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DEBT RENEGOTIATION, LIQUIDATION COST AND DEVELOPMENT BANK

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RESUMO:

Por meio de um contrato de débito simples, o emprestador distingue perfeitamente entre o tomador que obteve sucesso do tomador que obteve insucesso. O custo de se liquidar o tomador com insucesso é uma perda necessária para se obter tal distinção. Este artigo investiga como um contrato de débito pode ser renegociado de modo a amenizar este problema. Conclui-se que é ótimo para o credor propor renegociação. Tal renegociação, no entanto, deve ser composta de uma randomização entre perdão e punição de modo a maximizar o incentivo do devedor em pagar. Pode-se então caracterizar o comportamento ótimo de um intermediário financeiro que perdoa parte do débito, mesmo que alguma fração dos devedores em condição de pagar não pague. Caracterizamos este resultado para o caso especial de um banco de desenvolvimento.

PALAVRAS-CHAVE:

Renegociação da dívida; Intermediários Financeiros; Banco de Desenvolvimento; Brasil.

1 INTRODUCTION

In the basic costly state verification model, there is complete distinction between successful and unsuccessful borrower. The successful borrower pays back her debt and the unsuccessful borrower enters bankruptcy. The bankruptcy cost is a dead-weight loss of the arrangement. We investigate how a renegotiation proposal improves the agent's return by avoiding this dead-weight loss.

When the lender does not commit not to renegotiate, the initial contract is always renegotiated when default is threatened, that is, bankruptcy does not occur. The gain from renegotiation is proportional to the liquidation cost. The successful borrower will not always pay. Nonetheless, there is room for the lender to have some power over the borrower ex post because, while there is no credible threat to impose bankruptcy, there is a credible threat to make the terms of the renegotiation more or less onerous. In the process, we examine the situation when such a randomization of the renegotiation terms plays a useful role. Instead of being uncertain about the occurrence of renegotiation the borrower is uncertain about the renegotiation outcome. We show that the degree of forgiveness decreases with the interest rate.

This analysis is related to Kahn & Huberman (1988) who argue that under a symmetric information environment, a secured loan contract with renegotiation achieves efficient outcomes. Bester (1994) analyzes a renegotiation process seeking an efficient outcome when the lender does not observe the project realization. He analyses the importance of a secured debt contract with no precommitment to avoid renegotiation.

Renegotiation improves efficiency. This is the case related to a positive liquidation cost in which the lender does not appropriate the total value of the project. This loss can be understood as the costs incurred with the judicial process or as the value that is lost due to the lender's inability to manage the liquidated project. We show that the chance of a successful borrower to default increases with the liquidation cost and that the lender's return decreases with the liquidation cost. A bank that finance investment projects with diversified technical characteristics should have managerial disadvantage. On the other hand, the liquidation process can also be more expensive with highly inefficient legal systems. If we accept the fact that a development bank suffers from such inefficiencies, we have that this type of financial intermediary should have low rate of return and a great number of successful borrower that does not pay. This result shows that such a financial intermediary is not wasting resources when it renegotiates with some chance of forgiveness, allowing some number of successful borrower to masquerade as unsuccessful and benefits from the renegotiation[1].

Following this introduction, the second section describes the renegotiation game, derives the equilibrium and analyzes the efficiency aspect of renegotiation. The last section concludes.

2 DEBT RENEGOTIATION WITHOUT INFORMATION GATHERING

2.1 THE RENEGOTIATION GAME

The lender is a financial intermediary that deals with a representative borrower. He provides capital (I) to the borrower using the mechanism of a debt contract. The relevant assumption that makes debt contract optimal is used, what indicates that considering debt contract is not a problem. Krasa & Villamil (1995) using a renegotiation game, what they call settlement game, similar to the one analyzed here are able to show that debt contract is optimal. Also note that the notion of debt contract secured by a collateral is not used. If we assume that the loss of taking over the collateral can be completely avoided, then we can show that the amount of collateral used is the maximum available. That is, the borrower's total wealth is used as collateral.

The lender and the borrower are risk-neutral. The borrower has an investment project but does not have the liquid capital to invest; he possesses

[1] A major problem appears if the liquidation cost is determined as a cost due to corruption. We do not allow for this possibility.

a wealth w in the form of illiquid capital. The project realization, that is a function of the state θ, where $\theta \in \Theta=\{L,H\}$, determines the borrower's type *ex post* B^{θ}. The production technology transforms one unit of capital in y_{θ} units in the next period, where $y_H > y_L$. Consider q as the probability that y_H occurs.

In the contracting period, the lender offers a debt contract to the borrower. C_1 states the face value of the debt R, where R>I, and that the lender will foreclose the project if R is not paid. It is assumed that $R \geq y_L$ and that the lender can not recover I in case of project failure, that is, $I > y_L$.

The realization of the project is private knowledge to the entrepreneur. The lender learns the project realization by imposing bankruptcy. The borrower pays R or defaults. B^L always defaults and B^H can default or pay. The lender can impose bankruptcy or propose a renegotiation in case of default. The bankruptcy procedure is exogenous. In bankruptcy the debt value R is forgiven in return for a seizure of the investment project. Bankruptcy is costly but credible. When the lender imposes bankruptcy, he incurs in a cost of $(1-\delta)y_{\theta}$ to take over the project.[2] The bankruptcy loss is avoided by renegotiating. If the lender decides to renegotiate he offers a new contract C_2 that expresses the terms of the renegotiated value of debt. Letting $\Re$ be the set of the new contracts that can be offered at renegotiation, define $\Delta(\Re)$ as the set of probability distribution over $\Re$. C_2 is then a particular probability distribution of the renegotiated debt value picked from $\Delta(\Re)$. $\overline{R}$ represents the new debt value and $\pi(\overline{R})$ is the probability of offering $\overline{R}$.

We consider a renegotiation regime in which the lender can not commit to any particular contract for the renegotiation stage. It is assumed, as in Bester (1994), that the expected foreclosure value of the project exceeds the investment cost and the creditor's expected profit from making a loan can be made positive simply by allowing him to foreclose on the project in case of default:

A1. $\delta[qy_H + (1-q)y_L] > I$

The borrower chooses how often to default when she is solvent and the probability of accepting the lender's offer in the renegotiation stage. Her strategy set is $s_B=(\sigma_L,\sigma_H,d)$, where B^H and B^L accept the new contract with probability σ_H and σ_L, respectively, and d is the rate of default. The lender's strategy is to offer C_1 and to choose the frequency of renegotiation. Let b be the probability of renegotiation not to be offered. The lender's strategy is expressed by $s_L=(R,C_2,b)$. The set of strategy is described as a function of the contract terms, where $s=(R;\sigma_L,\sigma_H,b,d;C_2)$.

We consider renegotiation as the proposal of a menu of offers that reflects an incomplete contract and whose terms are determined as a result of ex-post agreement. Next we will describe and characterize the renegotiation procedure.

2.2 EQUILIBRIUM

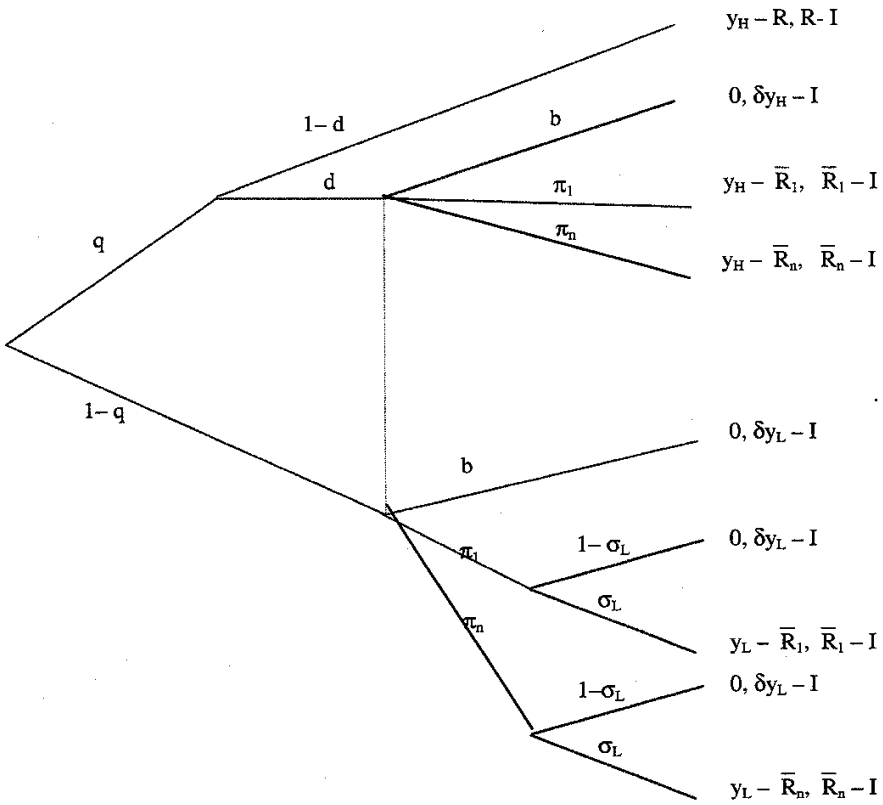
A renegotiation procedure with multiple offers consists of a second contract C_2 stating a menu of renegotiation offers. C_2 determines the terms of the renegotiated contract and is expressed as a particular probability distribution of renegotiated debt value picked from $\Delta(\Re)$.

In the initial period, the lender offers a contract C_1 with debt value R and C_2 with the menu of renegotiation offers in case of default. The borrower has the option of paying back R or defaulting. If she defaults the lender will select a renegotiation offer from C_2 or impose bankruptcy. The borrower then has the option of accepting the offer and paying the prescribed amount or defaulting. If she defaults she receives 0 and the lender receives the realization times δ. The solvent borrower always accepts any offer and the insolvent borrower only accepts the offer of y_L.

[2] This is equivalent to the Bester (1994) and Kahn and Huberman (1988) model as well as to the costly state verification approach.

Figure 1 represents the renegotiation game:

FIGURE 1



Under non-commitment the lender offers a contract with debt value R and is free to make any renegotiation offer in case of default. The borrower has the option to pay back R or default. If she defaults the lender will randomly select a renegotiation offer or impose bankruptcy. The borrower then has the option of accepting the offer and paying the prescribed amount or defaulting. If she defaults she receives 0 and the lender receives the realization times δ. The solvent borrower always accepts any offer and the insolvent only accepts an offer equal or lower than y_L.

The rationale for renegotiation under non-commitment is that when the lender tends to offer $\bar{R}>y_L$, the best that he can do is to offer $\bar{R}=y_H$. Once the borrower with bad shock is not able to pay any $\bar{R}>y_L$, only the borrower at good shock can pay this $\bar{R}$, implying that the lender can pose $\bar{R}$ slightly lower than y_H and extract all the surplus from B^H. Such an offer does not allow the lender to share the benefit of renegotiation with the borrower. It works like an incentive device to oblige B^H not to default. The offer of $\bar{R}=y_H$, in fact slightly smaller than y_H to make $\sigma_H=1$, should not always be done because there is a probability q that the borrower is not able to pay R. So, $\bar{R}=y_L$ is valid to be proposed with some frequency to avoid the dead-weight loss, $(1-\delta)y_L$, of taking over the asset of B^L. This is a kind of forgiveness that gives a gain of $(y_H - y_L)$ to B^H. This rent is the benefit that the borrower gets with the chance of a renegotiation proposal. Proposition 1 shows the optimal menu.

Proposition 1: The optimal menu is the offer of y_H with probability $\pi_H^* = \frac{R_M - y_L}{y_H - y_L}$ and y_L with probability $\pi_L^* = \frac{y_H - R_M}{y_H - y_L}$. The borrower always defaults when insolvent and defaults with probability $d=d_M$ when solvent, where $d_M = \frac{(1-q)(1-\delta)y_L}{q(y_H - y_L)}$. The solvent borrower always accepts any offer and the insolvent only accepts the offer lower or equal to y_L. Bankruptcy only occurs when an offer is not accepted.

In this equilibrium, the borrower's expected return is r and the lender's expected return is $LER_M = q(1 - d_M)R_M + qdy_H + (1 - q)\delta y_L - I$, where $R_M = y_H - r/q$.

Proof:

To derive the multiple offer equilibrium under non-commitment we first derive the credible renegotiation offer in the first step. Then, in the second step we show that the equilibrium must be in completely mixed strategy.

First step: derive the credible renegotiation offer.

We show that $\{y_H, y_L\}$ is the menu that maximize the lender's expected return given any borrower's action.

When faced with a renegotiation offer a borrower has a simple strategy. A solvent borrower accepts any offer lower than y_H, rejects any offer greater than y_H and is indifferent with an offer equal to y_H. An insolvent borrower accepts any offer lower than y_L, rejects any offer greater than y_L and is indifferent to an offer equal to y_L. For the time being, assume that the borrower accepts the offer when indifferent. (Later we will show that there is no equilibrium when the borrower randomizes over accepting or not when she is indifferent) Clearly the lender will not offer $\bar{R} > y_H$, since such an offer will always be rejected and it is dominated by $\bar{R} = y_H$. For $\bar{R} \leq y_H$, the lender's expected outcome of an offer is:

$$F(\bar{R}, d) = \mu \bar{R} + \mu(\delta y_L + (\bar{R} - \delta y_L)\sigma_L)$$

where $\sigma_L = 0$ if $\bar{R} > y_L$, $\sigma_L = 1$ otherwise; and μ is the lender's belief that the borrower is solvent, $\mu = \frac{qd}{qd + (1-q)}$. Bankruptcy is equivalent to the offer $\bar{R} = \delta y_H$ and to the appropriation of borrower's outcome. It is, however, strictly dominated by $\bar{R} = y_H$.

Given the lender's response strategy and the probability of default by each type of borrower, the offers that are not dominated are y_H and y_L. As any offer between y_L and y_H is accepted with the same probability thus the lender may as well offer y_H. Any offer less than y_L is always accepted therefore the lender may as well offer y_L. Which of these two is the best depends on the relative likelihood of the borrower being of each of the two types:

$$\bar{R} = y_L \text{ if } 0 \leq d \leq d_M$$
$$\bar{R} = y_H \text{ if } 1 \geq d \geq d_M.$$

In other words, y_H is the best offer if it is likely that the lender is of type H, y_L is the best offer if it is likely that the lender is of type L. If $d=d_M$, the lender is indifferent between the two offers: $F(y_L, d_M) = F(y_H, d_M)$.

So far we have treated the default decision as exogenous, we next consider which frequency of default can occur in equilibrium. We will show that d_M is the only possibility.

Second step: show that the equilibrium is in mixed strategy.

Consider any possible offer $\bar{R}^i \in [0, y_H]$ and let π_i be the probability of such an offer. The solvent borrower decides to pay if the expected renegotiation gain $\sum \pi_i (y_H - \bar{R}^i)$ is lower than the outcome with payment $y_H - R$. By the analysis above, we can restrict the lender's renegotiation proposal to y_H with probability π_H and y_L with probability π_L. Given the borrower's best response consider that:

a) $(y_H - y_H)\pi_H + (y_H - y_L)\pi_L > y_H - R$.

This implies that d=1 and it can be achieved with $\pi_L > \frac{y_H - R}{y_H - y_L}$. However, this cannot be equilibrium because d=1 implies $\pi_L = 0$ since $F(y_H, d=1) > F(y_L, d=1)$.

b) $(y_H - y_H)\pi_H + (y_H - y_L)\pi_L < y_H - R_M$.

This implies that d=0 and it can be achieved with $\pi_L < \frac{y_H - R}{y_H - y_L}$. However, this cannot be equilibrium because d= 0 implies π_L=1 since $F(y_H,d=0)<F(y_L,d=0)$.

c) $(y_H - y_H)\pi_H + (y_H - y_L)\pi_L = y_H - R_M$.

This implies that d=dM and that the lender's best reaction is to randomize over yH and yL.

Note that any d different from d_M, 1 or 0 is not possible in equilibrium because: $0<d<d_M$ implies π_L=1, with $\bar{R}=y_L$ for sure, but then the borrower would choose d=1;

$1>d>d_M$ implies π_H=1, with $\bar{R}=y_H$ for sure, but then the borrower would choose d=0.

This conclusion certifies that the lender does not choose to randomize over more than two renegotiation offers and that the unique equilibrium is in mixed strategy.

There is no equilibrium with the borrower defaulting when indifferent. Consider any candidate for such an equilibrium. The lender will find it advantageous to cut the charge by ε, increasing his profits.

The menu is also time consistent because after the borrower has defaulted with probability d_M the lender keeps the same expected return by setting π_H=0 or π_L=0, or both. It is not, however, with certainty that this equilibrium is feasible. The constraint about R>I demands that $r<q(y_H - y_L)$.

Note that the value of π_H increases with the interest rate in order to increase the borrower's incentive to pay, since higher R_M increases the B^H's advantage of defaulting. That is, the lender should renegotiate tougher when he is appropriating a greater part of the project return. Alternatively, the frequency of forgiveness decreases with the interest rate. That is, if the project was financed with low interest rate, the lender maximizes by forgiving more. This shows that we should expect renegotiation with forgiveness when the interest rate is low.

The rate of default increases with the liquidation cost. As the degree of pooling is defined as qd_M, the liquidation cost is an important factor that gives the borrower some flexibility to benefit from the lender's willingness to renegotiate. The greater this cost is, the greater the lender's loss with bankruptcy is and the greater the advantage of defaulting. It works as a base level to determine the amount of loss the lender tends to incur with lending. Note that the lender's return is a decreasing function of the liquidation cost, illustrating the situation in which a higher degree of pooling reduces the lender's outcome.

This last result has interesting implication once we categorize each lender with a specific liquidation cost. If we assume that the liquidation cost is greater as the lender is less efficient on managing the borrower's project and as legal system is more inefficient, we can classify a development bank in a developing country as a financial intermediary with very high liquidation cost. From the discussion above this means that such a lender will have lower return and will have more successful borrower defaulting and benefiting from renegotiation. Moreover, if this bank lends with a low interest rate, the equilibrium will also include a great amount of forgiveness. This shows that the practice of renegotiation with high liquidation cost justifies one behavior that would not seem to be rational otherwise.

The lender that is maximizing profit as shown in proposition 1 may be wasting resources if renegotiation does not provide any improvement. We need to show the advantage of renegotiation.

2.3 ADVANTAGE OF RENEGOTIATION

The advantage of a contract with renegotiation over one where renegotiation is not allowed is expressed by Proposition 2:

Proposition 2: Inducing renegotiation in contract is valuable.

The following arguments demonstrate this proposition. Under the non-renegotiation scheme the lender has to take over the borrower's asset whenever default occurs, i.e., b=1 if the payment is y_L, b=0 when the payment is R. When renegotiation leads to an improvement in the

agent's expected return, it should be expected that the lender tries to benefit from this opportunity. On the occasion of commitment not to renegotiate, the LER is equal to $LER = qR_n + (1-q)\delta y_L - I$, where $R_n=R_M$.

The multiple proposal renegotiation process is more efficient than the case where there is precommitment not to renegotiate at all. The face value of debt is the same for the procedure under commitment and under non-commitment. The advantage of renegotiation occurs because the menu allows the lender to reduce the cost of bankruptcing insolvent borrower and, at the same time, allows him to appropriate part of the solvent borrower surplus. This implies that, independently of the renegotiation procedure, a lending-borrowing process where the lender commits *ex-ante* not to renegotiate is a non credible promise. Moreover, since $LER_M - LER = (y_H - R_M)d_M$ and d_M increases with the liquidation cost, the improvment from renegotiation also increases with the liquidation cost.

This shows that if there is some sort of loss with forgiveness and a partial pooling equilibrium, the cost would be much higher when renegotiation is not allowed.

3 CONCLUSION

To avoid fraud, the bank should keep the ability to enforce the terms of a contract by imposition of criminal penalties. The more severe are the ex post penalties, the lower are the ex ante requirements. Due to liquidation cost, the lender's ability to impose such penalties is inefficient and there is a high cost on following these procedures. To mitigate this problem the lender proposes renegotiation.

A promise not to renegotiate the original contract is not credible. The reason for the renegotiation is the possibility of minimization of the dead-weight loss with inefficient liquidation. One drawback of renegotiation is that some degree of default from the successful borrower must be admitted. Although the lender has the power to determine the terms and the decision to offer a new contract, he can not recover through renegotiation the part of rent transferred to the solvent borrower. Such a borrower is qualified as a free rider of the renegotiation process.

The optimal renegotiation scheme is one in which renegotiation is done by the randomization over two offers: y_H or y_L. This game is characterized by a new contract offer every time there is default if the lender is unable to commit.

A development bank can be characterized as a financial intermediary that may have very high liquidation cost. This means that a development bank gets great benefits whenever default is declared and the bank proposes renegotiation. The renegotiation procedure should be the forgiveness of the debt not paid or the imposition of a high penalty. Such a procedure does not avoid default from the successful borrowers. It, however, minimizes the successful borrower's willingness to default.

We did not consider the possibility of the contract be secured by an external collateral. It can be shown, however, that collateral is always used but it does not exert any role in the renegotiation stage besides the fact of increasing the frequency of renegotiation for the pooling equilibrium case.

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ABSTRACT:

A simple debt contract induces the complete separation between successful and unsuccessful borrower. The cost of liquidating the unsuccessful borrower is a dead-weight loss of the arrangement. This paper investigates how a debt contract can be renegotiated to mitigate this problem. We conclude that it is optimal to the lender always propose renegotiation. The renegotiation procedure should, however, balance the degree of forgiveness to maximize the borrower's incentive to pay. We are then able to characterize the behavior of a financial

intermediary that forgives part of the debt even though part of the successful borrower defaults, benefiting from the renegotiation. We characterize this result for a development bank.

KEY WORDS:

Key Words: Debt Contract; Renegotiation; Financial Intermediary, Development Bank; Brazil.

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