract to be incentive-compatible, the expected punishment from defaulting strategically, $\beta\phi\pi$, must be greater or equal to the benefit from carrying out such a strategy, R.

We now give some intuition for how to find the optimal contracts, while leaving the formal proofs for the Appendix B. The following lemmas help finding the optimal contracts.

LEMMA 1: *The individual rationality constraint of the lender (2) is binding at the optimum.*

LEMMA 2: *The incentive compatibility constraint of the manager (1) is binding at the optimum.*

Lemma 1 comes from the fact that the lender is perfectly competitive, so he makes zero profits $\pi_L = \theta R + (1-\theta)\,\beta\alpha l - I$ at the optimum. Lemma 2 is a typical feature of this type of contracting problems (Bolton and Scharfstein, 1990).

In the case of $\alpha > 0$, by making use of Lemmas 1 and 2 we can express the optimal liquidation probability β^* and the optimal repayment R^* as functions of the optimal liquidation value l^*, i.e., $\beta^* = \frac{I}{\theta\phi\pi + (1-\theta)\alpha l^*}$ and $R^* = \frac{I\phi\pi}{\theta\phi\pi + (1-\theta)\alpha l^*}$ These expressions reveal two interesting relations: $\frac{\partial\beta^*}{\partial l^*} < 0$ and $\frac{\partial R^*}{\partial l^*} < 0$, i.e., both β^* and R^* decrease as l^* increases. The intuition is that, by increasing the lender's recovery in the bad state of nature αl^*, the manager can decrease the repayment in the good state of nature R^* (see (2)) and also the liquidation probability β^*, since the incentives for strategic default decrease as well (see (5)). The solution for the optimal contract arises from finding l^* and plugging it into the above expressions for $R^*$and β^*. Proposition 1 summarises the optimal contract when $\alpha > 0$.

PROPOSITION 1: *The optimal contract in the case of distress resolution via a private workout when* $0 < \alpha \leq 1$, $\{R^*, \beta^*, l^*\}$, *is:*
$R^* = \phi\pi\beta^*, \beta^* = \frac{I}{\sqrt{\frac{(1-\theta)I\phi\pi}{\theta n}\alpha - \theta^2\phi^2\pi^2\frac{1-\alpha^2}{\alpha^2}}}, l^* = \sqrt{\frac{I\phi\pi}{\theta(1-\theta)n\alpha} - \frac{\theta^2\phi^2\pi^2(1-\alpha^2)}{(1-\theta)^2\alpha^4}} - \frac{\theta\phi\pi}{(1-\theta)\alpha}$.

The rather complex expressions of Proposition 1 yield, however, some interesting insights. The optimal contract is tailored to the project's characteristics and, specifically, to the technological parameter n. First, notice that $\frac{\partial l^*}{\partial n} < 0$, i.e., the higher the marginal cost of overinvesting in capital n, the lower the optimal liquidation value l^*. Second, $\frac{\partial \beta^*}{\partial n} > 0$ and $\frac{\partial R^*}{\partial n} > 0$, i.e., projects with higher marginal cost of overinvesting in capital n need to offer a higher liquidation probability β^* and a higher repayment R^* to the lender. These can be understood by using the chain rule: $\frac{\partial \beta^*}{\partial n} = \frac{\partial \beta^*}{\partial l^*} \cdot \frac{\partial l^*}{\partial n}$ and $\frac{\partial R^*}{\partial n} = \frac{\partial R^*}{\partial l^*} \cdot \frac{\partial l^*}{\partial n}$ where, as shown before, $\frac{\partial \beta^*}{\partial l^*} < 0$, $\frac{\partial R^*}{\partial l^*} < 0$ and $\frac{\partial l^*}{\partial n} < 0$. In words: increasing the liquidation value reduces the liquidation probability and the repayment, but the liquidation value decreases as the marginal cost of overinvesting in capital rises.

Proposition 2 summarises the optimal contract when $\alpha = 0$. The intuition is straightforward. If $\alpha = 0$, then the liquidation proceedings αl are zero irrespective of the liquidation value l, so that overinvesting in capital (i.e., $l > 0$) does not reduce funding costs R but it reduces cash flows at t=1 by nl. In other words, since pledging collateral is useless but costly, no overinvestment takes place: $l^{**} = 0$. Notice that the liquidation probability β^{**} lies in the $[0, 1]$ interval since $I \leq \theta\phi\pi$ by assumption.

PROPOSITION 2: *The optimal contract in the case of distress resolution via a private workout when* $\alpha = 0$, $\{R^{**}, \beta^{**}, l^{**}\}$, *is:*
$R^{**} = \frac{I}{\theta}, \beta^{**} = \frac{I}{\theta\phi\pi}, \quad l^{**} = 0$.

3 Distress Resolution via Insolvency Institutions.

Although, in principle, individuals can deal with financial distress themselves, i.e., without the use of an insolvency institution, contract incompleteness makes private workouts often unfeasible in practice (Hart, 2000). As the previous section showed, a firm and its creditors may write their own insolvency procedure -tailored to their own situation- by specifying as part of a debt contract what should happen in a default state. However, writing such a contract may be difficult since, for instance, the debtor may acquire new assets and creditors as time passes. Moreover, private workouts are often unfeasible due to high bargaining costs: they fail due to coordination and asymmetric information problems (Gilson *et al*, 1990; Morrison, 2008a). In fact, the empirical evidence shows that firms rarely write such contracts[12] and that, by contrast, almost all countries have some form of state-provided insolvency institution (Hart, 2000). An insolvency institution would offer an "off the shelf" procedure for distress resolution, i.e., one that the parties can use if they do not write their own. In the next section we model two insolvency institutions -bankruptcy and mortgage- as providers of pre-specified credit contracts that the manager and the lender of our base model can use.

3.1 Modelling insolvency institutions.

The above contracting game can be implemented under two different institutions: the bankruptcy system and the mortgage system. This means that the manager and the lender, when aggreeing on $\{R, \beta, l\}$, also choose which institution for distress resolution they will use in the event of default, so that contracts are signed and enforced under that institution. Given some particular features of each system, let us use the subscripts B and M for the values of variables and parameters in bankruptcy and mortgage, respectively. The contract under bankruptcy will be denoted by $\{R_B, \beta_B, l_B\}$ and the contract under mortgage by $\{R_M, \beta_M, l_M\}$.

If parties decide to use the bankruptcy system, the lender assumes control of the firm's assets with probability β_B in case of default, where $\beta_B \in [0, 1]$ is an *exogenous* parameter set by the bankruptcy code. As in Ayotte and Yun (2007) and in Acharya *et al.* (2011), we interprete β_B as the variable that measures the degree of "creditor-friendliness" of the bankruptcy law by expressing how likely is that the creditor takes control of the assets following default. Hence, the higher β_B, the higher the creditor rights. For instance, $\beta_B = 1$ corresponds to a perfectly creditor-friendly code: control is transferred to creditors with certainty following default. In case of liquidation, the lender obtains $\alpha_B l_B$, where $\alpha_B \in [0, 1]$ captures the transaction costs incurred in liquidating the assets (litigation costs, length of the process, etc) and, in turn, it measures the efficiency of the liquidation technology of the bankruptcy system. This notion of efficiency is very close to that of Djankov *et al.* (2008), who measure the efficiency of an insolvency procedure via creditor discounted recovery rates.

If parties decide to use the mortgage system instead, the lender assumes control of the firm's assets with (exogenous) probability $\beta_M = 1$ in case of

[12] A remarkable exception was Administrative Receivership in the U.K. Under Administrative Receivership, an important creditor -typically a bank- contracted with the debtor to be granted a "floating charge", which gave the creditor the right to appoint a receiver if the firm defaulted. The receiver would take charge of the firm and decide whether to liquidate it or keep it as a going concern. Franks and Sussman (2005) show that Administrative Receivership was best seen as a privately negotiated contract between a debtor and its creditors. However, Administrative Receivership was abolished in 2003 after the entry into force of the Enterprise Act 2002.

default, i.e., control is transferred to creditors with certainty following default. We model the liquidation proceedings obtained by the lender by $\alpha_M l_M$, where $\alpha_M \in [0,1]$ measures the efficiency of the liquidation technology of the mortgage system. A parametric assumption we make is $\alpha_M > \alpha_B$, i.e., the mortgage system is more efficient than the bankruptcy system, in the sense of providing higher liquidation proceedings for the same liquidation value: $\alpha_M l > \alpha_B l$.

Therefore, both insolvency institutions have their relative pros and cons. The mortgage system provides higher liquidation proceedings, which may bring lower funding costs than under bankruptcy if the firm finds it optimal to over-invest in capital at the expense of productive inefficiencies. However, it may be too creditor-friendly ($\beta_M = 1$) relative to the bankruptcy system ($0 \leq \beta_B \leq 1$): since in mortgage control is transferred to creditors with certainty following default, and creditors are biased towards liquidation, there will always be liquidation in the event of default, even though it is *ex-post* inefficient.

The firm's manager will choose to sign the credit contract with the lender under the insolvency institution that maximises her expected utility. To find the equilibrium utility in each case we first need to solve for the optimal contracts under each institution. We shall abstract from renegotiation issues by assuming full commitment. This assumption is quite plausible in the case under analysis. First, the mortgage system does not provide any mechanism for debt restructuring: default triggers straight liquidation of the foreclosed assets. Second, although many bankruptcy systems allow for reorganisations, the empirical evidence shows that most of the firms that file for bankruptcy end up liquidated (Celentani, García-Posada and Gómez, 2010).

3.2 Optimal contracts under bankruptcy and optimal bankruptcy code.

For the study of the optimal contracts under bankruptcy it is necessary to analyse first the optimal bankruptcy code β_B^* , i.e., the liquidation probability that maximises aggregate welfare. A way to address the problem would be to assume that a welfare-maximising social planner chooses and announces β_B^* before t=0, understanding how contracts $\{R_B, l_B\}$ will respond in equilibrium. However, for simplicity of exposition we assume that the bankruptcy code β_B is chosen by the manager at t=0 and offered along with $\{R_B, l_B\}$ as part of an optimal contract that maximises his profits. The two perspectives are equivalent (Ayotte and Yun, 2007).

For simplicity, let us set the efficiency parameter to zero, i.e., $\alpha_B = 0$. Since our aim is to analyse the determinants of the choice of insolvency institution, we only care about the relative values of the key parameters, so that the assumption $\alpha_B = 0$, which satisfies $\alpha_M > \alpha_B$ for any $\alpha_M > 0$, will not determine our conclusions. Nevertheless, the solution of the model with $\alpha_B > 0$ is shown in Appendix C.

The optimal contract and the optimal bankruptcy code maximise the manager's expected utility EU -which is just the expected profits of the project- subject to the following constraints: (6) the manager does not default strategically (incentive compatibility); (7) the lender decides to provide credit (individual rationality); (8) since the manager is wealthless, the repayment cannot exceed the cash flow at t=1 in the good state of nature (first feasibility constraint); (9) the liquidation probability β lies in the interval $[0,1]$ (second feasibility constraint). Formally, the maximisation problem is the following:

$$\underset{\{R_B,\beta_B,l_B\}}{MAX}\ EU_B = \theta\left[\pi - nl_B - R_B + \phi\pi\right] + (1-\theta)(1-\beta_B)\phi\pi$$

subject to:

$$\pi - nl_B - R_B + \phi\pi \geq \pi - nl_B + (1-\beta_B)\phi\pi \tag{6}$$

$$\theta R_B \geq I \tag{7}$$

$$R_B \leq \pi - nl_B \tag{8}$$

$$0 \leq \beta_B \leq 1 \tag{9}$$

Equation (6), analogous to equation (1) in the analysis of private workouts, shows the repayment decision of the manager after having observed the cash flow at t=1. An alternative interpretation of the incentive-compatibility constraint comes from simplifying and rearranging (9):

$$\beta_B\phi\pi \geq R_B \tag{10}$$

Equation (10) shows that, for the contract to be incentive-compatible, the expected punishment from defaulting strategically, $\beta_B\phi\pi$, must be greater than or equal to the benefit from carrying out such a strategy, R_B. Therefore, the more creditor-friendly the bankruptcy code, i.e., the higher β_B, the easier that (10) holds. This captures the idea that "tougher" bankruptcy codes reduce the incentives for debtors to engage in moral hazard, which in turn increase the incentives for lenders to provide credit.

Since the above maximisation program is the same as the one for private workouts when $\alpha = 0$, its solution is identical. We can also find the economy's welfare by first computing the manager's equilibrium utility and then making use of the fact that the lender is perfectly competitive, so its equilibrium utility is zero ($\theta R_B^* - I = 0$). We summarise the results in the following proposition.

PROPOSITION 3: *The optimal bankruptcy code* β_B^* *and the optimal contract under bankruptcy* $\{R_B^*, l_B^*\}$ *are* $\beta_B^* = \frac{I}{\theta\phi\pi}$, $R_B^* = \frac{I}{\theta}$,$l_B^* = 0$. *The economy's welfare is* $W_B^* = (\theta+\phi)\pi - I - \frac{1-\theta}{\theta}I$

In order to analyse the inefficiencies that may arise under this contract it is useful to rewrite the economy's welfare as $W_B^* = (\theta+\phi)\pi - I - (1-\theta)\beta_B^*\phi\pi$. The first two terms $(\theta+\phi)\pi - I$ express the project's net present value in the first-best, while the last term $-(1-\theta)\beta_B^*\phi\pi$ is the expected cost of inefficient liquidations, which can be decomposed as the product of the probability of inefficient liquidations $(1-\theta)\beta_B^*$ and the size of such inefficiency. With probability $(1-\theta)$ the manager defaults and with probability β_B^* the lender takes control of the firm and liquidates its assets. Since the cash flow at t=2, $\phi\pi$, is foregone, while the project yields zero liquidation proceeds because $l_B^* = 0$, the size of the inefficient liquidation is $\phi\pi$. Hence, by choosing $l_B^* = 0$ the manager avoids any cost of productive inefficiencies $(D(l) = nl_B^* = 0)$ but she maximises the size of inefficient liquidations.

Furthermore, β_B^* is the minimum value that makes the contract incentive-compatible, so that the manager does not default strategically and consequently the lender is willing to provide credit, while minimising the probability that an inefficient liquidation occurs. In other words, if $\beta_B < \beta_B^*$, the contract cannot be signed under the bankruptcy institution, while if $\beta_B > \beta_B^*$ the contract can be signed but the likelihood of an inefficient liquidation is not minimised. Let us highlight the former result in Lemma 4, leaving its proof for Appendix B.

LEMMA 4: *β_B^* is the minimum level of creditor rights in bankruptcy that makes the lender provide credit. If $\beta_B < \beta_B^*$, then the contract is not feasible under the bankruptcy institution.*

If $\beta_B > \beta_B^*$ the contract is feasible but the economy's welfare will be lower than in the case of $\beta_B = \beta_B^*$. Let us summarise this result in Proposition 4.

PROPOSITION 4: *If $\beta_B > \beta_B^*$, then the contract is feasible under the bankruptcy institution. In that case the optimal contract $\{R_B^{**}, l_B^{**}\}$ is given by $R_B^{**} = \frac{I}{\theta}, l_B^{**} = 0$. The economy's welfare is $W_B^{**} = (\theta + \phi)\pi - I - (1-\theta)\beta_B\phi\pi$*

As we will see, the existing trade-offs among creditor protection, inefficient liquidations and productive inefficiencies are the driving factors of all the model's key results.

3.3 Optimal contracts under mortgage.

The analysis of the optimal contract under mortgage differs from that under bankruptcy in two key points: $\alpha_M > 0$ and $\beta_M = 1$. $\alpha_M > 0$ makes the decision of overinvesting in capital non-trivial, since increasing the liquidation value l_M reduces the funding costs R_M but at the expense of incurring in productive inefficiencies that reduce the cash flows at t=1 by nl_M. $\beta_M = 1$ maximises the likelihood of inefficient liquidations, since the firm will be liquidated with certainty following default regardless of its liquidation and continuation values, but it also maximises creditor protection and hence the incentives to lend.

The optimal contract maximises the manager's expected utility EU subject to the following constraints: (11) the manager does not default strategically (incentive compatibility); (12) the lender decides to provide credit (individual rationality); (13) since the manager is wealthless, the repayment cannot exceed the cash flow at t=1 in the good state of nature (feasibility constraint). Formally, the maximisation problem is the following:

$MAX\ EU_M = \theta\left[\pi - nl_M - R_M + \phi\pi\right]$
$\{R_M, l_M\}$
subject to:

$$\pi - nl_M - R_M + \phi\pi \geq \pi - nl_M \qquad (11)$$

$$\theta R_M + (1-\theta)\,\alpha_M l_M \geq I \qquad (12)$$

$$R_M \leq \pi - nl_M \qquad (13)$$

To find the optimal contract the three following lemmas are very useful.

LEMMA 5: *The incentive compatibility constraint of the manager (11) is not binding at the optimum.*

LEMMA 6: *The feasibility constraint (13) is not binding at the optimum.*

LEMMA 7: *The individual rationality constraint of the lender (12) is binding at the optimum.*

Using these three lemmas it can be shown that there are two equilibrium contracts, which depend on the relative value of n *vis-à-vis* α_M. These contracts and the corresponding welfares are summarised in Proposition 5.

PROPOSITION 5: *The equilibrium contracts and the economy's welfare under mortgage are:*
a) For $n \leq \frac{1-\theta}{\theta}\alpha_M$: $l_M^* = I$, $R_M^* = \frac{I-(1-\theta)\alpha_M I}{\theta}$, $W_M^* = (\theta+\phi)\,\pi - I - (1-\theta)\left[\phi\pi - \alpha_M I\right] - \theta nI$.
b) For $n > \frac{1-\theta}{\theta}\alpha_M$: $l_M^{**} = 0$, $R_M^{**} = \frac{I}{\theta}$, $W_M^{**} = (\theta+\phi)\,\pi - I - (1-\theta)\,\phi\pi$.

The intuition behind this result is easy to grasp. In case a), since the marginal cost from overinvesting in capital n is low enough *vis-à-vis* the efficiency of the mortgage's liquidation technology α_M $\left(n \leq \frac{(1-\theta)}{\theta}\alpha_M\right)$, the marginal reduction in funding costs is higher than the marginal cost of productive inefficiencies, so the manager overinvests as much as possible, obtaining the maximum liquidation value $l_M^* = I$. The opposite occurs in case b), so that the manager does not overinvest at all, i.e., $l_M^{**} = 0$.

An important corollary comes from the inspection of the equilibrium welfares in each scenario. In case a) the size of inefficient liquidations $[\phi\pi - \alpha_M I]$ is minimised by setting the maximum liquidation value I, but at the expense of maximising the cost of productive inefficiencies θnI. By contrast, in case b) the size of inefficient liquidations $[\phi\pi - \alpha_M l]$ is maximised by setting the lowest liquidation value $l_M^{**} = 0$, but the cost of productive inefficiencies is none $(\theta nl_M^{**} = 0\ )$ by the same token.

4 Choice of insolvency institution.

The firm's manager will choose to sign the credit contract with the lender under the insolvency institution that maximises her expected utility. The analysis relies in the comparison of the equilibrium utilities in each of the scenarios described by Propositions 3-5[13] and in the conditions under which the contracts are feasible.

We shall differentiate between two cases in terms of the value of the marginal cost of overinvesting in capital n *vis-à-vis* the efficiency of the mortgage's liquidation technology α_M: (1) $n \leq \frac{1-\theta}{\theta}\alpha_M$; (2) $n > \frac{1-\theta}{\theta}\alpha_M$. Likewise, we shall also differentiate among three cases in terms of the value of the liquidation probability under bankruptcy β_B: (i) $\beta_B < \beta_B^*$; (ii) $\beta_B = \beta_B^*$; (iii) $\beta_B > \beta_B^*$. In other words, we shall analyse the choice of the insolvency institution in terms of three exogenous parameters: the project's technology (captured by n), the efficiency of the mortgage institution (captured by α_M) and the level of creditor rights' protection under bankruptcy (captured by β_B) .

4.1 Choice of insolvency institution when $n \leq \frac{1-\theta}{\theta}\alpha_M$.

If $\beta_B < \beta_B^*$, the project cannot be undertaken under the bankruptcy institution, as expressed in Lemma 4, so it will be carried out under the mortgage institution.

If $\beta_B = \beta_B^*$, then the manager will choose the mortgage institution if and only if $EU_M^* \geq EU_B^*$ which, by simple algebraic manipulation of the equilibrium welfares in Propositions 3 and 5a), amounts to:

$$n \leq \bar{n} \equiv \frac{(1-\theta)\left[\frac{I}{\theta}+\alpha_M I-\phi\pi\right]}{\theta I}$$

In other words, the manager will choose the mortgage institution if $n \in [0, \bar{n}]$ and the bankruptcy system if $n \in \left(\bar{n}, \frac{1-\theta}{\theta}\alpha_M\right]$. The intuition is straightforward: when the cost of overinvesting in capital is not too high ($n \leq \bar{n}$), the manager will choose the mortgage institution because the gains from lower funding costs under mortgage will outweigh the costs from productive inefficiencies. A study of the feasibility of $\bar{n}$, so the interval $[0, \bar{n}]$ for which mortgage is chosen is not empty and exists in the scenario $n \leq \frac{1-\theta}{\theta}\alpha_M$, is shown in Appendix B.

If $\beta_B > \beta_B^*$ then the manager will choose the mortgage institution if and only if $EU_M^* \geq EU_B^{**}$ which, by simple algebraic manipulation of the equilibrium welfares in Propositions 4 and 5a), is equivalent to:

$$n \leq \widetilde{n} \equiv \frac{(1-\theta)[\alpha_M I-\phi\pi(1-\beta_B)]}{\theta I}$$

In other words, the manager will choose the mortgage system if $n \in [0, \widetilde{n}]$ and the bankruptcy system if $n \in \left(\widetilde{n}, \frac{1-\theta}{\theta}\alpha_M\right]$. The result follows the same logic as the previous case, and it can be shown that $\widetilde{n} \geq \bar{n}$, i.e., there are more values

[13] Propositions 3-5 show the equilibrium welfares in each scenario. However, since the lender is perfectly competitive, he makes zero profits, so the expressions for the welfares also represent the manager's expected utilities in equilibrium.

for which the manager will choose mortgage over bankruptcy, simply because $EU_B^{**} \leq EU_B^*$. A study of the feasibility of $\widetilde{n}$, so the interval $[0, \widetilde{n}]$ for which mortgage is chosen is not empty and exists in the scenario $n \leq \frac{1-\theta}{\theta}\alpha_M$, is shown in Appendix B.

4.2 Choice of insolvency institution when $n > \frac{1-\theta}{\theta}\alpha_M$.

If $\beta_B < \beta_B^*$, the project cannot be undertaken under the bankruptcy institution, as expressed in Lemma 4, so it will be carried out under the mortgage institution.

If $\beta_B = \beta_B^*$, then the manager will choose the mortgage institution if and only if $EU_M^{**} \geq EU_B^*$. This is equivalent to $I \geq \theta\phi\pi$, which violates the assumption $I \leq \theta\phi\pi$ except for the limit case $I = \theta\phi\pi$ in which $EU_M^{**} = EU_B^{**}$ (i.e., the manager is indifferent). Therefore, we can conclude that the project will never be undertaken under mortgage.

If $\beta_B > \beta_B^*$ the manager will choose the mortgage institution if and only if $EU_M^{**} \geq EU_B^{**}$, which is equivalent to $\beta_B \geq 1$, a condition only feasible for the limit case $\beta_B = 1$ in which $EU_M^{**} = EU_B^{**}$. Therefore, we can conclude that the project will never be undertaken under mortgage.

All the above results regarding the choice of insolvency institution are summarised in Table 2.

Table 2: Choice of insolvency institution.

	$n \leq \frac{1-\theta}{\theta}\alpha_M$	$n > \frac{1-\theta}{\theta}\alpha_M$
$\beta_B < \beta_B^*$	Mortgage	Mortgage
$\beta_B = \beta_B^*$	Mortgage if $n \leq \bar{n}$	Bankruptcy
$\beta_B > \beta_B^*$	Mortgage if $n \leq \widetilde{n}$	Bankruptcy

Those results are also summarised in Proposition 6.

PROPOSITION 6: When the creditor rights in bankruptcy are lower than the optimal ($\beta_B < \beta_B^*$) the firm's manager can only implement the project under the mortgage institution. When the creditor rights in bankruptcy are greater than or equal to the optimal ($\beta_B \geq \beta_B^*$), the choice of the insolvency institution depends on the marginal cost from productive inefficiencies n. If the cost from productive inefficiencies is low *vis-à-vis* the efficiency of the mortgage's liquidation technology ($n \leq \frac{1-\theta}{\theta}\alpha_M$), then the mortgage institution will be chosen for some sufficiently low values of n. If the cost from productive inefficiencies is high *vis-à-vis* the efficiency of the mortgage's liquidation technology ($n > \frac{1-\theta}{\theta}\alpha_M$), then the mortgage institution will never be chosen.

5 Aggregate welfare and bankruptcy rates.

So far we have discussed the case of a single firm manager and a single competitive lender. For the analysis of aggregate welfare and bankruptcy rates it is convenient to move to a set up of multiple heterogenous firm managers. Each manager can implement a project with the same net present value in the first best $((\theta+\phi)\pi - I)$ but that differs in the marginal cost of overinvesting in capital n. Specifically, we have a population of managers of measure N which are continuously distributed with $n \sim [N_1, N_2]$ and $N_2 - N_1 = N$. Notice that we do not need to assume any particular statistical distribution for n since we are only going to compute aggregate welfares in different scenarios, rather than its distribution across individuals. Finally, there is a population of measure N of (perfectly competitive) homogeneous lenders, each with an inital endowment of I, so that all the demand for credit by the managers can be met.

Following Proposition 6 we will study aggregate welfare depending on the value of n relative to α_M ($n \leq \frac{1-\theta}{\theta}\alpha_M$, $n > \frac{1-\theta}{\theta}\alpha_M$) and the value of β_B ($\beta_B < \beta_B^*$, $\beta_B = \beta_B^*$, $\beta_B > \beta_B^*$).

5.1 Scenario 1: $n \leq \frac{1-\theta}{\theta}\alpha_M \; \forall \; n \sim [N_1, N_2]$

If $\beta_B < \beta_B^*$ projects cannot be undertaken under the bankruptcy institution, as expressed in Lemma 4, so they will be carried out under the mortgage institution. Hence the corresponding bankruptcy rate (BR_1) will be zero, since the bankruptcy institution is never used, and the aggregate welfare Ω_1 will be, using Proposition 5a): :

$$\Omega_1 = \int_{N_1}^{N_2} W_M^* dn = \int_{N_1}^{N_2} \{(\theta+\phi)\pi - I - (1-\theta)[\phi\pi - \alpha_M I] - \theta n I\} dn$$

If $\beta_B = \beta_B^*$ we know from the analysis in section 4.1 that the projects with $n \in [N_1, \bar{n}]$ will be undertaken under mortgage and the projects with $n \in (\bar{n}, N_2]$ will be implemented under bankruptcy. The corresponding bankruptcy rate will be $BR_2 = (1-\theta)\frac{N_2-\bar{n}}{N}$, since a proportion $\frac{N_2-\bar{n}}{N}$ of managers will use the bankruptcy system and will default with probability $(1-\theta)$. The aggregate welfare will be:

$$\Omega_2 = \int_{N_1}^{\bar{n}} W_M^* dn + \int_{\bar{n}}^{N_2} W_B^* dn$$

$$\Omega_2 = \int_{N_1}^{\bar{n}} \{(\theta+\phi)\pi - I - (1-\theta)[\phi\pi - \alpha_M I] - \theta n I\} dn +$$
$$+ \int_{\overline{n}}^{N_2} \{(\theta+\phi)\pi - I - \tfrac{1-\theta}{\theta} I\} dn$$

If $\beta_B > \beta_B^*$ we know from the analysis in section 4.1 that the projects with $n \in [N_1, \widetilde{n}]$ will be undertaken under mortgage and the projects with $n \in (\widetilde{n}, N_2]$ will be implemented under bankruptcy. The corresponding bankruptcy rate will be $BR_3 = (1-\theta)\frac{N_2-\widetilde{n}}{N}$, since a proportion $\frac{N_2-\widetilde{n}}{N}$ of managers will use the bankruptcy system and will default with probability $(1-\theta)$. The aggregate welfare will be:

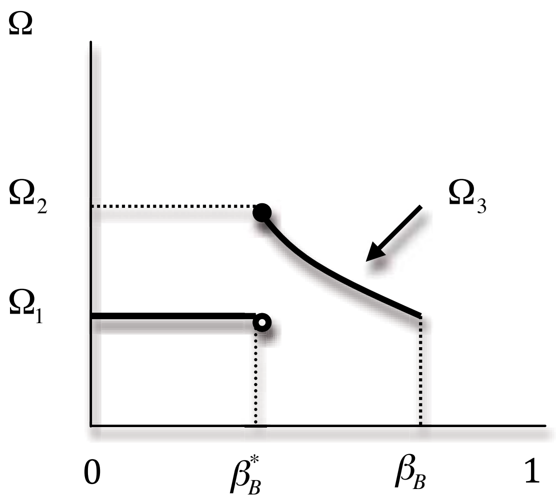
$$\Omega_3 = \int_{N_1}^{\tilde{n}} W_M^* dn + \int_{\widetilde{n}}^{N_2} W_B^{**} dn =$$
$$= \int_{N_1}^{\widetilde{n}} \{(\theta+\phi)\pi - I - (1-\theta)[\phi\pi - \alpha_M I] - \theta n I\} dn + \int_{\widetilde{n}}^{N_2} \{(\theta+\phi)\pi - I - (1-\theta)\beta_B \phi\pi\} dn$$

The comparison of aggregate welfares and bankruptcy rates among the three cases is summarised in Proposition 7.

PROPOSITION 7: Suppose the cost from productive inefficiencies is low *vis-à-vis* the efficiency of the mortgage institution for all managers, i.e., $n \leq \frac{1-\theta}{\theta}\alpha_M$ $\forall\ n \sim [N_1, N_2]$. Let us differentiate among three cases, $\beta_B < \beta_B^*$ (case 1), $\beta_B = \beta_B^*$ (case 2) and $\beta_B > \beta_B^*$ (case 3), where Ω_i and BR_i are the welfare and bankruptcy rates of case $i = 1, 2, 3$. Then it can be shown that $\Omega_1 \leq \Omega_3 < \Omega_2$ and $BR_1 \leq BR_3 < BR_2$.

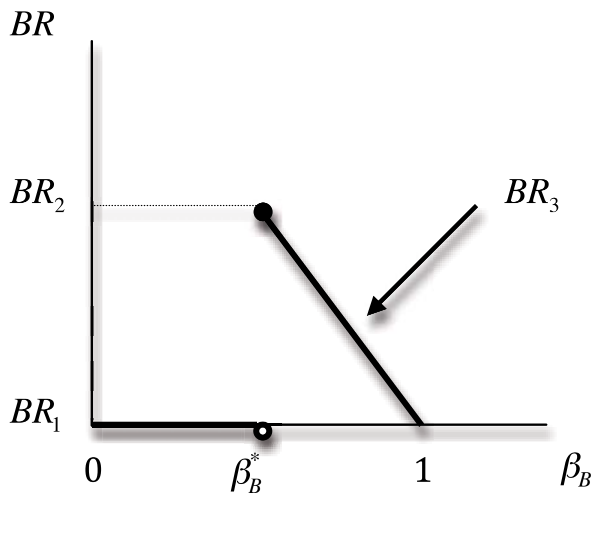
The intuition behind $\Omega_2 > \Omega_1$ is that, when moving from $\beta_B < \beta_B^*$ to $\beta_B = \beta_B^*$, the managers with projects with relatively higher costs from overinvesting in capital (i.e., those with $n > \bar{n}$) will switch from mortgage to bankruptcy, since they yield a higher payoff under the latter. The same reasoning applies to $\Omega_3 \geq \Omega_1$, which holds strictly for all cases except for the limit case $\beta_B = \beta_M = 1$ in which no manager switches from mortgage to bankruptcy. Finally, $\Omega_2 > \Omega_3$ just comes from the fact that managers choose between mortgage and the optimal bankruptcy in case 2, while they choose between mortgage and a non-optimal bankruptcy in case 3. These results are represented in Figure 4, which shows that welfare is a discontinuous non-monotonic function of the creditor rights under bankruptcy β_B, whose maximum Ω_2 is achieved at β_B^*. For $\beta_B < \beta_B^*$, welfare is Ω_1 for any value of β_B , while for $\beta_B > \beta_B^*$ welfare is $\Omega_3(\beta_B)$ with $\frac{\partial\Omega_3}{\partial\beta_B} < 0$ and $\frac{\partial^2\Omega_3}{\partial\beta_B^2} > 0$.

Figure 3: welfare when $n \leq \frac{1-\theta}{\theta}\alpha_M \; \forall \; n \sim [N_1, N_2]$



With respect to the bankruptcy rate, it is the highest when $\beta_B = \beta_B^*$, lower but strictly positive when $\beta_B > \beta_B^*$ unless $\beta_B = \beta_M = 1$ and zero when $\beta_B < \beta_B^*$ since no manager uses bankruptcy in such a case. These results are represented in Figure 5, which shows that the bankruptcy rate is a discontinuous non-monotonic function of the creditor rights under bankruptcy β_B , whose maximum BR_2 is achieved at β_B^*. For $\beta_B < \beta_B^*$, the bankruptcy rate is $BR_1 = 0$ for any value of β_B, while for $\beta_B > \beta_B^*$ the bankruptcy rate is $BR_3(\beta_B)$ with $\frac{\partial BR_3}{\partial \beta_B} < 0$.

Figure 4: bankruptcy rates when $n \leq \frac{1-\theta}{\theta}\alpha_M \; \forall \; n \sim [N_1, N_2]$



5.2 Scenario 2: $n > \frac{1-\theta}{\theta}\alpha_M \forall\ n \sim [N_1, N_2]$

If $\beta_B < \beta_B^*$, projects cannot be undertaken under the bankruptcy institution, as expressed in Lemma 4, so they will be carried out under the mortgage institution. Hence the corresponding bankruptcy rate (BR_1) will be zero, since the bankruptcy institution is never used, and the aggregate welfare will be:

$$\Omega_4 = \int_{N_1}^{N_2} W_M^{**} dn = \int_{N_1}^{N_2} \{(\theta + \phi)\,\pi - I - (1-\theta)\,\phi\pi\} dn$$

If $\beta_B = \beta_B^*$ we know from the analysis in section 4.2 that no project will be undertaken under mortgage. The corresponding bankruptcy rate will be $BR_5 = (1-\theta)$, since all managers will use the bankruptcy system and will default with probability $(1-\theta)$. The aggregate welfare will be:

$$\Omega_5 = \int_{N_1}^{N_2} W_B^{*} dn = \int_{N_1}^{N_2} \{(\theta + \phi)\,\pi - I - \tfrac{1-\theta}{\theta} I\} dn$$

If $\beta_B > \beta_B^*$ we know from the analysis in section 4.2 that no project will be undertaken under mortgage. The corresponding bankruptcy rate will be $BR_5 = (1-\theta)$, since all managers will use the bankruptcy system and will default with probability $(1-\theta)$. The aggregate welfare will be:

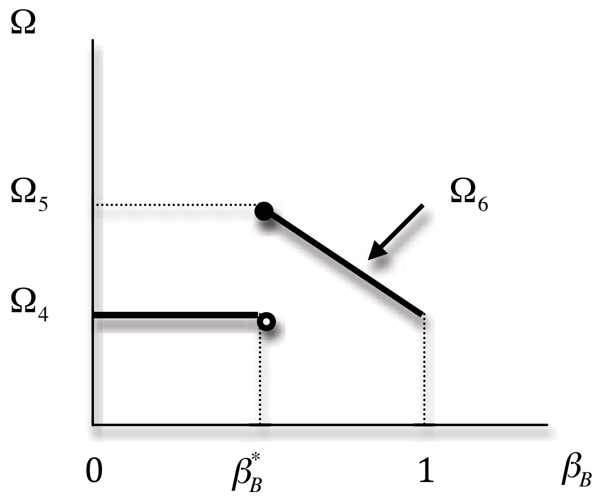
$$\Omega_6 = \int_{N_1}^{N_2} W_B^{**} dn = \int_{N_1}^{N_2} \{(\theta + \phi)\,\pi - I - (1-\theta)\,\beta_B\phi\pi\} dn$$

The comparison of welfare and bankruptcy rates among the three cases is summarised in Proposition 8.

PROPOSITION 8: Suppose the cost from productive inefficiencies is high *vis-à-vis* the efficiency of the mortgage institution for all managers, i.e., $n > \frac{1-\theta}{\theta}\alpha_M\ \forall\ n \sim [N_1, N_2]$. Let us differentiate among three cases, $\beta_B < \beta_B^*$ (case 4), $\beta_B = \beta_B^*$ (case 5) and $\beta_B > \beta_B^*$ (case 6), where Ω_i and BR_i are the welfare and bankruptcy rates of case $i = 4, 5, 6$. Then it can be shown that $\Omega_4 \leq \Omega_6 < \Omega_5$ and $BR_4 < BR_5 = BR_6$.

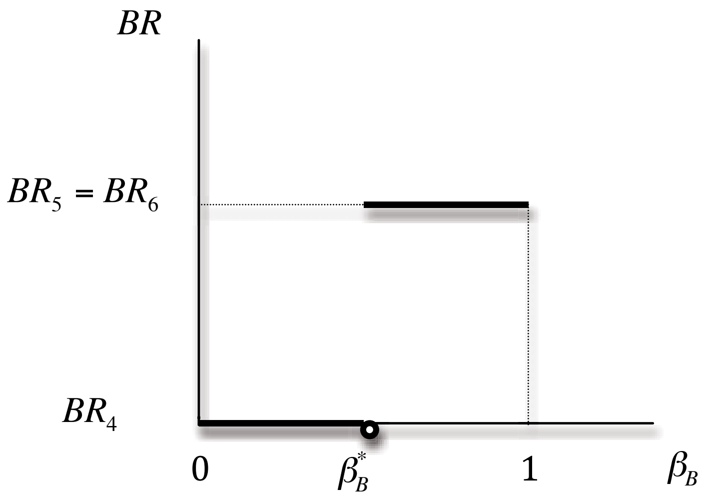
The intuition behind $\Omega_5 > \Omega_4$ and $\Omega_6 \geq \Omega_4$ is that, when the cost from productive inefficiencies is high, all managers obtain a higher utility by implementing their projects under bankruptcy except in the limit case $\beta_B = \beta_M = 1$, in which the two institutions yield the same payoff. These results are represented in Figure 5, which shows that welfare is a discontinuous non-monotonic function of the creditor rights under bankruptcy β_B , whose maximum Ω_5 is achieved at β_B^*. For $\beta_B < \beta_B^*$, welfare is Ω_4 for any value of β_B , while for $\beta_B > \beta_B^*$ welfare is $\Omega_6(\beta_B)$ with $\frac{\partial\Omega_6}{\partial\beta_B} < 0$ and $\frac{\partial^2\Omega_6}{\partial\beta_B^2} = 0$.

Figure 5: welfare when $n > \frac{1-\theta}{\theta}\alpha_M \ \forall \ n \sim [N_1, N_2]$



With respect to the bankruptcy rate, it is strictly positive when $\beta_B \geq \beta_B^*$ $(BR_4 = BR_5 = (1-\theta))$ and zero when $\beta_B < \beta_B^*$ since no manager uses bankruptcy in such a case, as shown in Figure 6.

Figure 6: bankruptcy rate when $n > \frac{1-\theta}{\theta}\alpha_M \forall \ n \sim [N_1, N_2]$



6 Policy implications and the Spanish case.

The model's policy implications are drawn from the results summarised in Figures 3 and 5, according to which aggregate welfare is a non-monotonic and *asymmetric* function of the creditor rights under bankruptcy β_B, regardless of the firms' marginal costs from productive inefficiencies n. Specifically, welfare is strictly higher when $\beta_B \geq \beta_B^*$ than in the case of $\beta_B < \beta_B^*$, except for the limit case $\beta_B = \beta_M = 1$ where it is the same. Obviously, if possible, the legislator should set $\beta_B = \beta_B^*$ in order to maximise welfare, which would also maximise the bankruptcy rate. However, if in practice the optimal level of creditor rights is not known, a too creditor-friendly system ($\beta_B > \beta_B^*$) is (weakly) preferred to a too debtor-friendly-system ($\beta_B < \beta_B^*$). Thus the legislator should be biased towards setting high levels of creditor rights despite the risk of having them higher than the optimal level, i.e., $\beta_B > \beta_B^*$.

Let us illustrate this idea more formally. According to Proposition 3, the optimal level of creditor rights is $\beta_B^* = \frac{I}{\theta \cdot \phi \pi}$. Suppose that (I, θ, ϕ, π) are not parameters but random variables, so that β_B^* is also a random variable with expectation $E[\beta_B^*]$ and variance $V[\beta_B^*]$. If aggregate welfare Ω was a symmetric function of β_B, a risk-neutral legislator should set $\beta_B = E[\beta_B^*]$. However, if $\Omega(\beta_B > \beta_B^*) > \Omega(\beta_B < \beta_B^*)$, the legislator should set $\beta_B = E[\beta_B^*] + \gamma$ with $\gamma > 0$ and $E[\beta_B^*] + \gamma < 1 = \beta_M$.

The reason why welfare is higher when $\beta_B > \beta_B^*$ than when $\beta_B < \beta_B^*$ is that β_B^* is the minimum level of creditor rights that makes a credit contract signed under the bankruptcy institution feasible. In other words, when creditor rights exceed the optimal level agents can choose between two different insolvency institutions, bankruptcy and mortgage, in other to maximise their payoffs. However, when creditor rights are lower than the optimal only one institution, the mortgage system, can be used. According to Hart (2000) and Ayotte and Yun (2007), allowing for a menu of insolvency options that differ in aspects such as their debtor/creditor orientation can increase efficiency. In our model this is achieved by setting creditor rights under bankruptcy high enough.

A related corrollary comes from the inspection of Figures 4-5 and 6-7, which show a positive relationship between bankruptcy rates and welfare. This theoretical prediction is consistent with the empirical evidence provided by Claessens and Klapper (2005) and by Celentani, García-Posada and Gómez (2010), which find a positive correlation between bankruptcy rates and per capita GDP.

The model can also be used to analyse the Spanish case and drawing - with the necessary caution- some policy implications. According to the hypothesis of Celentani, García-Posada and Gómez (2010), the low efficiency of the bankruptcy system *vis-à-vis* that of the mortgage system (in our model, $\alpha_B < \alpha_M$), together with the fact that the Spanish bankruptcy code does not grant enough protection to creditors ($\beta_B < \beta_B^*$) make firms and their lenders deal with credit provision and potential default through the latter, thus reducing bankruptcy rates. Our model suggests that the low bankruptcy rates observed in Spain are also associated with welfare losses. Therefore, strengthening creditor rights would increase *both* bankruptcy rates and welfare. In practice, increasing creditor rights can be achieved in different manners, such as allowing creditors to propose a liquidation plan or even forcing it and actively involving them in the appointment of the insolvency administrators, along the lines of the English, German and Italian systems.

7 Conclusions and directions for further research.

This paper warns about the potential efficiency losses associated to low business bankruptcy rates and shows that welfare could be improved by increasing the protection of creditors in the bankruptcy system. Those ideas are illustrated with the Spanish case. It also predicts a positive correlation between welfare and bankruptcy rates, a finding that is consistent with the available cross-country empirical evidence when the former is proxied by per capita GDP (Claessens and Klapper, 2005, Celentani, García-Posada and Gómez, 2010).

The argument, analysed with an incomplete contracts model à la Bolton and Scharfstein (1996), is as follows. The low efficiency and low creditor protection of the Spanish bankruptcy system relative to those of an alternative insolvency institution, the mortgage system, makes firms and their creditors mainly deal with credit provision and eventual insolvency through the latter. However, this institutional framework, in which the mortgage system is widely used while the bankruptcy system is relegated to marginal cases, may have a negative impact on welfare. The reason is that the mortgage system is not well suited for some industries, which incur in several inefficiencies when using it.

First, to obtain mortgage credit some firms must overinvest in capital assets (real estate, equipment), since those are the assets that can be pledged as mortgage collateral. This overinvestment leads to productive inefficiencies, which may be very costly for industries that require a high level of other factors of production (e.g., R&D). Furthermore, the mortgage system is too creditor friendly, in the sense that it always grants the control of the firm's assets to creditors in the event of default. Since creditors are inherently biased towards liquidation, this leads to some inefficient liquidations. This cost will be greater for firms with low liquidation values but high going-concern ones, such as those from technologically innovative industries, which are normally characterised by high levels of human capital and firm-specific assets.

Strengthening creditor rights in the bankruptcy system could increase *both* bankruptcy rates and welfare because some firms, those with high costs associated to using the mortgage system, would switch to bankruptcy. The bankruptcy system may be better suited for some industries because it does not require them to overinvest in capital and because it implies less inefficient liquidations, since control rights are not always transferred to creditors following default. Thus, setting creditor rights high enough in bankruptcy creates an institutional framework in which there are two *feasible* insolvency institutions, each of them with their own pros and cons, and allows agents to choose the one that suits them more. This idea is consistent with the arguments of Hart (2000) and Ayotte and Yun (2007), who advocate for a menu of insolvency options that differ in aspects such as their debtor/creditor orientation in order to increase efficiency. Although in practice it is not possible to set creditor rights at the optimal level, a "too creditor-friendly" system is preferred to a "too debtor-friendly-system" because it ensures that both insolvency institutions will be used.

Further theoretical research in the area could be carried out in many different ways. We briefly discuss four extensions that we believe could be worthwile. First, in this paper we have presented a partial equilibrium model, so that we take the price of inputs as given. A potentially insightful extension would be to develop a general equilibrium model where the price of capital is endogenously determined.[14] Therefore the cost from overinvesting in capital, as well as its optimal level, will also depend on its price, which can differ across several scenarios (i.e., different values of n and β_B).

Second, overinvestment in capital can take place in two different ways, which can loosely be called the "extensive margin" and the "intensive margin". The "extensive margin" consists of choosing business projects that require a high proportion of capital over projects with potentially higher productivity but a lower proportion of this production factor. The "intensive margin" consists of carrying out the same project but exceeding the optimal proportion of capital. Since in the present model the type of project owned by each manager (captured by the parameter n) is predetermined before the onset of the contracting game, the economy's productive structure is exogenous and we can only analyse the "intensive margin". Alternatively, one could study how the distribution of projects in the economy depends on the design of the insolvency institutions, and whether the current institutional framework deters projects with high net present value but high costs from overinvesting in capital (e.g., innovation) while it favours projects with lower NPV but low cost from overinvesting (e.g., construction), i.e., the "extensive margin". For instance, according to Banco de España (2010) and Arce *et al.* (2008), in Spain the less productive sectors (such as construction) would have benefited from the strong credit growth between 1995 and 2007, one of the reasons being that those sectors produce assets that can be used as collateral on loans.[15]

Another interesting extension is to model an alternative mechanism to deal with insolvency making use of mortgage collateral, the so-called "friendly foreclosures". In a friendly foreclosure, the secured lender repossesses the property with the consent of the borrower in exchange for cancelling the outstanding debt; after that, the lender can sell the property to a third party to recover -at least partially- its credit. With this mechanism the agents save the costs generated in a non-consensual foreclosure proceeding (time, litigation costs, etc) but it requires agreement between the contract parties, so that the incentives of borrowers and lenders to implement it must be analysed. The use of this mechanism has soared in Spain[16] during the housing burst, especially in the case of building and real estate companies.

Finally, the present analysis assumes that *corporate* bankruptcy applies to all firms. However, *personal* bankruptcy laws may be used by non-corporate businesses and by small corporate firms (Berkowitz and White, 2004). When a business is non-corporate, its debts are personal liabilities of the firm's owner. When a firm is a small corporation, lenders often require personal guarantees or security in the form of a second mortgage on the owner's home, which wipes out

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[14] A related model would be that of Suárez and Sussman (2007).

[15] Another paper close in spirit to these ideas is that of Araujo and Minetti (2011).

[16] The Spanish term is *Dación en pago.*

the owner's limited liability. An extension of the model would be to analyse the choice between personal bankruptcy and the mortgage system of an entrepreneur who has unlimited liability and is risk averse about her personal wealth.[17] This extension may be particularly appealing because of the high number of small and/or unincorporated firms in Spain and because the bankruptcy rates of the former are the lowest (Celentani, García-Posada and Gómez, 2010, 2012).

[17] The assumption of risk aversion may be crucial. Following the seminal paper of Fan and White (2003), the literature argues that less severe personal bankruptcy laws (i.e., high exemption levels, existence of a debt discharge) may be associated to higher levels of welfare by promoting entrepreneurship, since they provide (risk averse) potential entrepreneurs with partial wealth insurance.

8 Appendix A: the Spanish institutional framework.

In this section it will be argued that the Spanish bankruptcy system is quite inefficient relative to the mortgage system, and that the latter protects the rights of creditors more than the former. For a more thorough description of the Spanish bankruptcy code see Celentani, García-Posada and Gómez (2010, 2012).

8.1 The Spanish bankruptcy and mortgage systems.

The current bankruptcy system in Spain (*Ley Concursal*) entered into force in September 2004.[18] It only has an insolvency procedure, the *concurso de acreedores,* both for firms and individual debtors. Before the *Ley Concursal,* the previous one was notoriously inefficient (Cerdá and Sancho, 2000). The rules were archaic –mostly from the 1885 Commercial Code and the Law of Suspension of Payments of 1922, but also from an earlier Commercial Code of 1829- and procedures were complex and lengthy -25 years was not unheard of-.

Bankruptcy regimes are often classified as debtor-friendly or creditor-friendly. Debtor-friendly regimes are mostly concerned about keeping the firm as a going concern, while at the same time keeping an eye on the rights of other stakeholders, particularly employees. The paradigmatic case is the French one. Creditor-friendly regimes are essentially driven by creditors and are focused on maximising the net recovery of their credit. The paradigmatic case is the British one. The Spanish bankruptcy system is regarded as debtor-friendly, although not as much as the French one (Celentani, García-Posada and Gómez, 2010, 2012).

Alternatively, when a firm defaults on its debt, secured creditors can seize the assets that serve as collateral for the loans, i.e., they can ask the court to carry out a foreclosure (*ejecución hipotecaria*). A foreclosure does not protect unsecured creditors, who must rely on separate insolvency proceedings to enforce their claims. A related procedure is the "friendly foreclosure", in which the secured lender repossesses the property with the consent of the borrower in exchange for cancelling the outstanding debt. In Spain this mechanism (*dación en pago*) has been widely used during the housing burst by building and real estate companies. Therefore the Spanish mortgage system (*Ley Hipotecaria*) may play a major role as an alternative insolvency institution if firms and their creditors agree on foreclosing on the assets that were pledged as mortgage collateral instead of filing for bankruptcy.

[18] The current Act has been extensively modified twice, one in March 2009 and the other at the end of 2011, both trying to solve several shortcomings of the initial design. For instance, prepackaged bankruptcy (*convenio anticipado*) has been facilitated.

8.2 Efficiency.

Although there are theoretically appealing concepts of efficiency such as *ex-ante* and *ex-post* efficiency[19], those are difficult to measure empirically. An alternative way to measure the efficiency of an insolvency procedure is via creditor (discounted) recovery rates, which depend on factors such as the length of the proceeding, claim dilution and the direct costs in which the contract parties incur (court fees, fees of insolvency administrators, auctioneers, assessors and lawyers, etc). This notion of efficiency is very close to that of Djankov *et al.* (2008).[20]

In Spain foreclosures are much speedier than bankruptcy procedures. According to a survey of the European Mortgage Federation (2007), the usual length of a foreclosure process (the total time taken from the writ of execution to the actual distribution of the proceeds of the sale) is 7 to 9 months in Spain, while the median length of a bankruptcy process in 2007 ranged between 20 and 23 months (Van Hemmen, 2008). Furthermore, those figures mainly correspond to a pre-crisis situation. The economic crisis made the number of bankruptcy filings soar since 2008, implying a congestion of the courts and a dramatic increase in the median length of the bankruptcy process: between 27 and 35 months in 2008, between 31 and 36 in 2009 and between 28 and 36 in 2010 (Van Hemmen, 2009, 2010, 2011).[21]

Furthermore, secured credit suffers from dilution inside the bankruptcy process due to several factors, which further decrease creditor recovery rates. First, there is an automatic stay for secured credits over assets that are integrated in the debtor's production process, for the minimum of 1 year or the date in which a reorganisation plan is approved. Second, some labour and administrative claims enjoy priority over secured credits.[22] Finally, super-priority finance,

[19] *Ex-ante* efficiency is normally defined as the maximisation of the incentives of lenders to provide credit (Hart, 2000; Ayotte and Yun, 2007). It will be attained when the procedure provides debtors with the right incentives to repay their liabilities, so that moral hazard is prevented. *Ex-post* efficiency is the maximisation of the value of the firm, conditional on the firm having entered a bankruptcy procedure. It will be achieved when the procedure delivers a decision in favour of the liquidation of the bankrupt firm when the firm is worth more if liquidated piecemeal and a decision in favour of its reorganisation if the firm is worth more if kept as a going concern.

[20] Djankov *et al.* (2008) designed a survey to provide a quantitative measure of the losses in debt enforcement around the world and of the causes of these losses, i.e., what part is due to legal costs, duration, or inefficient decisions relative to the liquidation or continuation of an insolvent firm. Since they examine a *hypothetical* case study on a firm for which they *assume* a liquidation and a going-concern value, they can include the loss in value due to inefficient decisions.

[21] The reason why the median length is shown as a range is because there are two types of bankruptcy procedures, the simplied one (*concurso abreviado*) and the ordinary one (*concurso ordinario*). The simplied procedure is slightly faster, and it can be followed by the Court using several criteria (less than 50 creditors; liabilities not above € 5,000,000; assets not above € 5,000,000; anticipated restructuring agreement; foreseen sale of the firm as a going concern, etc.).

[22] Specifically, preferential credit (*créditos contra la masa*) enjoys priority over secured credit. Preferential credit comprises salaries for the last month of activity and the costs of the procedure itself, including compensation for the insolvency administrators.

which ranks above secured debt, can be raised.[23] Spanish secured creditors will not suffer any dilution in their claims if they avoid the bankruptcy process and foreclose on the collateral instead.

Although estimates of the direct costs of bankruptcy are not available for Spain, there seems to be a consensus among practitioners and legal scholars that foreclosures are much cheaper than bankruptcy filings.[24] In Spain, a foreclosure is a well-defined and quite standardised process with a low degree of uncertainty about its final outcome, so that its implementation is subject to economies of scale (the bank files several foreclosure lawsuits at the same time, only changing the details of the debtor and the collateral). By contrast, bankruptcy procedures are much more complex and uncertain and they often involve high information asymmetries between the company and its creditors, requiring a great deal of invervention by the court, insolvency administrators, lawyers, etc.

8.3 Creditor protection: creditor *control* rights.

In this section we focus on a specific feature of creditor protection: creditor *control* rights. By creditor control rights we mean the chances that, following insolvency, the control of the firm is transferred from the firm's manager to some important creditor or an insolvency administrator appointed and supervised by a committee of creditors. For instance, the US bankruptcy code allows the firm's manager or owner to remain in control of the company during the whole procedure (the so-called "debtor-in-possession"). The opposite occurs in the UK bankruptcy system: following default, the holder of a floating charge[25] on the business -commonly one bank providing the bulk of finance to the company- appoints an administrator who takes over the management. The company management is entirely replaced, and the appointed administrator is supervised by a committee of creditors and the Court.

In the Spanish case, the insolvent debtor normally keeps the control of the firm, although she is overseen by the insolvency administrators, who must also authorize all transactions outside the day-to-day business of the company.[26] The

[23]Super-senior financing corresponds to the rights of certain creditors of a bankrupt debtor to receive payment before others that would seem to have more senior claims; it is typically granted when a creditor provides much-needed financing after a bankruptcy filing. The most common case is debtor-in-possession financing.

[24]According to European Mortgage Federation (2007), the total costs of foreclosures are between the 5% and 15% of the price obtained in the auction of the collateral. The percentage decreases as the sale price increases, suggesting that an important part of the costs are fixed.

[25]A floating charge is a security interest over a fund of changing assets of a firm, which "floats" until it "crystallises" (converts) into a fixed charge, at which point the charge attaches to specific assets. The crystallisation can be triggered by a number of events, being one of them the borrower's default. The main difference of the floating charge relative to other security interests such as a mortgage is that, because the security "floats", the firm remains free to purchase and sell all types of assets: credit is secured by all the assets of the firm, not by certain types of assets such as real estate.

[26]An exception occurs when the bankruptcy filing is initiated by the creditors (*concurso necesario*) and not by the debtor (*concurso voluntario*). In that case the insolvency administrators take over management. In practice, since the entry into force of the *Ley Concursal* (September 2004), around 87% have been the so-called voluntary filings, on the debtor's initiative. Source: *Consejo General del Poder Judicial.*

general rule is that there will be one, who is appointed by the Court.[27] Only when the proceeding is especially important (due to factors such as the number of creditors, annual turnover, employees, etc) the Court may also appoint a creditor from the upper third part of credits in terms of amount.

The debtor is also the only one that can present a liquidation plan at the onset of the process, while restructuring or reorganisation plans may be proposed both by the debtor and by the creditors.[28] This also limits the effective control rights of creditors, who can only wait for the presentation of a reorganisation plan and then vote against it if they believe that liquidation is the option that better safeguards their interests: if no reorganisation plan is presented or reaches approval, or if the approved plan fails, the insolvency administrators will submit a liquidation plan to the court.

By contrast, under the Spanish mortgage law control is transferred to creditors with certainty following default. Once a determinate number of mortgage payments has not been made, the creditor -normally a bank- can go to the courts and ask for a foreclosure process in order to seize the assets that serve as collateral for the loan. The debtor can only stop the foreclosure if she pays all the outstanding debt plus the delay interest and all the expenses involved in the court process (prosecutors, judges, official expenses, etc). Once the seizure process finishes, the creditor sends the property to the courts to public auction, whose proceedings will be used to repay the creditor. If there are no bidders, the creditor can repossess the asset.

9 Appendix B: justification of D(l)=nl.

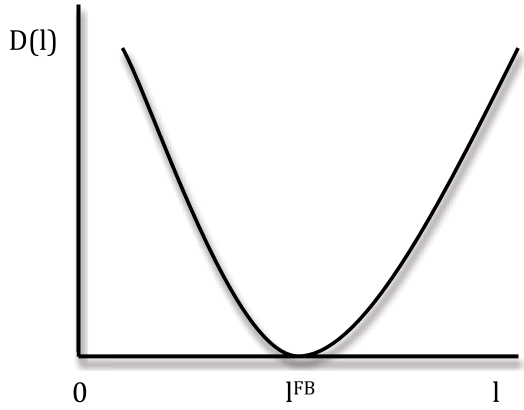
In the model we have assumed that the cost function of productive inefficiencies is $D(l) = nl$ with $n > 0$. Although we have chosen this function for its analytical tractability rather than for its realism (since $l^{FB} = 0$ and $l = \gamma I$, $\gamma^{FB} = 0$, i.e., the optimal amount of capital is zero), it satisfies some desirable properties.

A more general function function $D(l)$ is depicted in Figure A1, where *D(l)* is a symmetric function around the first-level liquidation value l^{FB} .

[27] She may be a practicing lawyer or an auditor, economist or commercial expert (*titulado mercantil).* The number of administrators has gone down to one from the initial number of three (one in the simplified procedure) in the last reform of 2011, with entry into force in January 1st 2012.

[28] Data shows that in virtually all cases –nearly 97%- it is the debtor who proposes the reorganisation plan. Source: *Consejo General del Poder Judicial.*

Figure A1: An example of cost function from productive inefficiencies



The manager may have incentives to deviate from the optimal proportion of capital, hence incurring in productive inefficiencies, if by doing so she increases the project's liquidation value l and consequently the recovery rate of the lender in the event of default, and in turn decreases the repayment R. This mechanism, which follows the same logic as increasing the collateral's value to reduce the risk premium of a loan, can be observed from the inspection of the payoff function of the lender in the case of non-strategic default, recalling that he is perfectly competitive:

$$\theta R + (1 - \theta)\, \beta \alpha l - I = 0$$

From the above equation one can see that a higher value of l yields, *ceteris paribus*, a lower value of R. The same reasoning also implies that the manager will never choose a proportion of capital such that $l < l^{FB}$, because she would incurr in productive inefficiencies with cost $D(l) > D(l = l^{FB}) = 0$. and she would also have a higher funding cost R than if choosing $l = l^{FB}$. Thus, since the only relevant cases are the ones in which $l \geq l^{FB}$, let us truncate the support of the above dead-weight loss function at $l = l^{FB}$ and set $l^{FB} = 0$ for simplicity. A function that satisfies these properties is:

$D(l) = nl$ where $n > 0$.

10 Appendix C: proofs of lemmas and propositions.

10.1 Proofs for the optimal contracts (distress resolution via private workouts).

LEMMA 1: *The individual rationality constraint of the lender (2) is binding at the optimum.*

PROOF: Suppose to the contrary that (2) is slack. In such a case lowering R would increase EU, since $\frac{\partial EU}{\partial R} < 0$, and makes (1) and (3) hold *a fortiori*. ■

LEMMA 2: *The incentive compatibility constraint of the manager (1) is binding at the optimum.*

PROOF: Suppose, to the contrary, that (1) is slack. In such a case we could lower β to $\beta' = \beta - \varepsilon$ where $\varepsilon > 0$. To keep (2) binding we need to increase R to $R' = R + \frac{1-\theta}{\theta}\alpha l\varepsilon$. The old utility is $V_0 \equiv \theta\left[\pi - nl - R + \phi\pi\right] + (1-\theta)(1-\beta)\phi\pi$. The new utility is $V_1 \equiv \theta\left[\pi - nl - \left(R + \frac{1-\theta}{\theta}\alpha l\varepsilon\right) + \phi\pi\right] + (1-\theta)\left[1-(\beta-\varepsilon)\right]\phi\pi$. The new utility is higher than the old utility because $V_1 - V_0 > 0 \iff -(1-\theta)\alpha l\varepsilon + (1-\theta)\phi\pi\varepsilon > 0 \iff \phi\pi > \alpha l$ which is true by assumption. Therefore, (1) cannot be slack at the optimum since there would be a pair β', R' that would increase the manager's utility without violating the lender's individual rationality constraint. ■

PROPOSITION 1: *The optimal contract in the case of distress resolution via a private workout when* $0 < \alpha \leq 1$, $\{R^*, \beta^*, l^*\}$, *is:* $R^* = \phi\pi\beta^*, \beta^* = \frac{I}{\sqrt{\frac{(1-\theta)I\phi\pi}{\theta n}\alpha - \theta^2\phi^2\pi^2\frac{1-\alpha^2}{\alpha^2}}}, l^* = \sqrt{\frac{I\phi\pi}{\theta(1-\theta)n\alpha} - \frac{\theta^2\phi^2\pi^2(1-\alpha^2)}{(1-\theta)^2\alpha^4}} - \frac{\theta\phi\pi}{(1-\theta)\alpha}$.

PROOF: Making use of Lemmas 1 and 2 we can express the liquidation probability β and the repayment R as functions of the liquidation value l, i.e., $\beta^* = \frac{I}{\theta\phi\pi + (1-\theta)\alpha l}$ and $R^* = \frac{I\phi\pi}{\theta\phi\pi + (1-\theta)\alpha l}$. Plugging those expressions into the manager's utility and the remaining constraints we have the following maximisation problem:

$$\underset{\{l\}}{MAX}\ EU = \theta(\pi - nl) + \phi\pi - \frac{I\phi\pi}{\theta\phi\pi + (1-\theta)\alpha l}$$

subject to:

$$I \leq \theta\phi\pi + (1-\theta)\alpha l \tag{14}$$

$$I \leq \frac{\pi - nl}{\phi\pi}\left[\theta\phi\pi + (1-\theta)\alpha l\right] \tag{15}$$

To avoid considering multiple cases, let us assume that the cash flow at t=1 in the good state of nature, $\pi - nl$, is greater than or equal to the expected cash flow at t=2, $\phi\pi$. In such a case, if (14) holds, then (15) must hold, so we can ignore the latter from the analysis. Now let us rearrange (14):

$$l \geq \frac{I - \theta\phi\pi}{(1-\theta)\,\alpha} \tag{16}$$

Since $I \leq \theta\phi\pi$ and $l \geq 0$ by construction, (16) is always satisfied for any value of l, so we can ignore it as well.

We then face an unconstrained maximisation program, whose solutions are $l = -\frac{\theta\phi\pi}{(1-\theta)\alpha} \pm \sqrt{\frac{I\phi\pi}{\theta(1-\theta)n\alpha} - \frac{\theta^2\phi^2\pi^2(1-\alpha^2)}{(1-\theta)^2\alpha^4}}$

However, since $l \geq 0$, we can rule out the negative root, so the unique solution is $l^* = \sqrt{\frac{I\phi\pi}{\theta(1-\theta)n\alpha} - \frac{\theta^2\phi^2\pi^2(1-\alpha^2)}{(1-\theta)^2\alpha^4}} - \frac{\theta\phi\pi}{(1-\theta)\alpha}$. Plugging l^* into the above expressions for β and R we find $\beta^* = \frac{I}{\sqrt{\frac{(1-\theta)I\phi\pi}{\theta n}\alpha - \theta^2\phi^2\pi^2\frac{1-\alpha^2}{\alpha^2}}}$ and $R^* = \phi\pi\beta^*$. By differentianting EU twice with respect to l we find $\frac{\partial^2 EU}{\partial l^2} < 0$, i.e, the function is concave and l^* is its maximand.

■

PROPOSITION 2: *The optimal contract in the case of distress resolution via a private workout when* $\alpha = 0$, $\{R^{**}, \beta^{**}, l^{**}\}$, *is:*
$R^{**} = \frac{I}{\theta}$,$\beta^{**} = \frac{I}{\theta\phi\pi}$, $l^{**} = 0$.

PROOF: Making use of Lemmas 1 and 2 we can again find the liquidation probability β and the repayment R, which they do not longer depend on the liquidation value l: $\beta^{**} = \frac{I}{\theta\phi\pi}$ and $R^{**} = \frac{I}{\theta}$. Plugging those expressions into the manager's utility and the remaining constraints we have the following maximisation problem:

$MAX\ EU = \theta(\pi - nl) + \phi\pi - \frac{I}{\theta}$
$\{l\}$

subject to:

$$\pi - nl - \frac{I}{\theta} \geq 0 \tag{17}$$

$$I \leq \theta\phi\pi \tag{18}$$

Since $\frac{\partial EU}{\partial l} < 0$ for any l,we have a corner solution: $l^{**} = 0$. Plugging $l^{**} = 0$ into (17) and rearranging it becomes $I \leq \theta\pi$. Since $I \leq \theta\phi\pi$ (18) is satisfied by construction while (17) is satisfied because $0 < \phi < 1$.

■

10.2 Proofs for the optimal contracts (distress resolution via bankruptcy).

LEMMA 4: *β_B^* is the minimum level of creditor rights in bankruptcy that makes the lender provide credit. If $\beta_B < \beta_B^*$, then the contract is not feasible under the bankruptcy institution.*

PROOF: Making use of lemma 2 and equation (10) we obtain the following incentive-compatibility constraint: $\beta_B^* \phi \pi = R_B$. If $\beta_B < \beta_B^*$, then $\beta_B \phi \pi < R_B$, i.e., the incentive-compatibility constraint is violated. The only way we could make the constraint hold again would be by lowering R_B. However, lemma 1 posits that the individual rationality constraint of the lender (2) is binding at the optimum, so that $R_B^* = \frac{I}{\theta}$ is both the optimal and the minimum feasible repayment, and we cannot lower R_B below that value without violating the constraint. ■

PROPOSITION 4: *If $\beta_B > \beta_B^*$, then the contract is feasible under the bankruptcy institution. In that case the optimal contract $\{R_B^{**}, l_B^{**}\}$ is given by $R_B^{**} = \frac{I}{\theta}, l_B^{**} = 0$. The economy's welfare is $W_B^{**} = (\theta + \phi)\pi - I - (1-\theta)\beta_B \phi \pi$*

PROOF: Making use of Lemma 1 we find that the optimal repayment is $R_B^{**} = \frac{I}{\theta}$. Since $\frac{\partial EU}{\partial l_B} < 0$ for any l_B and lowering l_B makes (8) hold *a fortiori,* we have $l_B^{**} = 0$. Because of Lemma 2 and $\beta_B > \beta_B^*$ the incentive compatibility constraint is slack and becomes $\beta_B \phi \pi > \frac{I}{\theta}$. Rearranging it we find a constraint for the initial outlay I: $I < \beta_B \theta \phi \pi$. Another constraint for I arises from plugging R_B^{**} and l_B^{**} into (8) and rearranging: $I \leq \theta \pi$. However, since $0 \leq \beta_B \leq 1$ and $0 < \phi < 1$, if $I < \beta_B \theta \phi \pi$ holds, then $I \leq \theta \pi$ must also hold, so we can ignore the latter. To see that $I < \beta_B \theta \phi \pi$ holds recall that we have imposed $\beta_B > \beta_B^* = \frac{I}{\theta \cdot \phi \pi}$, which makes such constraint hold by construction. Finally, plugging $R_B^{**} = \frac{I}{\theta}$ and $l_B^{**} = 0$ into the manager's expected utility and using the fact the lender breaks even we find $W_B^{**} = (\theta + \phi)\pi - I - (1-\theta)\beta_B \phi \pi$. ■

10.3 Proofs for the optimal contracts (distress resolution via mortgage).

LEMMA 5: *The incentive compatibility constraint of the manager (11) is not binding at the optimum.*

PROOF: First, simplifiy and rearrange (11) to obtain $R_M \leq \phi \pi$. Since $\frac{\partial EU_M}{\partial R_M} < 0$ and by lowering R_M (11) holds *a fortiori,* one would like to decrease R_M as much as possible to increase EU_M, which implies that
(11) is not binding. ■

LEMMA 6: *The feasibility constraint (13) is not binding at the optimum.*

PROOF: First, rearrange (13) to obtain $R_M + nl_M \leq \pi$. Since $\frac{\partial EU_M}{\partial R_M} < 0$ and $\frac{\partial EU_M}{\partial l_M} < 0$ and by lowering R_M and l_M (13) holds *a fortiori,* one would like to decrease R_M and l_M as much as possible to increase EU_M, which implies that (13) is not binding. ■

LEMMA 7: *The individual rationality constraint of the lender (12) is binding at the optimum.*

PROOF: Suppose to the contrary that (12) is slack. In such a case lowering R_M and l_M would increase EU_M, since $\frac{\partial EU_M}{\partial R_M} < 0$ and $\frac{\partial EU_M}{\partial l_M} < 0$, and makes (11) and (13) hold *a fortiori*. ■

PROPOSITION 5: *The equilibrium contracts and the economy's welfare under mortgage are:*

a) For $n \leq \frac{(1-\theta)}{\theta}\alpha_M$*:* $l_M^* = I$, $R_M^* = \frac{I-(1-\theta)\alpha_M I}{\theta}$, $EU_M^* = (\theta+\phi)\pi - I - (1-\theta)[\phi(\pi - n\cdot f(1)) - \alpha_M f(1)] - (\theta+\phi) n f(1)$.

b) For $n > \frac{(1-\theta)}{\theta}\alpha_M$ *:* $l_M^{**} = 0$, $R_M^{**} = \frac{I}{\theta}$, $EU_M^{**} = (\theta+\phi)\pi - I - (1-\theta)\phi\pi$.

PROOF: Since by lemma 7 we know that (12) is binding, rearraging it we find the repayment cost as function of the liquidation value: $R_M = \frac{I-(1-\theta)\alpha_M l_M}{\theta}$. Plugging this expression into EU_M, and knowing by lemmas 5 and 6 that (11) and (13) are not binding, we have the following unconstrained program:

$$\underset{\{l_M\}}{MAX}\ EU_M = \theta\left[\pi - n l_M - \frac{I-(1-\theta)\alpha_M l_M}{\theta} + \phi\pi\right]$$

Differentiating EU_M with respect to l_M we have $\frac{\partial EU}{\partial l_M} = -\theta n + (1-\theta)\alpha_M$. The sign of the derivative depends on the relative value of n *vis-à-vis* α_M:

$\frac{\partial EU_M}{\partial l_M}>0$ if and only if $n < \frac{(1-\theta)}{\theta}\alpha_M$; $\frac{\partial EU_M}{\partial l_M}<0$ if and only if $n > \frac{(1-\theta)}{\theta}\alpha_M$.

Hence we have two corner solutions:

a) For $n \leq \frac{(1-\theta)}{\theta}\alpha_M$*:* $l_M^* = I$, $R_M^* = \frac{I-(1-\theta)\alpha_M I}{\theta}$.

b) For $n > \frac{(1-\theta)}{\theta}\alpha_M$ *:* $l_M^{**} = 0$, $R_M^{**} = \frac{I}{\theta}$.

Plugging those solutions into the manager's expected utility and using the fact that the lender breaks even we find the corresponding equilibrium welfares. ■

10.4 Proofs for the choice of insolvency institution.

ANALYSIS OF THE FEASIBILITY OF $\bar{n} \equiv \frac{(1-\theta)\left[\frac{I}{\theta}+\alpha_M I - \phi\pi\right]}{\theta I}$.

When $n \leq \frac{1-\theta}{\theta}\alpha_M$ and $\beta_B = \beta_B^*$, the manager will choose the mortgage institution if and only if $EU_M^* \geq EU_B^*$, which amounts to:

$$n \leq \bar{n} \equiv \frac{(1-\theta)\left[\frac{I}{\theta}+\alpha_M I - \phi\pi\right]}{\theta I}$$

For that condition to be feasible we need to check that a) $\bar{n} \geq 0$, so the interval $[0, \bar{n}]$ for which mortgage is chosen is not empty, and that b) $\bar{n} \leq \frac{1-\theta}{\theta}\alpha_M$, so it occurs in the scenario $n \leq \frac{1-\theta}{\theta}\alpha_M$.

a) $\bar{n} \geq 0$. It is equivalent to $\alpha_M I \geq (1-\beta_B^*)\,\phi\pi$, i.e., that the liquidation proceedings in mortgage when $n \leq \frac{1-\theta}{\theta}\alpha_M$ are greater than the cost of inefficient liquidations in optimal bankruptcy. Rewritting that expression as $\alpha_M \geq \frac{\phi\pi}{I} - \frac{1}{\theta}$, we need to check that $\frac{\phi\pi}{I} - \frac{1}{\theta} \leq 1$, so there may exist a sufficiently high $\alpha_M \leq 1$ that satisfies the previous inequality. $\frac{\phi\pi}{I} - \frac{1}{\theta} \leq 1$ can be rewritten as $I \geq \frac{\theta\phi\pi}{1+\theta}$, which is feasible since $I \leq \theta\phi\pi$ by assumption.

b) $\bar{n} \leq \frac{1-\theta}{\theta}\alpha_M$ can be rewritten as $I \leq \theta\phi\pi$. Thus, it is satisfied by construction.

In sum, $\bar{n} \equiv \frac{(1-\theta)\left[\frac{I}{\theta}+\alpha_M I-\phi\pi\right]}{\theta I}$ is feasible if $\alpha_M \geq \frac{\phi\pi}{I} - \frac{1}{\theta}$.

ANALYSIS OF THE FEASIBILITY OF $\widetilde{n} \equiv \frac{(1-\theta)[\alpha_M I-(1-\beta_B)\phi\pi]}{\theta I}$.

When $n \leq \frac{1-\theta}{\theta}\alpha_M$ and $\beta_B > \beta_B^*$, the manager will choose the mortgage institution if and only if $EU_M^* \geq EU_B^{**}$, which amounts to:

$$n \leq \widetilde{n} \equiv \frac{(1-\theta)[\alpha_M I-(1-\beta_B)\phi\pi]}{\theta I}$$

For that condition to be feasible we need to check that a) $\widetilde{n} \geq 0$, so the interval $[0,\widetilde{n}]$ for which mortgage is chosen is not empty, and that b) $\widetilde{n} \leq \frac{1-\theta}{\theta}\alpha_M$, so it occurs in the scenario $n \leq \frac{1-\theta}{\theta}\alpha_M$.

a) $\widetilde{n} \geq 0$. It is equivalent to $\alpha_M I \geq (1-\beta_B)\,\phi\pi$, i.e., that the liquidation proceedings in mortgage when $n \leq \frac{1-\theta}{\theta}\alpha_M$ are greater than the cost of inefficient liquidations in non-optimal bankruptcy. Rewritting that expression as $\alpha_M \geq \frac{\phi\pi}{I}(1-\beta_B)$, we need to check that $\frac{\phi\pi}{I}(1-\beta_B) \leq 1$, so there may exist a sufficiently high $\alpha_M \leq 1$ that satisfies the condition. Since $\frac{\phi\pi}{I}(1-\beta_B) \leq 1$ is equivalent to $\beta_B > 1 - \frac{I}{\phi\pi}$, we need to check that its RHS is lower than 1 for a sufficiently high β_B to be able to satisfy it. However, notice that it is always the case, since $\frac{I}{\phi\pi} > 0$.

b) $\widetilde{n} \leq \frac{1-\theta}{\theta}\alpha_M$ can be rewritten as $-\phi\pi\,(1-\beta_B) \leq 0$, which is always true since $\phi\pi > 0$ and $0 \leq \beta_B \leq 1$.

In sum, $\widetilde{n} \equiv \frac{(1-\theta)[\alpha_M I-(1-\beta_B)\phi\pi]}{\theta I}$ is feasible if $\alpha_M \geq \frac{\phi\pi}{I}(1-\beta_B)$, where $\beta_B > \beta_B^* = \frac{I}{\theta\phi\pi}$

11 Appendix D: analysis when $\alpha_B > 0$.

The aim of this section is to show that the model's results do not change qualitatively when we relax the assumption $\alpha_B = 0$ and we allow for some positive credit recovery under bankruptcy, i.e., $\alpha_B > 0$. Specifically, under bankruptcy the level of overinvestment in capital is (weakly) lower, i.e., $l_B^* \leq l_M^*$, as well as the probability of inefficient liquidations, i.e., $\beta_B^* \leq \beta_M^*$.

11.1 Optimal contract under bankruptcy and optimal bankruptcy code.

In the baseline model, where $\alpha_B = 0$, the optimal bankruptcy code β_B^* does not depend on the marginal cost from productive inefficiencies n. If $\alpha_B > 0$ this is no longer the case. The maximisation program to find the optimal bankruptcy code β_B^*, together with the optimal contract $\{R_B^*, l_B^*\}$, is the following:

$$MAX\ EU_B = \theta\left[\pi - nl_B - R_B + \phi\pi\right] + (1-\theta)(1-\beta_B)\phi\pi$$
$$\{\beta_B, R_B, l_B\}$$

subject to:

$$\beta_B\phi\pi \geq R_B \tag{19}$$

$$\theta R_B + (1-\theta)\beta_B\alpha_B l_B \geq I \tag{20}$$

$$R \leq \pi - nl_B \tag{21}$$

$$0 \leq \beta_B \leq 1 \tag{22}$$

The solution strategy to the above program is identical to that of the base model (distress resolution via private workouts), so we refer the reader to the proof of Proposition 1. The results are summarised in Proposition C1.

PROPOSITION C1: *The optimal bankruptcy code β_B^* and the optimal contract $\{R_B^*, l_B^*\}$ when $\alpha_B > 0$ are:*

$$\beta_B^* = \frac{I}{\sqrt{\frac{(1-\theta)I\phi\pi}{\theta n}\alpha_B - \theta^2\phi^2\pi^2\frac{1-\alpha_B^2}{\alpha_B^2}}};\ R_B^* = \phi\pi\beta_B^*\ ;\ l_B^* = \sqrt{\frac{I\phi\pi}{\theta(1-\theta)n\alpha_B} - \frac{\theta^2\phi^2\pi^2\left(1-\alpha_B^2\right)}{(1-\theta)^2\alpha_B^4}} - \frac{\theta\phi\pi}{(1-\theta)\alpha_B}.$$

Several remarks are worth making regarding the optimal bankruptcy code β_B^*. First, β_B^* depends on the technological parameter n, which implies that the bankruptcy code should be firm/industry specific. This provides additional support to one of the key arguments of the paper, namely that allowing for a menu of insolvency options that differ in their debtor/creditor orientation can increase efficiency. Second, the higher the marginal cost of overinvesting in capital n, the more "creditor-friendly" the optimal bankruptcy code should be (i.e., $\frac{\partial\beta_B^*}{\partial n} > 0$). Since the optimal bankruptcy code is the minimum level of creditor rights that makes the credit contract feasible under bankruptcy (Lemma 4), this implies that, unless creditor rights are set "sufficiently high", some industries (e.g. R&D) will not be able to use the bankruptcy institution, even if they would be better off by doing so, and they will have to use the mortgage institution instead. Finally, $\beta_B^* \leq \beta_M = 1$, i.e., the liquidation probability is (weakly) lower in bankruptcy than in mortgage. Too see this notice that, in analogous fashion to the base model, the optimal liquidation probability can be expressed as a function of the optimal liquidation value: $\beta_B^* = \frac{I}{\theta\phi\pi+(1-\theta)\alpha_B l_B^*}$. Since $I \leq \theta\phi\pi$ by assumption, $\beta_B^* < 1$ as long as $l_B^* > 0$. Only if $l_B^* = 0$ (which can be shown that happens when $n = \frac{I(1-\theta)\alpha_B^3}{\theta^3\phi\pi}$) and $I = \theta\phi\pi$, then $\beta_B^* = 1$.

With respect to the level of overinvestment in capital under bankruptcy, it is lower than under mortgage. It can be shown that $l_B^* > 0$ when $n < \frac{I(1-\theta)}{\theta^3\phi\pi}\alpha_B^3$ while we know from Proposition 5 that $l_M^* = I$ when $n \leq \frac{1-\theta}{\theta}\alpha_M$. Since $\frac{I(1-\theta)}{\theta^3\phi\pi}\alpha_B^3 < \frac{1-\theta}{\theta}\alpha_M$, overinvestment will take place in bankruptcy for less and lower values of n and the size of such overinvestment will also be (weakly) smaller: $l_B^* \leq l_M^*$.

11.2 Optimal contracts under non-optimal bankruptcy code.

11.2.1 Optimal contracts.

The optimal contract maximises the manager's expected utility EU subject to the following constraints: (23) the manager does not default strategically (incentive compatibility); (24) the lender decides to provide credit (individual rationality); (25) since the manager is wealthless, the repayment cannot exceed the cash flow at t=1 in the good state of nature (feasibility constraint). Formally, the maximisation problem is the following:

$$\underset{\{R_B, l_B\}}{MAX}\ EU_B = \theta\left[\pi - nl_B - R_B + \phi\pi\right] + (1-\theta)(1-\beta_B)\phi\pi$$

subject to:

$$\beta_B\phi\pi \geq R_B \tag{23}$$

$$\theta R_B + (1-\theta)\beta_B\alpha_B l_B \geq I \tag{24}$$

$$R_B \leq \pi - nl_B \tag{25}$$

This maximisation program is the generalisation of that for the mortgage institution (section 4.2) in which the liquidation probability β_B is not necessarily 1. Thus we can follow the same strategy to solve it. The optimal contracts are summarised in Proposition C2.

PROPOSITION C2: *The equilibrium contracts under bankruptcy for any bankruptcy code such that* $\beta_B > \beta_B^*$ *are:*

a) For $n \leq \frac{1-\theta}{\theta}\beta_B\alpha_B$: $l_B^* = I$, $R_B^* = \frac{I-(1-\theta)\beta_B\alpha_B I}{\theta}$.

b) For $n > \frac{1-\theta}{\theta}\beta_B\alpha_B$: $l_B^{**} = 0$, $R_B^{**} = \frac{I}{\theta}$.

11.2.2 Overinvestment: bankruptcy vs. mortgage.

As displayed in Proposition C2, unlike in the case with $\alpha_B = 0$, there is overinvestment in capital for some values of n. However, *such overinvestment occurs for less and lower values of n than in the case of mortgage, i.e., there is less overinvestment.* This can be shown by comparing the equilibrium liquidation values under non-optimal bankruptcy with $\alpha_B > 0$ (from Proposition C2) with those under mortgage (from Proposition 5) .

In the case of bankruptcy: $l_B^* = I$ for $n \leq \frac{1-\theta}{\theta}\beta_B\alpha_B$ and $l_B^{**} = 0$ for $n > \frac{1-\theta}{\theta}\beta_B\alpha_B$. In the case of mortgage: $l_M^* = I$ for $n \leq \frac{1-\theta}{\theta}\alpha_M$ and $l_M^{**} = 0$ for $n > \frac{1-\theta}{\theta}\alpha_M$. The fact that $\beta_B \leq 1$ and $\alpha_B < \alpha_M$ implies $\frac{1-\theta}{\theta}\beta_B\alpha_B < \frac{1-\theta}{\theta}\alpha_M$, which means that overinvestment under bankuptcy ($l_B^* = I$) takes place for less and lower values of n than in the case of mortgage ($l_M^* = I$).

The intuition of this finding is straightforward. Overinvesting in capital reduces funding costs at the expense of costs of productive inefficiencies. The funding costs, as a function of the liquidation value, are $R_B = \frac{I-(1-\theta)\beta_B\alpha_B l_B}{\theta}$ under bankruptcy and $R_M = \frac{I-(1-\theta)\alpha_M l_M}{\theta}$ under mortgage. Since $\frac{\partial R_B}{\partial l_B} = -\frac{1-\theta}{\theta}\beta_B\alpha_B$ while $\frac{\partial R_M}{\partial l_M} = -\frac{1-\theta}{\theta}\alpha_M$ and $\alpha_B < \alpha_M$, $\beta_B \leq 1$, the marginal benefit from overinvesting in capital (i.e., the marginal reduction in funding costs) is higher in the case of mortgage, while its marginal cost, n, is the same for both institutions.

12 Appendix E: analysis when the lender is not perfectly competitive.

In the main model it has been assumed that the lender is perfectly competitive. However, this may not be a realistic assumption in the case of some countries like Spain. Spanish firms are generally very dependent on banking credit -since most companies have limited access to capital markets- and the banking sector has traditionally been highly concentrated. Moreover, it is currently undergoing a restructuring process that will further increase its concentration. The aim of this appendix is to show a version of the model that relaxes this assumption, proving that the model's conclusions are robust to different degrees of competition in the credit market. Specifically, it will be shown that, as in the main model, the level of overinvestment in capital under bankruptcy is lower than under mortgage, i.e., $l_B^* < l_M^*$, as well as the probability of inefficient liquidations, i.e., $\beta_B^* \leq \beta_M^*$.

We depart from perfect competition by assuming that the lender has some bargaining power. Following Suárez and Sussman (2007) we assume that the manager makes a take-it-or-leave-it offer to the lender with probability λ and the lender makes the offer with probability $1 - \lambda$. Since we have already solved the contracts for the case where the manager makes the offer in the main model, what we need to do is to solve those contracts for the other case and then combine the results. The main findings are summarised in Propositions E1, E2 and E3.

PROPOSITION E1: *The optimal bankruptcy code* β_B^* *and the optimal contract under bankruptcy* $\{R_B^*, l_B^*\}$ *are* $\beta_B^* = \lambda\left(\frac{I}{\theta\phi\pi} - 1\right) + 1$, $R_B^* = \lambda\frac{I}{\theta} + (1-\lambda)\,\phi\pi$, $l_B^* = 0$.

PROOF: Let us first find the solution for the case where the lender makes a take-it-or-leave-it offer to the manager. The optimal contract and the optimal bankruptcy code maximise the lender's expected utility Π_B subject to the following constraints: (26) the manager does not default strategically (incentive compatibility); (27) the manager decides to undertake the project (individual rationality); (28) since the manager is wealthless, the repayment cannot exceed the cash flow at t=1 in the good state of nature (first feasibility constraint); (29) the liquidation probability β_B lies in the interval $[0,1]$ (second feasibility constraint). Formally, the maximisation problem is the following:

$MAX\ \Pi_B = \theta R_B - I$
$\{R_B, \beta_B, l_B\}$

subject to:

$$\beta_B\phi\pi \geq R_B \tag{26}$$

$$\theta\left[\pi - nl_B - R_B + \phi\pi\right] + (1-\theta)(1-\beta_B)\,\phi\pi \geq 0 \tag{27}$$

$$R_B \leq \pi - nl_B \tag{28}$$

$$0 \leq \beta_B \leq 1 \tag{29}$$

To solve this problem, first notice that, if (28) holds, then (27) must hold, so that we can ignore the latter. To see this just rearrange (27): $R_B \leq \frac{1}{\theta}\left[(\pi - nl_B + \phi\pi) + (1-\theta)(1-\beta_B)\,\phi\pi\right]$. The RHS of (27) is larger than the RHS of (28) because $\theta < 1$, $\phi\pi > 0$ and $\beta_B \leq 1$. Now notice that, since $\frac{\partial\Pi_B}{\partial R_B} > 0$, the lender chooses $l_B^* = 0$ to make (28) as loose as possible. Plugging $l_B^* = 0$ into (28) and rearranging (26) as $R_B \leq \beta_B\phi\pi$ we see that, if (26) holds, then (28) must hold, so we can ignore the latter. (26) must be binding at the optimum because, if it was slack, we could raise R_B to increase Π_B. Now plug $R_B = \beta_B\phi\pi$ into (29) and rearrange to obtain $R_B \leq \phi\pi$. Since $\frac{\partial\Pi_B}{\partial R_B} > 0$, the previous constraint must be binding at the optimum, so we get $R_B^* = \phi\pi$. Then it follows that $\beta_B^* = 1$. Finally, let us check that the lender's utility is non-negative: $\Pi_B^* = \theta R_B^* - I = \theta\phi\pi - I \geq 0$ which is true because $I \leq \theta\phi\pi$ by assumption.

The optimal bankruptcy code and the optimal contract under bankruptcy are just weighted averages of those where the manager has all the bargaining power (shown in Proposition 3) and those where the lender has all the bargaining power (just shown), where the weights are the probabilities of each scenario, λ and $1-\lambda$. ■

PROPOSITION E2: *The optimal contract* $\{R_B^{**}, l_B^{**}\}$ *under (non-optimal) bankruptcy is* $R_B^{**}=\lambda\frac{I}{\theta}+(1-\lambda)\,\beta_B\phi\pi$, $l_B^{**}=0$.

PROOF: Let us first find the solution for the case where the lender makes a take-it-or-leave-it offer to the manager. The optimal contract maximises the lender's expected utility Π_B subject to the following constraints: (30) the manager does not default strategically (incentive compatibility); (31) the manager decides to undertake the project (individual rationality); (32) since the manager is wealthless, the repayment cannot exceed the cash flow at t=1 in the good state of nature (feasibility constraint). Formally, the maximisation problem is the following:

$MAX\ \Pi_B = \theta R_B - I$
$\{R_B, l_B\}$

subject to:

$$\beta_B\phi\pi \geq R_B \tag{30}$$

$$\theta\left[\pi - nl_B - R_B + \phi\pi\right] + (1-\theta)(1-\beta_B)\,\phi\pi \geq 0 \tag{31}$$

$$R_B \leq \pi - nl_B \tag{32}$$

The solution of the problem follows the same steps as the previous maximisation program, yielding $R_B^{**} = \beta_B\phi\pi$ and $l_B^{**} = 0$. Let us check that the lender's utility is non-negative: $\Pi_B^{**} = \theta R_B^{**} - I = \theta\beta_B\phi\pi - I$. Since $I \leq \theta\phi\pi$ by assumption, a sufficient condition for $\Pi_B^{**} > 0$ is $\beta_B = 1$ and a necessary condition is $\beta_B > 0$.

The optimal contract under (non-optimal) bankruptcy $\{R_B^{**}, l_B^{**}\}$ is just the weighted averages of R_B^{**} and l_B^{**} where the manager has all the bargaining power (shown in Proposition 4) and where the lender has all the bargaining power (just shown), where the weights are the probabilities of each scenario, λ and $1-\lambda$. ■

PROPOSITION E3: *The optimal contracts under mortgage are:*
a) For $n \leq \frac{1-\theta}{\theta}\alpha_M$*:* $R_M^{*} = \lambda\frac{I-(1-\theta)\alpha_M I}{\theta}+(1-\lambda)\,\phi\pi$, $l_M^{*} = \lambda I+(1-\lambda)\,\frac{\pi}{n}(1-\phi)$.

b) For $n > \frac{1-\theta}{\theta}\alpha_M$ *:* $R_M^{**} = \lambda\frac{I}{\theta}+(1-\lambda)\phi\pi$, $l_M^{**} = (1-\lambda)\,\frac{\pi}{n}(1-\phi)$

PROOF: Let us first find the solution for the case where the lender makes a take-it-or-leave-it offer to the manager. The optimal contract maximises the lender's expected utility Π_M subject to the following constraints: (33) the manager does not default strategically (incentive compatibility); (34) the manager decides to undertake the project (individual rationality); (35) since the manager is wealthless, the repayment cannot exceed the cash flow at t=1 in the good state of nature (feasibility constraint). Formally, the maximisation problem is the following:

$$\underset{\{R_M, l_M\}}{MAX}\ \Pi_M = \theta R_M + (1-\theta)\,\alpha_M l_M - I$$

subject to:

$$\phi\pi \geq R_M \tag{33}$$

$$\theta\left[\pi - nl_M - R_M + \phi\pi\right] \geq 0 \tag{34}$$

$$R_M \leq \pi - nl_M \tag{35}$$

To solve this problem, first notice that, if (35) holds, then (34) must hold, so that we can ignore the latter. Now rearrange (35) as $R_M + nl_M \leq \pi$. (35) is binding at the optimum because, if it was slack, we could increase R_M and/or l_M to increase Π_M. (33) is also binding since $\frac{\partial \Pi_B}{\partial R_B} > 0$, so we obtain $R_M^* = \phi\pi$. Plugging R_M^* into (35) and rearranging we get $l_M^* = \frac{\pi}{n}(1-\phi)$.

The optimal contracts under mortgage $\{R_M^*, l_M^*\}$ and $\{R_M^{**}, l_M^{**}\}$ are just the weighted averages of $\{R_M^*, l_M^*\}$ and $\{R_M^{**}, l_M^{**}\}$ where the manager has all the bargaining power (shown in Proposition 5) and where the lender has all the bargaining power (just shown), where the weights are the probabilities of each scenario, λ and $1-\lambda$. ■

Now let us compare the equilibrium liquidation values under (optimal and non-optimal) bankruptcy (Propositions E1 and E2) with those in mortgage (Proposition E3). In bankruptcy those are $l_B^* = l_B^{**} = 0$ while in mortgage they are $l_M^* = \lambda I + (1-\lambda)\frac{\pi}{n}(1-\phi)$ if $n \leq \frac{1-\theta}{\theta}\alpha_M$ and $l_M^{**} = (1-\lambda)\frac{\pi}{n}(1-\phi)$ if $n > \frac{1-\theta}{\theta}\alpha_M$. Since $l_M^* > l_M^{**} > 0$, we can conclude that the level of overinvestment in capital under bankruptcy is lower than under mortgage.

With regards to the equilibrium liquidation probabilities, recall that in mortgage $\beta_M = 1$ by assumption. Under optimal bankruptcy $\beta_B^* = \lambda\left(\frac{I}{\theta\phi\pi} - 1\right) + 1 \leq 1$ since $I \leq \theta\phi\pi$. Under non-optimal bankruptcy $0 < \beta_B \leq 1$. Hence the probability of inefficient liquidations under bankruptcy is (weakly) lower than under mortgage.

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