

FUCAPE WORKING PAPERS

Bankruptcy law and credit market: a general-equilibrium approach

Aloisio Araujo (EPGE/FGV and IMPA)
Bruno Funchal (FUCAPE Business School)

No.39 / (Março) 2013

Bankruptcy Law and Credit Market: A General-Equilibrium Approach*

Aloisio Araujo (EPGE/FGV and IMPA)
Bruno Funchal (FUCAPE Business School)

August 7, 2007

Abstract

This study has as its main objective to analyze the best bankruptcy procedure considering the conflict of interests between managers, secured creditors and trade creditors. Such trade-off is strictly connected with industry and countries characteristics, which is also relevant to the design of the bankruptcy law. Simulating a general-equilibrium model with incomplete markets and bankruptcy, we show that for liquidation procedure that does not depreciates the failed assets too much, bankruptcy-liquidation produces better economic results for sectors intensive in physical capital. As the depreciation in liquidation increases and/or the industry sectors are less intensive in physical capital, the availability of reorganization produces better economic results. Using data of 44 countries, our results points that approximately 60% of the countries in the sample apply a procedure aligned with our suggestions.

Keywords: Bankruptcy; Legal System; Credit.

JEL Codes: G33; K4; E51.

1 Introduction

The structure of creditors-debtor relationship and the design of bankruptcy laws has received special care from scholars, practitioners and lawmakers since the debt has usually been a major source of financing for firms. When lawmakers design a bankruptcy law that is best for their specific economy, they cannot just resort to existing theories in economics and corporate finance because countries differ in their economic environments and usually, these theories do not capture such cross-country differences. Understanding these differences, we can search the optimal bankruptcy law for particular countries.

In this study, we analyze how the optimal bankruptcy laws depend on the specific industries and countries characteristics, and we propose the best law for different countries based on their particularities. The theory used to approach this issue is the general-equilibrium

*We would like to thank John Geanakoplos, Pierre-André Chiappori, Arilton Teixeira, V. Filipe Martins da Rocha, Luis Henrique Braido and Carlos Eugenio da Costa for helpful comments as well as seminar participants at EPGE/FGV, VII Latin American Workshop of Economic Theory at Rio de Janeiro and the 3rd CARESS-Cowles Conference of General Equilibrium and its Application at Yale University.

method with incomplete markets and possibility of bankruptcy. To introduce institutions in general-equilibrium, more specifically the bankruptcy law, we cannot follow the standard general-equilibrium model and the main difference comes from the asset structure, which deviates from the usual Arrow assets.

A key relationship, common to all countries, is between entrepreneurs who need to raise funds to buy the inputs for the firm and secured and trade creditors that provide such funds. The need of both creditors creates a conflict of interests between them and consequently a trade-off – that depends from the country’s characteristics – emerges. The intuition behind this trade-off is the following: for countries where the industrial sectors intensive in physical capital predominates, the bankruptcy should be pro-secured creditors since they supply the bigger share of the credit. This way, the existing mechanisms of some bankruptcy laws that incentive reorganization like the automatic stay of the firms’ collateral and no restriction to managers entering on reorganization should not be optimal. Then, the bankruptcy law that provides just bankruptcy-liquidation would improve the aggregated credit-market conditions. On the other hand, for countries predominating industries intensive in variable input the bankruptcy law should be pro-debtors, inducing the reorganization since it increases the expected return of trade creditors and improves their credit conditions.¹ Since the share of trade creditors is bigger than secured creditors, even worsening the secured credit situation, the aggregated conditions of credit market will improve.

Another important country’s characteristic that must be considered in the design of the optimal bankruptcy law is the cost (direct and indirect) of liquidation and the cost of reorganization procedures. The direct costs, that considers bankruptcy filing fees, expenses with trustee, accountant, debtors’ attorney and unsecured creditors’ committee, consumes a small share of the debtors’ total assets.² Besides the literature is divided in pointing the more expensive procedure, at least inside the U.S..³ However, when we consider the indirect costs, the liquidation procedure seems to work worse at retaining value throughout the bankruptcy process, imposing a severe burden on the insolvent firms’ assets.⁴ The explanation for this evidence comes from distinct sources. First, is that when financial markets are imperfect, which is very common in developing countries, the best managers may not be able to raise the necessary cash to buy the firm. The firm may therefore be inefficiently dismantled and its assets sold cheaply. Another explanation for the loss of value in liquidation is that when a firm in financial distress needs to sell its assets, its industry peers are likely to be experiencing problems themselves, forcing the trustee to sell the assets below their potential value.⁵ As this difference between the procedures’ costs varies, the optimal bankruptcy should vary too, aiming at minimizing such burden.

For a social planner which designs a procedure that aims to provide the best conditions in the credit market, we will show that an optimal bankruptcy law has to address the following issues:⁶

¹With reorganization trade creditors have one more chance to be paid.

²See LoPucki and Doherty (2004).

³For example, Altman (1984), Hotchkiss (1995), and Weiss and Wruck (1998), among others, consider reorganization costs to be high, whereas Alderson and Betker (1995), Gilson (1997), and Maksimovic and Phillips (1998) consider costs to be low and Bris et al. (2006) consider that the difference on costs are not statistically significant.

⁴See Bris et al. (2006).

⁵See Shleifer and Vishny (1992).

⁶Dubey, Geanakoplos and Shubik (2005) show, using a general equilibrium model with incomplete markets and default, that for a economy with one good the maximal credit (risk sharing) traduces itself in a maximum

1. It should facilitate liquidation when the costs of liquidation relative to reorganization is small and the industry sector is more capital intensive;
2. It should facilitate reorganization as the costs of liquidation relative to reorganization increases and the industry sector became more input variable intensive.

The theoretical framework will be drawn upon the general equilibrium framework. Corporations take debts for several different reasons. One important characteristic of this act is that such firms wish to repay their debts with their future gains. But, there is always the possibility, for some reason, of no fulfillment of such a repayment promise. Also, since in practice debt contracts do not specify in which state of nature the promise should be fulfilled, i.e. they are state-independent, and since each debt contract is specific to each type of creditor, we broach the problem by developing a general equilibrium model with incomplete markets and bankruptcy.

We solve a general equilibrium problem with two periods, two states of nature one good and three agents – individual (manager) who runs the firm; secured creditors who lend an amount of the good for the firm’s (which could be saw as a fixed input) and have the priority over the assets of the failed firm; and trade creditors (or unsecured creditors), who sell the good on credit (which could be saw as a variable input) and have residuals rights over the assets of the failed firm. Simulating for a range of parameters that describe the characteristics of the countries (bankruptcy costs) and industry sectors (the portion of physical and variable inputs) we find:

- a menu of bankruptcy law that maximizes the amount of credit in each sector
- the optimal bankruptcy law for the economy as a whole, considering the share of the value added of each sector and its best bankruptcy procedure.

After the simulation for a range of parameters, we fix the bankruptcy-liquidation costs in the level estimated by the U.S. to find the best bankruptcy procedure for a sample of 44 countries. Our results points that approximately 61% of the countries in the sample apply a procedure aligned with our suggestions. Also, they suggest that 80% of the countries (35 of 44) should apply a pro-reorganization bankruptcy law.

We also analyze the economic effects of the Absolute Priority Rule violations. Using an aggregated production function we try to find out which level of violation (pro-debtors and pro-unsecured creditors) maximizes the size of the credit market.

The remainder of the article is organized as follows: section 2 discusses the literature review; section 3 discusses the corporate bankruptcy law; section 4 presents the theoretical model; section 5 presents the simulation results; section 6 discusses the APR violations and section 7 concludes.

2 Literature Review

Our paper belongs to the body of the literature on the designs of bankruptcy laws. The early economists consider bankruptcy laws for firms that are already in default, focusing on the deviations from the absolute priority rule (APR), and on the costs associated with bargaining

welfare.

in the reorganization procedure. Some economic theorists favored a market auction approach to cutting the costs implicit in reorganization.⁷ Specifically, a state official would auction insolvent firms to the market, free of current claims, and then distribute the proceeds to creditors according to absolute priority rules. On the other hand, Bebchuk argues that reorganization can capture a greater value than liquidation, especially when the company's assets are worth much more as a going concern than if sold piecemeal and if there are few or no buyers with both accurate information about the company and sufficient resources to acquire it. He therefore proposes an options approach that homogenizes the interests of the holders and follows the absolute priority rule, creating a reorganization procedure without the burden of APR violations or bargaining costs.

Bebchuk's idea receives significant support in subsequent literature. For example, Aghion, Hart, and Moore use it as the basis for a bankruptcy reform proposal that includes an auction mechanism, and Hart and others adapt it to develop a new procedure using multiple auctions.⁸ These procedures also generated their share of critical or skeptical reactions. The criticism emphasizes that the lack of liquidity (since the firms are in financial distress) makes it impossible for shareholders to exercise their options; and the skepticism centers on the complexity of the mechanisms, which makes it difficult to implement the proposals of Aghion, Hart, and Moore and Hart and others.

Early theorists thus held that bankruptcy systems should follow absolute priority strictly. This requires secured creditors to be repaid in the order that the firms' contracts determine, which means that they have priority over other creditors, as trade creditors. The rule implies that equity holders should receive nothing, because the residual claim on an insolvent firm is worth nothing.

Modern theory relates the results of a bankruptcy procedure to the early stages in the life of the borrowing firm. An ex post efficient bankruptcy system maximizes the payoff that creditors receive from insolvent firms. In the borrowing stage, a competitive credit market would reduce the amounts that lenders can require solvent firms to repay when the lenders' expected insolvency payoffs increase. Thus, interest rates fall as the efficiency of the applicable bankruptcy system increases. In contrast, the ex ante efficiency of the bankruptcy system is related to the optimal division of the firm's total value. Substantial research addresses the issue of the reorganization procedure through violations of the absolute priority rule (APR), arguing that the ex ante effect of deviations from the rule are actually beneficial. In particular, this line of research shows that APR deviations encourage desirable ex ante investments in firm-specific human capital; that they facilitate the transfer of information to creditors and improve the timing of decisions to file for bankruptcy, to liquidate, or to recapitalize; and that they discourage excessive risk-taking by financially distressed firms.⁹ Bebchuk shows that reorganization that allows ex post APR deviations also have negative effects on ex ante decisions made by shareholders. He argues that such deviations have an adverse effect on ex ante management decisions made prior to the onset of financial distress. The presence of APR deviations aggravates the moral hazard problem, but the final effect of such deviations is inconclusive.

This paper also relates the bankruptcy design with the early stages of firms life, but in contrast, we explore the trade-off between betors and creditors and also between different classes

⁷See Baird (1986) and Jensen (1991).

⁸Aghion, Hart, and Moore (1992); Hart and others (1997).

⁹Berkovitch, Israel, and Zender (1997); Povel (1999); Berkovitch and Israel (1999); Eberhart and Senbet (1993).

of creditors: secured and unsecured creditors (or trade creditors). The main goal is to analyze the use of different procedures considering some countries' particularities as productive structure and the bankruptcy costs.

3 Corporate Bankruptcy Law

Liquidation

The liquidation procedure determines the sale of firm's assets when it is in financial distress (see figure 1).¹⁰ This can involve either the sale of the whole business or its productive units or the piecemeal sale of its assets, depending on demand. The absolute priority rule determines how the proceeds of sale are divided among the claimants. It specifies what claims are paid in full according to an order defined by bankruptcy law of each country. Usually, for secured creditors is given high priority since they have bargained with the firm for the right to claim a particular asset or its value if the firm files for bankruptcy.

When capital markets are imperfect, the best managers may not be able to raise the cash necessary to buy the firm. The firm may be inefficiently dismantled, and its assets sold of cheaply causing the called "loss of value in liquidation". Reorganization provides a good alternative for countries with weak capital markets. Another explanation for the loss of value in liquidation is that when a firm in financial distress needs to sell its assets, its industry peers are likely to be experiencing problems themselves, forcing the trustee to sell the assets below their potential value¹¹. Hence, if assets are very firm-specific and the correlation of returns across firms is high, reorganization is likely to be preferable to liquidation as way to maximize firm value after insolvency.

Reorganization

In reorganization the firm has one more chance of success since it continues to operate (see figure 2). Some features determined by the bankruptcy law are capable to make the reorganization more effective.

The first one is the so-called *automatic stay*. The choice for the reorganization produces a conflict between the secured creditors' right to claim their collateral and the goal of reorganizing the firm. To be successful, the firm must retain assets, which are crucial to its operations. At the same time, secured creditors often wish to claim these assets. Some countries, such as the United States,¹² resolve this conflict in the firm's favor by applying an automatic stay to secured creditors, thereby making the reorganization process more appealing. Not all countries have this degree of protection, and some – including Germany and the United Kingdom – do not have it at all. This weakens or even eliminates the possibility of reorganization.¹³ The other one is the method used in the choice between both procedures. Some countries (like Germany, France, and England) give the exclusive control of the proceeding to an outside official, who makes the initial decision of whether to liquidate the firm or to keep it operating. Other countries

¹⁰A firm is financially distressed or insolvent when it can no longer meet its debt obligations with another firm or institution.

¹¹See Shleifer and Vishny (1992).

¹²Thirty-eight percent in a sample of 133 countries apply the automatic stay, while sixty-two percent does not apply it.

¹³For example, in UK approximately only 20% of bankruptcy firms do not go to liquidation and in Germany less than 1%. See Brouwer (2006).

(including the United States) give managers the right to choose between filing for bankruptcy liquidation or reorganization, inducing a higher amount of reorganization procedures.

The payoff patterns under liquidation versus reorganization differ strongly. Under liquidation, secured creditors tend to receive full payoff while trade creditors the residuals, with equityholders receiving nothing at all. Under reorganization, since there is one more chance of success, each class of creditors and equity have positive expected return before the bankruptcy procedure begins.

4 The General Equilibrium Model

4.1 The Economy

In this model of general-equilibrium with incomplete markets, we consider a two-period economy with three different agents: individuals (manager), secured creditors (banks) and trade creditors (suppliers). The individual runs a firm and needs to borrow from the others agents to implement her investment project. Secured creditors and trade creditors lend an amount of good in exchange of a debt contract. In the period zero (the present) there is just one state of nature. The chance moves and selects one of two states of nature: bankruptcy and non-bankruptcy. In the second period the assets payoff. There is only one kind of goods and two assets in this economy.

Goods

There is only one good in this economy. The credit supplied by the secured creditors can be used as collateral, but if the firm goes to reorganization¹⁴ it depreciates $(1 - \delta)$ (it could be saw as a fixed input), while the credit supplied by the trade creditors cannot be used as collateral (it could be saw as variable input).¹⁵ The individual needs both types of credit to produce.

Assets

There are two different assets in this economy and both of them are not Arrow assets.

- Asset traded only with secured creditors: they supply an amount of the good in the first period in exchange of a debt contract that pays 1 good in non-bankruptcy states and a fraction of it in bankruptcy states. In the bankruptcy states secured creditors have the highest priority over the goods of the bankrupt firm.
- Asset traded with trade creditors: they supply an amount of the good in exchange of a debt contract that pays that pays 1 in non-bankruptcy states and a fraction (residual priority) in bankruptcy states.

Endowment

Banks and trade creditors own some amount of goods – K and V respectively – but no investment project, while individuals also own the investment project.

Preferences

¹⁴Thus, if the firm goes to bankruptcy in the first period the good does not depreciates. Otherwise, if the firm chooses reorganization, it depreciates at a rate $(1 - \delta)$ at the end of the period.

¹⁵This economy could be modeled with 3 goods, two input and one final good produced by the firm. This set up only bring more computational difficulties and do not affect our main objective, which is to analyse the price and amount of the credit negotiated.

Secured creditors (Banks) are risk-neutral, while trade creditors and individuals are risk-averse.

Investment Project

The firm purchases some amount of goods (financed through asset selling) in the first moment. Then, the firm produces a random amount of output $\eta f(\cdot)$, where η is a random variable (idiosyncratic shock).

The Bankruptcy Cost

The cost of bankruptcy (direct plus indirect costs) is represented by the vector (reorganization cost, liquidation cost) = $(1, (1 - l))$, where $l \in (0, 1]$, since the direct costs of both procedures are small and not too much different and the indirect costs in liquidation is bigger than in reorganization.¹⁶ This way, the good supplied by secured creditors will be worth lK if the firm goes to liquidation and K if it is well succeed in reorganization.

Notation

- Our notation for the exogenous variables is:

K_0 = initial endowment of individuals

\overline{K} = initial endowment of secured creditors

\overline{V} = initial endowment of trade creditors

u^F = individuals utility function

u^{TC} = trade creditors utility function

u^{SC} = secured creditors utility function

η = idiosyncratic shock

$\delta \in [0, 1]$ = depreciation rate

$(1 - l) \in [0, 1]$ = relative cost of bankruptcy-liquidation

$p^L \in (0, 1)$ = probability of bankruptcy when the law is pro-liquidation

$p^R \in (0, 1)$ = probability of bankruptcy when the law is pro-reorganization

- Our notation for the endogenous variables is:

$\tau \in [0, 1]$ = proportion of individuals endowment consumed in the first period

$q^V \in \mathbb{R}_+$ = price of the asset traded with trade creditors

$q^K \in \mathbb{R}_+$ = price of the asset traded with secured creditors

$\theta_K \in \mathbb{R}_+$ = asset with collateral purchased by the individuals

$\theta_V \in \mathbb{R}_+$ = asset without collateral purchased by the individuals

$\varphi_K \in \mathbb{R}_+$ = asset with collateral sold by the secured creditors

$\varphi_V \in \mathbb{R}_+$ = asset without collateral sold by the trade creditors

$\rho_K \in [0, 1]$ = proportion paid to secured creditors in states of bankruptcy

$\rho_V \in [0, 1]$ = proportion paid to trade creditors in states of bankruptcy

4.2 Liquidation

There are two states mutually exclusives when the firms begins its operation: the non-bankruptcy state and the bankruptcy state. Under a bankruptcy system that works only with the liquidation procedure, when the firm enters in financial distress it will have its assets sold (see figure 1).

¹⁶See Bris et al. (2006).

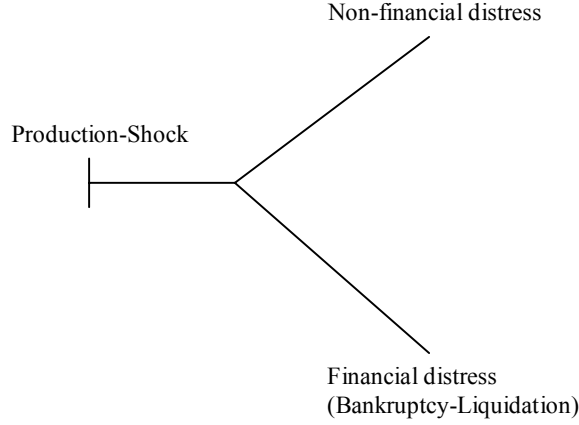


Figure 1: Scheme for Bankruptcy-liquidation

Definition 1 *The state of bankruptcy is the state in which $\eta_s f(q_K \theta_K + (1 - \tau)K_0, q_V \theta_V) + q_K \theta_K + (1 - \tau)K_0 - \theta_K - \theta_V < 0$, and the state of non-bankruptcy is the state in which $\eta_s f(q_K \theta_K + (1 - \tau)K_0, q_V \theta_V) + q_K \theta_K + (1 - \tau)K_0 - \theta_K - \theta_V \geq 0$.*

In words we can say that a firm files for bankruptcy if it has more debts (liabilities) than total assets which might be available to pay the debtors.

Individuals Individuals chose how much to borrow of each type credit and how much to consume of their endowment, looking to maximize their expected utility.

$$\begin{aligned}
 & \max_{\tau, \theta_K, \theta_V} u^F(c_0) + p^L [u^F(c_{NB})] + (1 - p^L) [u^F(c_B)] \\
 \text{s.t. } c_0 &= \tau K_0 \\
 c_{NB} &= \eta_{NB} f(q_K \theta_K + (1 - \tau)K_0, q_V \theta_V) + q_K \theta_K + (1 - \tau)K_0 - \theta_K - \theta_V \\
 c_B &= \eta_B f(q_K \theta_K + (1 - \tau)K_0, q_V \theta_V) + l(q_K \theta_K + (1 - \tau)K_0) - \theta_K \rho_K - \theta_V \rho_V
 \end{aligned}$$

where $\rho_K = \min \left[1, \frac{\eta_{NB} f(q_K \theta_K + (1 - \tau)K_0, q_V \theta_V) + q_K \theta_K + (1 - \tau)K_0}{\theta_K} \right]$ and

$$\rho_V = \left(\frac{\eta_{NB} f(q_K \theta_K + (1 - \tau)K_0, q_V \theta_V) + q_K \theta_K + (1 - \tau)K_0 - \theta_K \rho_K}{\theta_V} \right).$$

Secured Creditors (Banks) Since secured creditors are risk-neutral we define their objective function as:

$$\max_{\varphi_K} (\bar{K} - q_k \varphi_K) + p^L \varphi_K + (1 - p^L) \varphi_K \rho_K.$$

Trade Creditors Trade creditors are risk-averse and we define their objective function as.

$$\begin{aligned} \max_c u^F(c_0) + p^L [u^F(c_{NB})] + (1 - p^L) [u^F(c_B)] \\ c_0 &= \bar{V} - q_V \varphi_V \\ c_{NB} &= \varphi_V \\ c_B &= \varphi_V \rho_V \end{aligned}$$

Defining the equilibrium for this economy we have:

Equilibrium An equilibrium for this economy is a list $\langle \tau, q_V, q_K, (\theta_K, \theta_V, \varphi_K, \varphi_V) \rangle$ such that (1) to (7) hold:

- (1) for *Individuals*, $(\tau, \theta_K, \theta_V) \in \arg \max u^F(c_0) + E[u^F(c)]$ over firm's budgeted $B^F(q_K, q_V, \theta_K, \theta_V, \rho_K, \rho_V)$
- (2) for *Secured Creditors*, $(\varphi_K) \in \arg \max u^{SC}(c_0) + E[u^{SC}(c)]$ over bank's budgeted $B^{SC}(q_K, \varphi_K, \rho_K)$
- (3) for *Trade Creditors*, $(\varphi_V) \in \arg \max u^{TC}(c_0) + E[u^{TC}(c)]$ over trade creditor's budgeted $B^{TC}(q_V, \varphi_V, \rho_V)$
- (4) $(\theta_K - \varphi_K) = 0$
- (5) $(\theta_V - \varphi_V) = 0$
- (6) $(K^F + K^B - \bar{K}) = 0$
- (7) $(V^F + V^T - \bar{V}) = 0$

4.3 Reorganization

Under a bankruptcy system that allows the reorganization procedure, in the financial distress states we have two possibilities of solution: liquidation if the firm is not economically efficient; and reorganization if it is economically efficient (see figure 2).

However, notice that once the individual has one more chance to recover from a drawback, it motivates moral-hazard action from debtors (individuals), making them chose a lower effort level, increasing the probability of bankruptcy. Accounting for this difference in the probability of bankruptcy we expect to introduce moral-hazard at our problem.

Definition 2 *A financial distressed business is economically inefficient if the state of bankruptcy occurs and if its expected value doesn't exceed its liquidation value, i.e. if $E_B[\eta f(K + (1 - \tau)K_0, V) + \delta(K + (1 - \tau)K_0)] \leq \eta_B f(K + (1 - \tau)K_0, V) + l(K + (1 - \tau)K_0)$. Otherwise a financial distressed firm is economically efficient .*

In words we can say that a *financial distressed* firm is economically inefficient if its liquidation value is bigger than its expected value if reorganization occurs.

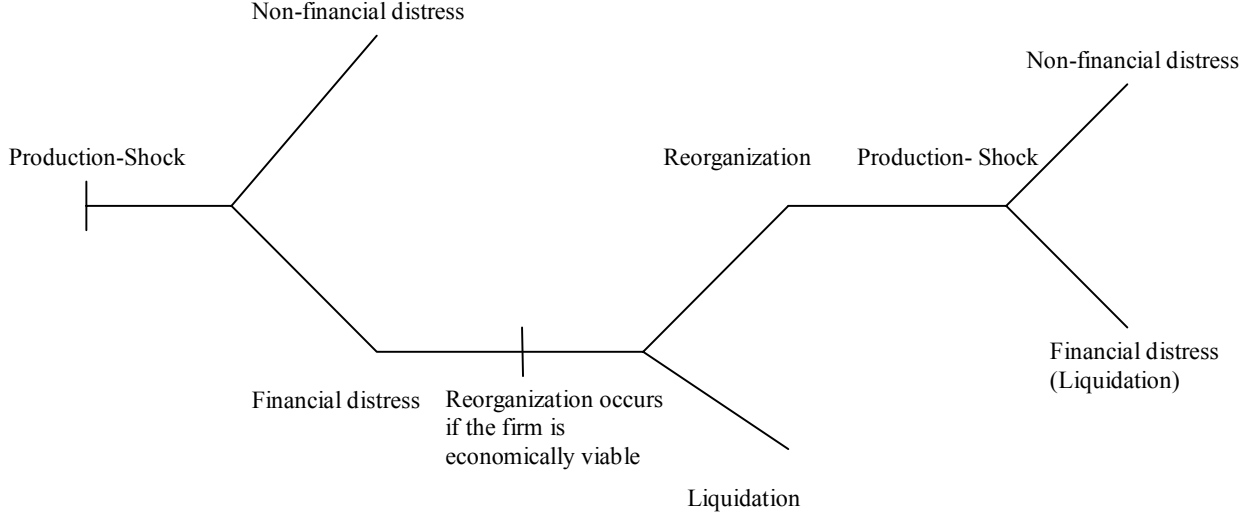


Figure 2: Scheme for Bankruptcy-reorganization

Individuals Individuals chose how much to borrow of each type credit and how much to consume of their endowment, looking to maximize their expected utility.

$$\begin{aligned}
& \max_{\tau, \theta_K, \theta_V} u^F(c_0) + p^R [u^F(c_{NB})] + (1 - p^R) [u^F(c_B)] \\
s.t. \quad c_0 &= \tau K_0 \\
c_{NB} &= \eta_{NB} f(q_K \theta_K + (1 - \tau) K_0, q_V \theta_V) + q_K \theta_K + (1 - \tau) K_0 - \theta_K - \theta_V \\
c_B &= \iota \{ \eta_B f(q_K \theta_K + (1 - \tau) K_0, q_V \theta_V) + l(q_K \theta_K + (1 - \tau) K_0) - \theta_K \rho_K^L - \theta_V \rho_V^L \} + \\
& (1 - \iota) \{ p^L [\eta_{NB} f(q_K \theta_K + (1 - \tau) K_0, q_V \theta_V) + \delta(q_K \theta_K + (1 - \tau) K_0) - \theta_K - \theta_V] + \\
& (1 - p^L) [\eta_{BB} f(q_K \theta_K + (1 - \tau) K_0, q_V \theta_V) + l \delta(q_K \theta_K + (1 - \tau) K_0) - \theta_K \rho_K^R - \theta_V \rho_V^R] \}
\end{aligned}$$

where $\iota = 1$ when $\{E_B[\eta f(K + (1 - \tau) K_0, V)] - \eta_B f(\tilde{K} + (1 - \tilde{\tau}) K_0, \tilde{V})\} + p^L \delta(K + (1 - \tau) K_0) + (1 - p^L) l \delta(K + (1 - \tau) K_0) - l(\tilde{K} + (1 - \tilde{\tau}) K_0) > 0$ and 0 otherwise, where K and \tilde{K} are fixed input and V and \tilde{V} are variable input if the firm chooses to reorganize or to liquidate. The variables ρ^R and ρ^L represent the fraction received in bankruptcy after reorganization and in liquidation.

Definition 3 After the reorganization plan the state of liquidation is the state in which $\eta f(K + (1 - \tau) K_0, V) + \delta K - \theta_K^F - \theta_V^F < 0$, and the state of recovery is the state in which $\eta f(K + (1 - \tau) K_0, V) + \delta(K + (1 - \tau) K_0) - \theta_K^F - \theta_V^F \geq 0$.

Secured Creditors (Banks) Since Banks are risk-neutral their objective function is:

$$\max_{\varphi_K} (\bar{K} - q_k \varphi_K) + p^R \varphi_K + (1 - p^R) (\iota \varphi_K \rho_K^L + (1 - \iota) [p^L \varphi_K + (1 - p^L) \varphi_K \rho_K^R])$$

Trade Creditors Trade creditors are risk-averse and we define their objective function as.

$$\begin{aligned} & \max_c u^F(c_0) + p^L [u^F(c_{NB})] + (1 - p^L) [u^F(c_B)] \\ c_0 &= \bar{V} - q_V \varphi_V \\ c_{NB} &= \varphi_V \\ c_B &= \iota \varphi_V \rho_V^L + (1 - \iota)(p^L \varphi_V + (1 - p^L) \varphi_V \rho_V^R) \end{aligned}$$

Defining the equilibrium for this economy we have:

Equilibrium An equilibrium for this economy is a list $\langle \tau, q_V, q_K, (\theta_K, \theta_V, \varphi_K, \varphi_V) \rangle$ such that (1) to (7) hold:

- (1) for *Individuals*, $(\tau, \theta_K, \theta_V) \in \arg \max u^F(c_0) + E[u^F(c)]$ over firm's budgeted $B^F(q_K, q_V, \theta_K, \theta_V, \rho_K^R, \rho_V^R, \rho_K^L, \rho_V^L)$
- (2) for *Secured Creditors*, $(\varphi_K) \in \arg \max u^{SC}(c_0) + E[u^{SC}(c)]$ over bank's budgeted $B^{SC}(q_K, \varphi_K, \rho_K^R, \rho_K^L)$
- (3) for *Trade Creditors*, $(\varphi_V) \in \arg \max u^{TC}(c_0) + E[u^{TC}(c)]$ over trade creditor's budgeted $B^{TC}(q_V, \varphi_V, \rho_V^R, \rho_V^L)$
- (4) $(\theta_K - \varphi_K) = 0$
- (5) $(\theta_V - \varphi_V) = 0$
- (6) $(K^F + K^B - \bar{K}) = 0$
- (7) $(V^F + V^T - \bar{V}) = 0$

5 Simulation

In this section we simulate a two states of nature model (bankruptcy and non-bankruptcy) using:

- CRRA utility function to represent the managers' preferences: $\frac{c^{1-\gamma}}{1-\gamma}$
- CES function to represent the firm's production function: $[\alpha K^\rho + (1 - \alpha)V^\rho]^{\frac{1}{\rho}}$
- CRRA utility function to represent the trade creditors' preferences: $\frac{c^{1-\gamma}}{1-\gamma}$
- and the following parameter values, most of them commonly used in growth models:¹⁷
 $\eta_B = 1, \eta_{NB} = 4, \eta_{BB} = 0.5, \eta_{BNB} = 2, \gamma = 2, \rho = -0.5^{18}, \delta = 0.84, p^L = 0.87$ and
 $p^L = 0.13, p^R = 0.80$ and $p^R = 0.20^{19}$.

¹⁷Each period of this model last 5 years

¹⁸See Koschel (2003). He found, for German data, that positive elasticities of substitution below unity are obtained for the majority of sectors and input pairs. This indicates an overall dominance of weak substitutability relationships. Our assumption is that elasticity substitution is 2/3, since $\rho = \frac{\sigma-1}{\sigma}$, where σ is the elasticity substitution parameter.

¹⁹Risk-adjusted default probabilities derived from corporate bond spreads. This probability of default is the mean of 5-year maturity bonds from AAA to B bonds. See Almeida and Philippon (2006).

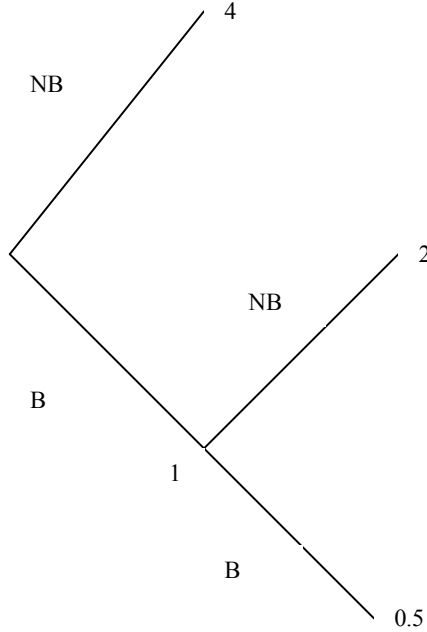


Figure 3: Payoff Diagram

Since the default probabilities were derived from 5-years maturity corporate bond, we consider that each period of this model last 5 years.

To analyze the effect of industry sectors and countries' characteristics on the choice of optimal bankruptcy law, we will vary the parameters α and $(1 - l)$ in our simulations. The parameter α determines the proportion of physical capital used in the sector, and $(1 - l)$ determines the cost of bankruptcy-liquidation normalized by the cost of bankruptcy-reorganization.

The diagram (Figure 3) describes the path of payoffs of a firm. In the first moment, the firm may have a positive shock (H), implying in a payoff of 4 or a negative shock that implies in a payoff of 1. If the firm is financially distressed it can be liquidated, selling all its assets or it can go to reorganization. If the reorganization is available, and if it is chosen, the firm has one more chance of a positive shock in the second moment.

5.1 Simulation Results

The Figure 4 summarizes the general results of the simulation exercise. The axis y represents the proportion of physical capital used in the production function (α). The axis x refers to the cost of bankruptcy-liquidation normalized by the cost of bankruptcy-reorganization cost $(1 - l)$.

The basic results can be described as the following:

- For sectors intensive in physical capital the best procedure is pro-liquidation, since it permits secured creditors to recover their claims immediately, making the cost of capital lower. Looking vertically at the figure 4, we see that firms more intensive in capital have preference for the liquidation process. Intuitively, the higher cost of unsecured loans is more than compensated by the lower cost of unsecured loans, since the share of the later type of credit is higher.

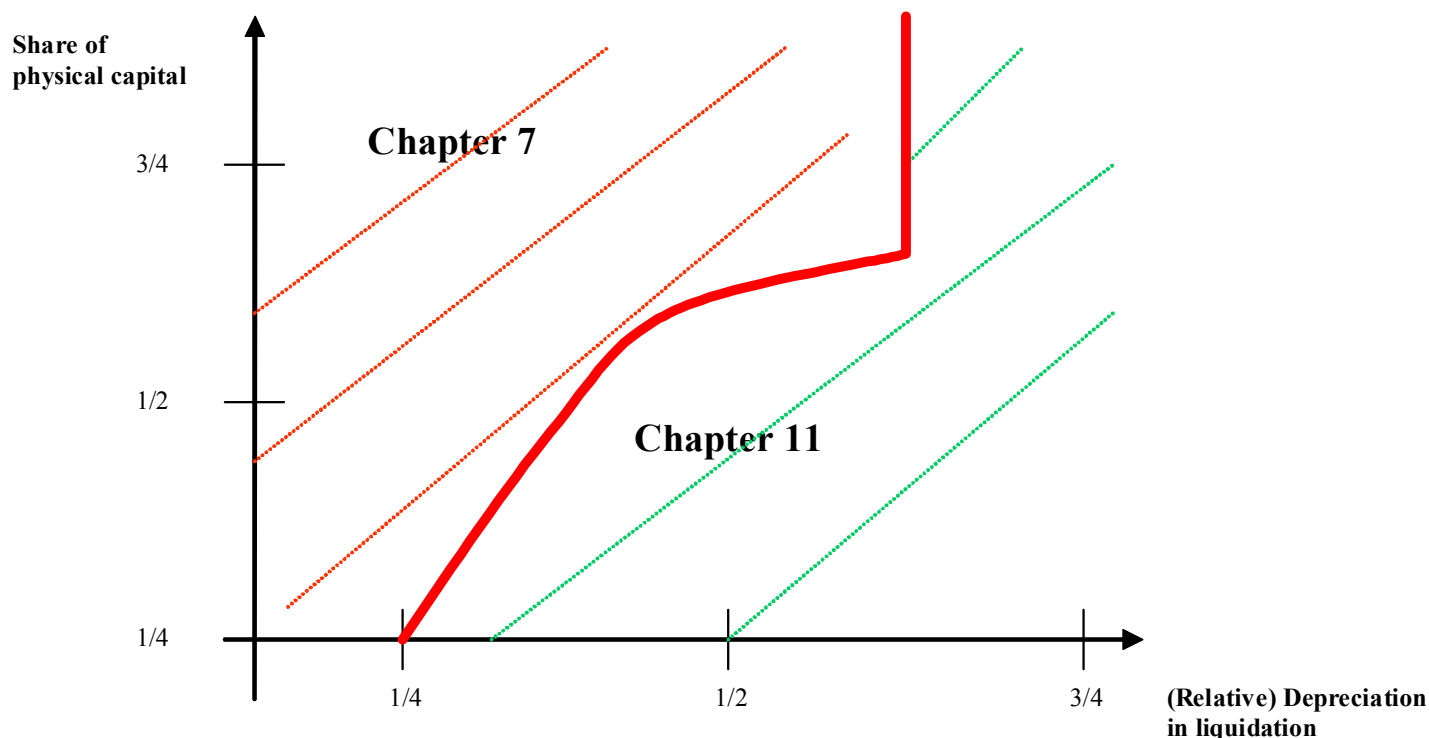


Figure 4: Best Bankruptcy Law Region

- For sectors intensive in variable input the best procedure is pro-reorganization since it gives another chance to trade creditors recover their credit, making this cost lower and more than compensating the higher cost of the secured loans. Looking vertically at figure 4, we see that firms less intensive in capital have preference for the reorganization process.
- The manager always put a higher share of her capital in the firm's production when the procedure is pro-reorganization.
- As the cost of bankruptcy-liquidation increases, the portion of capital that managers put in the firm increases. Intuitively, it happens due to the increase in the cost of secured credit, raising the marginal return for the managers' capital.
- In general, as the cost of bankruptcy-liquidation increases relative to the cost of bankruptcy-reorganization, the incentive to apply a pro-reorganization procedure increases. Notice that the area of pro-reorganization procedure tends to increase as the bankruptcy-liquidation increases.

5.2 The Optimal Bankruptcy Laws

Our strategy in this section is to compared our findings about the best bankruptcy procedure with the current procedures in 44 countries.

To do this, we impose two assumptions: first, we use the estimated value of the bankruptcy-liquidation cost for the U.S.;²⁰ second we use the U.S. sectorial costs share of materials and physical capital to calibrate the proportion of physical capital and variable input used in each one of the industry sectors. Using data from U.S. industry sector (that we interpret as industry representative) we hope to identify the technical component – common to the industry in every country – of industry physical capital intensity.

The information about the countries' industry sector is essentially from UNIDO Indstat-3 database, which provides a panel with data for 28 industries of several countries. The sectorial costs share of materials and physical capital of each industry is from the NBER-CES Manufacturing Industry Database. It is calculated as the mean for the 1990-1996 period. Since the definition of industry segments is different in NBER-CES Manufacturing Industry Database and UNIDO Indstat, the former classification is matched to the latter's 28 segments.

Once that the proportion of physical capital and the cost of bankruptcy-liquidation is known, it is possible to know the best bankruptcy procedure for each one of the 28 industry sectors.²¹ To analyze the optimal bankruptcy law for each country we use the following method: first, we calculate the value added share of each industry sector for each country (to infer the size of each sector), then we sum the share of each sector that should have a pro-liquidation (or pro-reorganization) procedure. If the aggregated share of the pro-liquidation sectors is bigger than 50%, then the best for the country is a pro-liquidation bankruptcy law, otherwise the best is a pro-reorganization bankruptcy law. The table 1 summarizes the results.²²

As a result we see that 26 in a sample of 44 countries (or approximately 59%) apply a procedure totally aligned with our suggestions. We call pro-liquidation procedure the one that does not apply the automatic stay in the firms assets, otherwise we call it pro-reorganization. A second order feature is the restrictions imposed by the law on managers to enter in reorganization. Usually when there is no restriction the reorganization is reached more easily.

In the majority, countries that should have a pro-reorganization procedure does not apply the so-called automatic stay for the assets of the failed firm (12 cases). It brings a significant incentive to creditors take their collateral, usually assets that are important for the firms' life, eliminating any chance for the firm to reorganize. This generates a significant burden for trade creditors that takes it into account in their prices. For countries intensive in variable input, it is a negative feature of the bankruptcy law. On the other hand, four countries that should not

have a pro-liquidation procedure does not apply it. These countries allows the automatic stay of the firms' assets and three of them does not impose any restrictions to managers on entering on reorganization procedure. Both features incentive the reorganization of the failed firms. Since the best for these countries is a pro-liquidation procedure, they should impose both restrictions to enter in reorganization and no automatic stay.

Notice that the results suggest that approximately 80% of the countries (35 of 44) should apply a pro-reorganization bankruptcy law.

It is important to remember that this result depends on our hypotheses of bankruptcy costs, which we assume, for all countries, to be equal to the estimated level for the U.S.. For countries

²⁰Bris et al. (2006) estimate that the average reorganization procedure retains value 137% better than the liquidation procedure in the U.S.. This result represents a cost of 0,58 for one unit of K in the liquidation procedure. The vector of cost in tis case became (cost of reorganization, cost of liquidation)= (1, 0.42).

²¹See Table B at the Appendix B.

²²The descriptions in red letters means that the share of sectors pro-liquidation (or pro-reorganization) is between 45% and 55%, wich means that the effect of both procedures on the economy is not too different.

with a lower bankruptcy-liquidation costs the result should move forward to the pro-liquidation procedure, while for countries with higher costs of liquidation the result should move forward to the pro-reorganization procedure.

Table 1: Bankruptcy Law Analysis

Countries	Optimal Bankruptcy	Current Bankruptcy Law	Proposed Changes
Australia	pro-reorganization	pro-liquidation	auto stay
Austria	pro-liquidation	pro-liquidation	none
Bangladesh	pro-reorganization	pro-reorganization	none
Belgium	pro-liquidation	pro-reorganization	no-auto stay and restrictions
Brazil	pro-liquidation	pro-reorganization	no-auto stay
Canada	pro-reorganization	pro-reorganization	none
Chile	pro-reorganization	pro-liquidation	auto stay
Colombia	pro-reorganization	pro-reorganization	none
Costa Rica	pro-reorganization	pro-reorganization	none
Denmark	pro-reorganization	pro-liquidation	auto stay
Egypt	pro-reorganization	pro-reorganization	none
Finland	pro-liquidation	pro-reorganization	no-auto stay and restrictions
France	pro-reorganization	pro-reorganization	none
Greece	pro-reorganization	pro-reorganization	none
India	pro-reorganization	pro-reorganization	none
Indonesia	pro-reorganization	pro-reorganization	none
Israel	pro-liquidation	pro-liquidation	restrictions on entering
Italy	pro-reorganization	pro-reorganization	none
Jamaica	pro-reorganization	pro-liquidation	auto stay
Japan	pro-reorganization	pro-reorganization	none
Jordan	pro-liquidation	pro-reorganization	no-auto stay and restrictions
Kenya	pro-reorganization	pro-liquidation	auto stay
Korea	pro-reorganization	pro-liquidation	none
Malaysia	pro-liquidation	pro-liquidation	none
Mexico	pro-reorganization	pro-reorganization	none
Morocco	pro-reorganization	pro-reorganization	none
Netherlands	pro-liquidation	pro-liquidation	none
New Zealand	pro-reorganization	pro-liquidation	auto stay
Nigeria	pro-reorganization	pro-liquidation	auto stay
Norway	pro-reorganization	pro-reorganization	none
Pakistan	pro-reorganization	pro-reorganization	none
Peru	pro-reorganization	pro-reorganization	none
Philippines	pro-reorganization	pro-reorganization	none
Portugal	pro-reorganization	pro-reorganization	none
Singapore	pro-liquidation	pro-liquidation	restrictions on entering
South Africa	pro-reorganization	pro-reorganization	none
Spain	pro-reorganization	pro-liquidation	auto stay
Silence	pro-reorganization	pro-reorganization	none
Sweden	pro-reorganization	pro-reorganization	none
Turkey	pro-reorganization	pro-liquidation	auto stay
UK	pro-reorganization	pro-liquidation	auto stay
US	pro-reorganization	pro-reorganization	none
Venezuela	pro-reorganization	pro-liquidation	auto stay
Zimbabwe	pro-reorganization	pro-liquidation	auto stay

6 Conclusion

The main challenge of this paper was to explore – in a general equilibrium setting with incomplete markets and default – the best bankruptcy procedure considering an important aspect: the relationship between entrepreneurs who needs to raise funds and secured and trade creditors that provide the funds.

When lawmakers design a bankruptcy law that is best for their specific economy, they must capture the cross-country differences. Understanding these differences, we can search the optimal bankruptcy law for particular countries. Thus, we analyze how the optimal bankruptcy laws depend on the specific industries and countries characteristics, and propose the best law for different countries based on their particularities.

Considering two dimensions of heterogeneity – the physical capital intensity and the costs of bankruptcy – we reach, through simulation methods, the following results:

- For sectors intensive in physical capital the best procedure is pro-liquidation, since it permits secured creditors to recover their claims immediately, making the cost of capital lower,
- For sectors intensive in variable input the best procedure is pro-reorganization, since it gives another chance to trade creditors recover their credit,
- The manager always put a higher share of her capital in the firm’s production when the procedure is pro-reorganization.
- As the cost of bankruptcy-liquidation increases, the portion of capital that managers put in the firm increases.
- In general, as the cost of bankruptcy-liquidation increases relative to the cost of bankruptcy-reorganization, the incentive to apply a pro-reorganization procedure increases.

After the simulation for a range of parameters, we fixed the bankruptcy-liquidation costs in the level estimated by the U.S. to find the best bankruptcy procedure for a sample of 44 countries. Our results points that approximately 59% of the countries in the sample apply a procedure totally aligned with our suggestions. Also, the results suggest that approximately 80% of the countries (35 of 44) should apply a pro-reorganization bankruptcy law.

References

- [1] Aghion, Philippe, Oliver Hart, and John Moore. 1992. “The Economics of Bankruptcy Reform.” *Journal of Law, Economics, and Organization* 8(3): 523–46.
- [2] Alderson, Michael J., and Brian L. Betker. 1995. “Liquidation costs and capital structure,” *Journal of Financial Economics* 39, 45-69.
- [3] Altman, Edward I. 1984. “A further empirical investigation of the bankruptcy cost question,” *Journal of Finance* 39, 1067-1089.
- [4] Araujo, Aloisio, and Bruno Funchal. 2005. “Bankruptcy Law in Latin America: Past and Future”, *Journal Economica*, 6(1): 149-216.
- [5] Baird, D. 1986. “The Uneasy Case for Corporate Reorganizations”, *Journal of Legal Studies*, 15(1): 127-147.
- [6] Bebchuk, Lucian A. 1988. “A New Approach to Corporate Reorganizations.” *Harvard Law Review* 101(3): 775–804.

- [7] Bebchuk, Lucian A., and Howard F. Chang. 1992. “Bargaining and the Division of Value in Corporate Reorganization.” *Journal of Law, Economics, and Organization* 8(2): 253–79.
- [8] Berkovitch, Elazar, and Ronen Israel. 1999. “Optimal Bankruptcy Laws across Different Economic Systems.” *Review of Financial Studies* 12(2): 347–77.
- [9] Berkovitch, Elazar, Ronen Israel, and Jaime F. Zender. 1997. “Optimal Bankruptcy Law and Firm-Specific Investments.” *European Economic Review* 41(3–5): 487–97.
- [10] Bris, Arturo, Ivo Welch and Ning Zhu. 2006. “The Costs of Bankruptcy: Chapter 7 Liquidation versus Chapter 11 Reorganization.” *The Journal of Finance* 61(3): 1253-1303.
- [11] Brouwer, Maria. 2006. “Reorganization in US and European Bankruptcy Law.” *European Journal of Law and Economics* 22(1): 5-20.
- [12] Eberhart, Allan C., William T. Moore, and Rodney L. Roenfeldt. 1990. “Security Pricing and Deviations from the Absolute Priority Rule in Bankruptcy Proceedings.” *Journal of Finance* 45(5): 747–69.
- [13] Eberhart, Allan C. and Lemma W. Senbet. 1993. “Absolute Priority Rule Violations and Risk Incentives for Financially Distressed Firms”, *Financial Management* 22(3): 101-116.
- [14] Franks, Julian R., and Walter N. Torous. 1989. “An Empirical Investigation of U.S. Firms in Reorganization.” *Journal of Finance* 44(3): 747–69.
- [15] Hart, Oliver, Rafael La Porta, Florencio Lopez-de-Silanes, John Moore. 1997. “A New Bankruptcy Procedure That Uses Multiple Auctions.” *European Economic Review* 41(3–5): 461–73.
- [16] Jensen, M. C., 1991: “Corporate Control and Politics of Finance”, *Journal of Applied Corporate Finance*, vol. 4, n° 2: 13-33.
- [17] La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, Robert W. Vishny. La Porta, Rafael, and others. 1998. “Law and Finance.” *Journal of Political Economy*, 106(6): 1113–55.
- [18] La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, Robert W. Vishny. 1997. “Legal Determinants of External Finance”, *Journal of Finance* 52(3): 1131-1150.
- [19] LoPucki Lynn M., and Joseph W. Doherty, 2004, “The determinants of professional fees in large bankruptcy reorganization cases,” *Journal of Empirical Legal Studies* 1, 111-141.
- [20] LoPucki, Lynn, and William C. Whitford. 1990. “Bargaining over Equity’s Share in the Bankruptcy Reorganization of Large, Publicly Held Companies.” *University of Pennsylvania Law Review* 139(1): 125–96.
- [21] Maksimovic, Vojislav, and Gordon Phillips. 1998. “Asset efficiency and reallocation decisions of bankrupt firms”, *Journal of Finance* 53, 1495-1532.
- [22] Povel, Paul. 1999. “Optimal ‘Soft’ or ‘Tough’ Bankruptcy Procedures.” *Journal of Law, Economics, and Organization* 15(3): 659–84.

- [23] Shleifer, Andrei, and Robert W. Vishny, 1992. “Liquidation Values and Debt Capacity: A Market Equilibrium Approach.” *Journal of Finance* 47(4): 1343–66.
- [24] Weiss, Lawrence A, and Karen H. Wruck. 1998. “Information problems, conflicts of interest, and asset stripping: Chapter 11’s failure in the case of Eastern Airlines,” *Journal of Financial Economics* 48, 55-97.

A Appendix

Table B: Optimal Bankruptcy procedure by industry sector

Industry Setor	Optimal Bankruptcy Procedure
Beverages	pro-reorganization
Fabricated metal prod	pro-liquidation
Food products	pro-reorganization
Footwear	pro-reorganization
Furniture	pro-reorganization
Glass and others	pro-liquidation
Ind. Chemicals	pro-liquidation
Iron and Stell	pro-liquidation
Leather Prod	pro-reorganization
Machinary eletr.	pro-liquidation
Machinary except eletr.	pro-reorganization
Misc. Petr ans Coal	pro-reorganization
Non-ferrous	pro-reorganization
Other Chemical	pro-reorganization
Other manuf prod	pro-reorganization
Other non-metalic mineral prod	pro-liquidation
Paper	pro-liquidation
Petroleum Ref.	pro-reorganization
Plastic Products	pro-reorganization
Pottery China	pro-liquidation
Printing and publishing	pro-liquidation
Professional and scientific equip.	pro-liquidation
Rubber Products	pro-liquidation
Textiles	pro-reorganization
Tobacco	pro-liquidation
Transport Equipment	pro-reorganization
Wearing Apparel	pro-reorganization
Wood Products ex. furniture	pro-reorganization