FUCAPE
BUSINESS SCHOOL

FUCAPE WORKING PAPERS

How much debtors' punishment?

Aloísio Araujo (IMPA and EPGE/FGV)
Bruno Funchal (FUCAPE)

No.01 / (Novembro) 2008

http://www.fucape.br/texto_discussao.asp

How much debtors' punishment?*

Aloisio Araujo (IMPA and EPGE/FGV)†

Bruno Funchal (FUCAPE Business School)‡

Abstract

This study investigates the relationship between debtors' punishment and the credit market development. As the main goal we analyze empirically which is the optimal level of the debtors' punishment, providing the highest credit market development. Aligned with earlier theoretical findings from Dubey, Geanakoplos and Shubik (2005), we find that there is an intermediate level of debtors' punishment that maximizes the size of the private credit market.

Keywords: Credit; Bankruptcy; Personal Bankruptcy Law.

JEL Codes: E51; G33; K35.

1 Introduction

The theoretical research on bankruptcy points to the important role of the punishment to debtors in supporting the development of credit markets. However, imperfections of such market that

*We would like to thank Luis Henrique Braido, Pierre-André Chiappori, John Geanakoplos and João Manoel Pinho de Mello for helpful comments as well as seminar participants of the 3rd CARESS-Cowles Conference at Yale University, EPGE/FGV, IBMEC-RJ, the 2006 European Meeting of the Econometric Society at Vienna, the 2006 Latin American Meeting of the Econometric Society at Mexico City, the 2007 Meeting of the Allied Social Science Associations at Chicago.

†E-mail: aloisioa@fgv.br

‡Corresponding author: Address: Fernando Ferrari Av., n^{o}1358, Goiabeiras, Vitória, Brazil. ZIP-Code: 29075-010. Phone number: 55 27 4009-4444. Fax number: 55 27 4009-4422 e-mail: bfunchal@fucape.br

might, to its incompleteness,[1] increase the relevance to the subject of laws that regulate it, like the Personal Bankruptcy Law studied in this paper. Dubey, Geanakoplos and Shubik (2005), using a General-Equilibrium model with incomplete markets show that an intermediate level of penalty to debtors is optimal in the sense that it provides a higher level of individuals' credit and welfare in the economy.

The present paper approaches this problem empirically. Here, we will analyze how the degree of debtors' punishment affects the development of the credit market. Recent empirical research in development of credit markets points to an important role of the legal protection to creditors in supporting these markets (e.g., La Porta et al. 1997 and Shleifer et al. 2007).

Aligned with the theoretical finding of Dubey, Geanakoplos and Shubik (2005), we evidence that there is an intermediate level of debtors' punishment – to protect creditors' interests – in that it is optimal for the development of the credit market, maximizing its size.

The intuition about this result comes from the influence that creditors' protection exerts on the supply and demand for loans. Legal systems that impose higher levels of punishment to debtors in case of bankruptcy (to protect creditors) tend to inhibit the demand for credit. On the other hand, a weak punishment to debtors provides a lower protection to creditors in case of bankruptcy, which inhibits the supply of credit. At the limit, extremely high or low levels of debtors' punishment tend to collapse the credit market, through the demand side or the supply side respectively.

To access this question empirically, we take advantage of changes provided by the Personal Bankruptcy Reform Act of 1978 that redefined the degree of penalty to debtors in case of

[1] The standard debt contact (non-contingent repayment of principal plus interest) that is usually offered to individuals and small businesses makes the market incomplete, since there is no contract that is offered contingent to the successful states of nature.

bankruptcy through the bankruptcy-exemption. Debtors are punished by losing their wealth that exceeds the state level of bankruptcy-exemption, and at the limit, if the exemption is zero, they lose everything they own if it exceeds the debt value. In this situation, when markets are incomplete, the fear of such harsh punishment of bankruptcy states makes debtors avoid borrowing, reducing their demand for credit. On the other hand, higher punishment increases the amount that creditors receive from debtors in bankruptcy, making them more likely to supply credit. As punishment reduces, debtors have the option to tailor another asset, aligned with their personal interests to substitute the original debt contract at a cost of the bankruptcy punishment, motivating them to demand credit, however it also makes debtors more willing to file for bankruptcy. But lower bankruptcy punishment (or lower creditor protection) also reduces the amount that lenders receive in repayment of debt in bankruptcy states, making them more likely to refuse the credit offer.[2]

Thus, this paper aims at answering the following issues: How does the relationship between debtors' punishment and the credit market development look? Is the optimal level of punishment intermediary? What is such an optimal level?

To reach our goals, first we present a theoretical approach that supports our empirical claims. We follow the idea from Dubey, Geanakoplos and Shubik (2005) in a more simple set-up and using real economic variables to reflect certain features observed in the U.S. economy such as the possibility of debtors to file for bankruptcy strategically or by bad fortune and the punishment exogenously imposed by the bankruptcy law. Then, we simulate the model to analyze how the

[2]See Dubey, Geanakoplos and Shubik (2005): "An agent who defaults on a promisse is in effect tailoring the given security and substituting a new security that is closer to his own needs, at a cost of bankruptcy penalty. With incomplete markets one set of assets may lead to a socially more desirable outcome than another set. Also, since each agent may be tailoring the same given asset to his special needs, one asset is in effect replaced by many assets as there are agents, and so the dimension of the asset span is greatly enlarged. A larger asset span is likely to improve the social welfare."

punishment affects the credit market in equilibrium. Finally, we estimate - using a parametric and a semi-parametric method - the effect of creditors' protection (or debtors' punishment) on the measure of credit market development, using equilibrium data of loans (aggregated) and information on bankruptcy exemption in each state over the period 1992-1997, when several changes occurred on exemption levels.

As a result, we found a non-monotonic shape in the relationship between the level of creditors' protection and the amount of credit to both small businesses and individuals. States with extreme levels of protection (high or low) tend to have a lower volume of credit relative to states with intermediary levels of protection. Thus, the punishment applied by the bankruptcy legislation should be neither so harsh that inhibits credit demand nor so lenient that worsens the credit offer conditions.

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

2 Literature Review

Several works formalize theories on private credit. Townsend (1979), Aghion and Bolton (1992), and Hart and Moore (1994, 1998) show that when lenders can more easily force repayment they are more willing to extend credit. Dubey, Geanakoplos and Shubik (1989, 2005) and Dubey and Shubik (1979) approach the problem through the debtors' side, arguing that the degree of punishment to debtors in case of bankruptcy influences the level of credit traded at the market. Dubey, Geanakoplos and Shubik (2005) show that in presence of incomplete markets, assuming that certain contingencies cannot be written into contracts, the intermediate level of penalty

that encourages some amount of bankruptcy provides a higher level of individuals' credit and welfare in the economy. Dubey and Shubik (1979) show that when markets are complete the optimal level penalty is extremely high. Our paper approaches the debtors' problem using similar features like incomplete markets and the imposition of exogenous debtors penalty. In our model the bankruptcy exemption is the exogenous penalty imposed to debtors in case of bankruptcy.

For empirical studies, La Porta, Silanes, Shleifer and Vishny (1997, 1998) construct a measure of legal rights of creditors, called creditor rights. The index measures the legal rights of creditors against defaulting debtors in different countries, and has been previously interpreted as a measure of creditor protection. They use cross-country regressions to suggest that the bigger the creditor protection is, the higher is the amount of private debt. Considering the effect of information on credit market, Jappelli and Pagano (2000, 2002), Pagano and Jappelli (1993) and Sapienza (2002) have shown the importance of this factor in the determination of credit availability. They use data of credit registries − information on credit histories and current indebtedness of various borrowers − to assess empirically this issue. Shleifer et al (2007), analyzing both factors (creditors' protection and information) together and using a larger sample of countries, found that more creditor protection and better information sharing are associated with broader credit market. In addition, they found that private credit to GDP ratio rises following either improvements in creditor rights or the introduction of credit registries.

Our paper, in contrast, analyzes the creditors' protection when it is directly determined by the debtors' punishment. To assess this question we compair the levels of punishment decreed by each state in the U.S., taking advantage of changes provided by the Personal Bankruptcy Reform Act of 1978 that redefined the degree of penalty to debtors in case of bankruptcy.

Contrary from the other authors, we find that the relationship between creditors' protection and the size of the credit market not always increasing, in fact, there will be an intermediate level of creditors' protection that is optimal for the credit market development.

3 Personal Bankruptcy Law and the 1978 Reform Act

The personal bankruptcy procedures apply directly to individuals and small businesses. The reason of why the personal bankruptcy law applies to small business, and not just to individuals, is because when a firm is noncorporate, its debts are personal liabilities of the firm's owner, so that lending to the firm is legally equivalent to lend to the owner. If the firm fails, the owner can file for bankruptcy and her business and unsecured personal debts will be discharged. When a firm is a corporation, limited liability implies that the owner is not legally responsible for the firm's debts. However, lenders may require, and they usually do, that the owner guarantee the loan with some personal good (second mortgage for example). Thus, personal bankruptcy law applies to noncorporate businesses and may also apply to small corporate business.

When individuals and unincorporated firms[3] file under Chapter 7 of the U.S. Bankruptcy Code, they receive a discharge from unsecured personal and business debt in return for giving up assets in excess of the relevant state's bankruptcy exemption.[4] Creditors may not enforce claims against debtors' assets if the assets are covered by Chapter 7 bankruptcy exemption and legal actions to obtain repayment. This provision prevents creditors from taking a blanket security interest in all debtors' possessions.

[3] Owners, typically, have high debt levels, much of which consists of debts of the failed firm.

[4] Most states have several types of exemptions like residence exemption (homestead exemption), personal propriety exemption (like equity in cars, furniture, jewelry and cash) and wild card (where the debtor chooses anything to be exempted until some fixed value). Usually, the homestead exemption is the largest, and other exemptions are small.

Personal bankruptcy law became much more favorable to debtors following the passage of 1978 Bankruptcy Reform Act. The new law allows states to opt out of the federal exemption by adopting their own bankruptcy exemption. By 1983 all the states had done so, although one third of the states allowed debtors to choose between states and Federal bankruptcy exemptions. Many states raised significantly their bankruptcy exemptions when they passed opt-out legislation, adopting widely varying exemption levels. In 1992 the lowest bankruptcy exemption level was in Maryland with no homestead exemption and USD 5,500 of personal bankruptcy exemption, while Texas' exemption was unlimited for homestead and USD 30,000 for personal property.

There is also a second bankruptcy procedure, called Chapter 13, and debtors are allowed to choose between them. Under Chapter 13, debtors must present a plan to use some of their future earnings to repay part or their total debt, but all their assets are exempt. Debtors generally have an incentive to choose Chapter 7 rather than Chapter 13 whenever their assets are less than bankruptcy exemptions, because doing so allows them to avoid repayment debt from either assets or future income. Because many states' exemption levels are high relative to the assets of typical person who file for bankruptcy, around 70 percent of all bankruptcy filings occur under Chapter 7[5]. Even when debtors file under Chapter 13, the amount that they are willing to repay is strongly affected by Chapter 7 bankruptcy exemption. Suppose, for example, that a person with assets of $50,000 living in a state whose exemption level is $35,000 considers filing for bankruptcy. Because the debtor would have to give up $15,000 in assets if she filed under Chapter 7, she would be willing to pay no more than $15,000 (in present value) from future income if she filed under Chapter 13. As a result of this close relationship between both

[5]See Barron and Staten (1997)

chapters, we ignore the distinction between them.

Now consider the set of small but incorporated firms. Corporate firms are legally separated from their owners, so owners are not personally responsible for debts of their corporations. Holding everything constant, this means that small corporations are less creditworthy than small unincorporated firms, because the former have only the corporations assets to back up business debt, while the latter have both the firm's assets and the owner's personal assets. Lenders also know that owners of small corporations can easily shift assets between their personal accounts and their corporations accounts, so that lenders may not view the corporation/noncorporation distinction as meaningful for small firms. In making loans to small corporations, lenders therefore may require that owners personally guarantee the loans. This abolishes the legal distinction between corporation and their owners for purposes of the particular loan and puts the owner's personal assets at risk to repay the loan.

Debts can be divided into two different categories: secured and unsecured loans. Unsecured debts would seem more likely to be affected by bankruptcy exemption than secured debts. In particular, this distinction is blurred and debtors are often able to arbitrage assets and debts across categories and thereby increase their financial benefit from bankruptcy. For example, debtors might borrow on their credit cards or obtain new consumer loans in order to reduce secured credit. These transactions convert nondischargeable secured debt into unsecured debt that is dischargeable in bankruptcy. Or debtors might sell personal property that is in excess of the personal property exempt and use the proceeds to reduce their mortgage or to buy exempted property. In addition, bankruptcy undermines the value of collateral to lenders, since lenders may be delayed in repossessing it or may be unable to repossess the collateral at all (for example, if they call to repossess an asset that they do not provide money to finance its

purchase)[6]. Also, lenders incur extra legal costs because they must obtain the permission of the bankruptcy trustee in order to repossess collateal. For these reasons we examine the effects of bankruptcy exemptions on total loans rather than on unsecured loans.

4 Theory

In this section we build a model that describes how the debtors' decision for bankruptcy develops, considering the different levels of punishment provided by the value of the bankruptcy exemption imposed by the Personal Bankruptcy Law.

4.1 The Model

Consider a consumer who lives for two periods and maximizes utility over her consumption c. The consumer born with some amount of durable goods of value D (like a house, a car, etc) that she consumes in both periods, but it depreciates at rate δ. Period 1 income w_1 is observed but the second period income is uncertain, varying according to the realization of the states of nature, thus $w_{2s} \in [w_{21}, ..., w_{2S}]$. Each state occurs with probability p_s, where $p_s > 0 \ \forall s$ and $\sum_s p_s = 1$.The wage is free observed by the borrower, but the lender may verify its value at a monitoring cost proportional to the borrowed amount B. The monitoring cost will be denoted by γB.[7]

There is a large number of agents divided in two different groups: borrowers and lenders.

[6] In relation to debtors' home, they may be able to get rid of some lien (junior creditors, like second mortgages) without paying a cent to the lienholder. In some states, if debtors' home is sold in bankruptcy, they will get their homestead amount ahead of junior secured creditors holding judicial liens. Debtors can get rid of the lien created by judgment by filing a "motion to avoid a judicial lien". They may also be able to get rid of some liens by filing separate lawsuit in bankruptcy court. See Elias, Renauer, Leonard and Michon (2004)

[7] A similar model applies to small businesses. Suppose that, instead of a two period economy, there is only one time period where the small firms' owners choose an amount B to invest at their project. The output is uncertain $w_s B^\alpha$, varying according the realization of the state of nature w_s. At this set up we reach the same results that the consumption model.

Borrowers may be thought as consumers and lenders as the financial institution that offers a standard debt contract.[8] Each lender is endowed with enough money to supply credit to consumers. Such lenders' endowment may be used either to lend to a borrower with rate r, or to purchase a risky-free asset paying an exogenously given rate of return r_f.

If the borrowers report bankruptcy, part of the debt will be discharged, and some of the individuals' assets, including personal goods (D) and their present income will be exempted up to the amount E. The bankruptcy law determines the level of E exogenously, and accordingly we call E the bankruptcy exemption level in this paper. The debt contract is subject to this bankruptcy law. Notice that part of borrowers' goods serves as an informal collateral imposed by the law to unsecured credit.

Definition 1 *Strategic bankruptcy*[9]*: It occurs when the borrower has enough wealth to pay her debts but she chooses not to do it.*

Definition 2 *Bankruptcy by bad fortune: It occurs when the realization of states of nature is bad in such way that borrowers are unable to fulfill their repayment promises.*

The consumption of the first period defines the level of debt B at the beginning of period 2:

$$B = (c_1 - D - w_1),$$

which means that the agent consumes more than the sum of her wage and durable goods.

A loan contract between the borrower and the lender consists of a pair (r, B), where B is

[8] Townsend (1979) and Williamson (1986, 1987) show that the standard debt contract is the optimal contract for competitive financial market condition.Ying Yan (1996) shows that the standard debt contract is the optimal debt contract for non-competitive financial market condition.

[9] *Moral hazard enters the picture because borrowers have a choice not to repay their debts.*

the loan volume and $(1+r)$ the loan rate, subject to the legal imposition on the exemption level E that applies to the situation in which the borrower does not repay the debt $(1+r)B$.

If at least some debt will be held, so that $B > 0$, we can divide the borrowers' actions in three distinct choices:

C1 does not file for bankruptcy if: $w_{2s} + \delta D \geq (1+r)B$ and $(1+r)B \leq \max(w_{2s} + \delta D - E, 0)$

C2 strategic bankruptcy if: $w_{2s} + \delta D \geq (1+r)B$ and $(1+r)B > \max(w_{2s} + \delta D - E, 0)$

C3 bad fortune bankruptcy if: $w_{2s} + \delta D < (1+r)B$ (and therefore $(1+r)B > \max(w_{2s} + \delta D - E, 0)$)

Analyzing the consumer choice for bankruptcy, it is optimal to file for bankruptcy if and only if their gains in bankruptcy are bigger than their gains when they choose not to file for bankruptcy, i.e., if and only if $(1+r)B > \max(w_{2s}+\delta D-E, 0)$. That is, the consumer will default whenever the second period debt exceeds the level of assets that can be seized and the debt can not be fully enforced. Therefore the consumer delivery $\min[(1+r)B, \max(w_{2s}+\delta D-E, 0)]$. This way, we can view the probability of no bankruptcy as $(1-p_{bankruptcy}) = p(C1) = \sum_s p_s \iota_s (1-\iota_d)$ and the probability of bankruptcy as $p_{bankruptcy} = p(C2)+p(C3) = \sum_s p_s \left[\iota_s \iota_d + (1-\iota_s)\right]$, where $\iota_s = 1$ if $w_{2s} + \delta D \geq (1+r)B$ and $\iota_d = 1$ if $(1+r)B > \max(w_{2s} + \delta D - E, 0)$.

The wealth in each situation for the borrowers is given as follows:

$$W_2 = \begin{cases} w_2 + \delta D - (1+r)B & \text{if no bankruptcy} \\ w_2 + \delta D - \max(w_{2s} + \delta D - E, 0) & \text{if bankruptcy.} \end{cases}$$

Thus the lender can receive in case of bankruptcy a payment between $w_{2s} + \delta D$ (if the bankruptcy exemption is zero) and zero (if the bankruptcy exemption overcomes the debtors' wealth in the second period).

For the lenders, the expected return on lending must be no less than the risk-free return. Therefore, the lender's participation constraint is:

$$(1+r_f)B \leq \sum_s p_s \iota_s (1-\iota_d)(1+r)B + \\ + \sum_s p_s \left[\iota_s \iota_d + (1-\iota_s)\right] \left[\max(w_{2s} + \delta D - E, 0) - \gamma B\right]; \tag{1}$$

The extra interest rate paid $r - r_f$ is exactly the one needed to offset the loss the financial institution makes when the consumer bankrupts: it is the same as a risk premium.

For a menu of the described contracts, the consumer chooses a pair (r, B) that maximizes her expected utility function.

$$\max_{(r,B)} u(c_1) + Eu(c) = u(c_1) + \theta \left[\sum_{s=1}^{S} p_s u(c_{2s})\right]$$

st (1) *and*

$$c_1 = w_1 + D + B$$

$$c_{2s} = w_{2s} + \delta D - \min[(1+r)B, \max(w_{2s} + \delta D - E, 0)] \quad \forall s$$

The constraint (1) is always valid with equality, since a smaller rate of return r makes the borrower strictly better and still makes the lender's participation constraint valid. Also, since the lender pays the monitoring cost to verify the wage value (w) in bankrupt states,

the contract specified above is incentive-compatible in the sense that borrowers do not have incentive in declaring a false state of nature.

Observe that the lenders' expected return, described by their participation constraint, determines the supply of credit in the economy. The supply of credit depends directly on the punishment level imposed by the local legislation. Intuitively, for E equal to zero, i.e. there is no exemption for borrowers, it rules out the possibility of strategic bankruptcy and increases the seizure of debtors' goods, raising the possibility of fulfillment of debtors' payment promises and consequently diminishing the cost of credit (r). As E increases the number of the states of nature in which the borrower does not default reduces, since the bigger the exemption level is, the lower is the possibility that the income value plus borrower's goods overcome the exemption level, increasing the possibility of strategic bankruptcy. Such excess of strategic bankruptcy increases the interest rate charged to the loans, and at the limit, the borrower has incentive to file for strategic bankruptcy in every state and the supply of credit goes to zero.

Proposition 1 *Any value of exemptions above the critical value E^* makes the supply of credit to individuals zero.*

Proof. See Appendix A. ■

Proposition 2 *As the bankruptcy exemption decreases, the interest rate charged to individuals reduces.*

Proof. See Appendix A. ■

Differently from the supply side, if the bankruptcy exemption increases (reducing the debtors' punishment), the consumer has more incentive to demand credit. This happens because the

cost to build another asset that is more aligned with debtors interests reduces, since they can keep a bigger amount of their personal goods if bankruptcy occurs. Such asset − that allows debtors to file for bankruptcy at a cost of their wealth less the bankruptcy exemption − acts to substitute te original debt contract. At the limit, if the exemption is unlimited, the cost of bankruptcy goes to zero, making the demand for credit even more attractive. On the other hand, if the bankruptcy exemption goes to zero, individuals can lose everything they have in case of a bad realization of the sate of nature, inhibiting their demand for credit.

Proposition 3 *As the bankruptcy exemption rises, the individuals' demand for credit increases.*

Proof. See Appendix A. ■

Therefore, there are two distinct forces acting in the proposed problem. If E decreases, the supply of credit is motivated, reducing the interest rate charged to borrowers, since the chances of creditors being repaid are bigger, and they receive more in bankruptcy-states. On the other hand, the demand is repressed since the debtors fear the punishment for losing their goods. With an increase of E there is an incentive to consumers demand credit since they can build assets aligned with their needs. On the other hand, such level of exemption inhibits the lenders' supply of credit since the chance and the amount of repayment fall.

Thus, there is a trade-off that concerns the choice of the exemption level: higher levels of exemption increase the demand of credit but also stimulate the moral hazard problem, lowering the supply of credit; on the other hand, lower levels of exemptions mitigate the moral hazard problem - what motivates the supply of credit - but this also has a negative effect on the demand side due to the fear of harsh punishment. The equilibrium level of credit provided by extreme levels of bankruptcy exemption (0 or unlimited) tends to be very low or even zero. An optimal

level of bankruptcy exemption E^* may exist where the the equilibrium of supply and demand of credit provide a higher level of credit and welfare in the economy.

The Simulation of the Equilibrium

Through the simulation method we intend to show how the equilibrium values of credit and welfare change as the bankruptcy exemption varies.

To simulate the model we simplify the setup described before. Now, the model has two periods, two states of nature in the second period ($s = H, L$) and two types of agents (lenders and borrowers). The lenders are risk-neutral and the consumers are risk-averse with logarithm utility function.

The debtors' problem is:

$$\max_{r,B} u(c_1) + Eu(c) = \ln(c_1) + \theta \left[p_L \ln(c_{2L}) + p_H \ln(c_{2H})\right]$$

st (1), and

$c_1 = w_1 + D + B$

$c_L = w_{2L} + \delta D - \min[(1+r)B, \max(w_{2L} + \delta D - E, 0)]$

$c_H = w_{2H} + \delta D - \min[(1+r)B, \max(w_{2H} + \delta D - E, 0)]$

The model simulation will be done according to the following value of parameters: $w_1 = 0.5, w_{2H} = 1.5, w_{2L} = 0.5, D = 0.3, \delta = 0.9, p_H = p_L = 0.5, \theta = 0.95, \gamma = 0.01$ and $r_f = 1.05$. We can interpret such wage values as the one of a person who is employed receiving 0.5 and expects a promotion for a better job that pays 1.5. The promotion occurs with probability of 0.5. Only the parameter E will be varying.

The simulation results (see table 1) tell us that extremely low and high levels of debtors'

punishment provide a small volume of credit negotiated in the economy. The demand for credit is inhibited since the punishment is very harsh when the exemptions are very low (see proposition 3), making the consumers lose a significant share of their goods in bankruptcy states. As the exemption level increases, the amount of credit and welfare rise, reaching its maximal level when the bankruptcy exemption is equal to 0.77. Increasing even more the exemption level, the welfare and the volume of credit decrease - considering that the supply is inhibited due to the major possibilities of strategic bankruptcy and lower recoveries in bankruptcy states - and the interest rates charged to individuals increases (see proposition 1 and 2). Thus, the volume of equilibrium of the credit B is a non-monotonic function of the bankruptcy exemption levels E, where the optimal level of exemption is intermediary, providing a punishment neither too harsh nor too lenient.

Table 1 enters here

5 Empirical Tests

In this study we use data from 1992 to 1997 from the *Federal Deposit Insurance Corporation Statistics on Banking* (FDIC) for small businesses and individuals' loans in each U.S. state and information on states' bankruptcy exemption to examine the empirical hypothesis. Comparing each state, we have 51 observations for a cross-section analysis. Since several changes happened in the levels of bankruptcy exemptions (which determine the debtors' punishment) during the period 1992-1997[10], we will test the relationship between the degree of punishment and the level of individuals and small businesses' loans using a pooled cross-section method, raising the

[10] See Table A in the appendix.

sample to 306 observations.

Most states have separate exemptions for equity in homesteads, personal property like equity in motor vehicles, some amount of cash, jewel, furniture, clothing etc, and miscellaneous category (wild card). Some states allow debtors to choose between the state's exemption and the Federal exemption, and for empirical tests we will use the bigger one. Also, some states allow married couples who file for bankruptcy to double (or raise) their exemptions. Because we are working with aggregated data, we assume that co-applicants are actually married couples[11] and we double (or otherwise raise) the exemptions in states that allow it. Table A in Appendix A lists the homestead, the personal property and the wild card exemptions in each state in 1992 and their changes until 1997. The table also indicates whether each state allows its residents to use Federal exemptions and whether it allows married couples to double the exemption.

The structure of the bankruptcy law and its reform in 1978 benefited our estimation in two different ways: the first is because inside the U.S. there is a well-controlled institutional environment where the only issue that distinguishes the bankruptcy procedure in the American states is the level of bankruptcy exemption, which varies widely across states; second is that the reform in the Personal Bankruptcy Law in 1978 provides a neat natural experiment.

To run our tests we construct a debtors' punishment variable[12]. We can define debtors' protection as a sum of homestead, personal property and wildcard exemption, that is how much cannot be taken off from the debtor in case of bankruptcy[13]. Notice that this variable

[11] As in Lin & White (2001) and Berkowitz & White (2004). Usually, more than 70% of debtors are married (Sullivan (1982)).

[12] The option to use this variable instead of bankruptcy exemption was made because the bankruptcy exemption itself does not affect uniformly the population. For example, the majority of the population is highly affected by exemptions from zero to US$5,000, while exemptions above US$200,000 have a weak effect on a small share of the population. The debtors' punishment variable works to fullfil this feature.

[13] For states that have an unlimited exemption level, we decided to impose a level of $500,000 (quite above the highest level of exemption established by an American State, namely, $100,000). To check the robustness

is inversely related to the penalty imposed on the debtors in their state, because the higher (lower) the debtor exemption, the less (more) the creditor can seize the debtors's goods. So this variable can be seen as the inverse of debtors' punishment (or the inverse of the creditors' protection). Normalizing the bankruptcy exemption by the lowest level and calculating its inverse, the variable used as the debtors' penalty is:

$$Debtors\prime Punishment = \frac{1}{Normalized\ Exemption} \in [0, 1].$$

But notice that the same monetary penalty may impose different punishments to the population. It happens because for a given level of bankruptcy-exemption, the less wealth the agent owns the smaller is the proportion of her wealth that the creditor can take. Therefore, it is also possible to define the debtors' punishment variable as the inverse of a ratio of the sum of homestead, personal property and wildcard exemption to each state per capita income because, for example, an exemption of $10,000 in a rich state is a bigger penalty than the same exemption for a poor state. Calling this variable as Effective Debtors' Punishment we have:

$$Effective Debtors\prime Punishment = \frac{1}{Exemption/GSP\ per\ capita} \in [0, 5.212].$$

The measures of the individuals' private credit that we use to run the regressions are:

CCL = amount of credit card loans given by financial institutions to individuals divided by GSP,

of this hypothesis tests were done with values of $250,000, $1,000,000 and ∞ (debtors' punishment equals zero) for unlimited bankruptcy exemptions. The regressions present only marginal changes compared with the last results and the variable of interest remains significant in all cases.

PL = amount of personal loans[14] given by financial institutions to individuals divided by GSP,

$TIL = PL + CCL$ = total amount of loans given by financial institutions to individuals divided by GSP.

Concerning small businesses' private credit, the measures used to run the tests are:

$SBL1$ = amount of loans of \$100,000 or less given by financial institutions to small business divided by GSP,

$SBL2$ = amount of loans between \$100,000 and \$250,000 given by financial institutions to small business divided by GSP,

$SBL3$ = amount of loans between \$250,000 and \$1,000,000 given by financial institutions to small business divided by GSP,

$SBL = SBL1 + SBL2 + SBL3$ = amount of loans given by financial institutions to small business divided by GSP.

To investigate the non-linear shape of the relationship between each measure of credit market development and debtors' punishment we will estimate the following equation:

$$y = f(x) + u,$$

such that $E(u/x) = 0$ and $E(u^2/x) < \infty$, implying that $E(y/x) = f(x)$. Thus, an estimation for $f(x)$ give us an estimator of the expectation of y conditional to x.

[14] Other loans to individuals for household, family and other personal expenditures (consumer loans) including single payment, installment and all student loans. Included are loans for such purposes as: (1) purchases of private passenger automobiles, pickup trucks, household appliances, furniture, trailers, and boats; (2) repairs or improvements to the borrower's residence (not secured by real estate); (3) educational expenses, including student loans; (4) medical expenses; (5) personal taxes; (6) vacations; (7) consolidation of personal (nonbusiness) debts; (8) purchases of real estate or mobile homes (not secured by real estate) to be used as a residence by the borrower's family; and (9) other personal expenditures.

To do this, we regress the logarithm[15] of each measure of individuals and small businesses' private credit on the punishment variable, its square and other control variables.

To test our hypothesis, one possibility is to analyze whether differences in punishment levels across states affect the volume of credit. However, cross-section results are vulnerable to criticism because the punishment variables may be acting as proxies for nonbankruptcy variables at the state level which are omitted from the regression. The usual response to this problem in the program evaluation literature has been to use pooled cross-section data rather than single year cross-section data and to introduce both state and year fixed effects[16]. Using pooled cross-section data and introducing state dummy variables into the estimation, the state dummies will capture the effect of variation across states in the punishment levels, while the punishment variable themselves will capture only the effects of changes in the punishment level between 1992 and 1997.

We will report results using the following specifications:

$$\ln(L_{it}) = \alpha + \beta_1(punishment_{it}) + \beta_2(punishment_{it})^2 + \boldsymbol{\beta}\mathbf{X}_{it} + \varepsilon_{it} \tag{2}$$

$$\ln(L_{it}) = \alpha_i + \psi_t + \beta_1(punishment_{it}) + \beta_2(punishment_{it})^2 + \boldsymbol{\beta}\mathbf{X}_{it} + \varepsilon_{it} \tag{3}$$

Then, we re-estimate the equations (2) and (3) for all measures of credit market development replacing debtors' punishment by effective debtors' punishment:

[15] Because the distribution of individuals and small businesses' loans are right-skewed, we use the natural logarithm of individuals' loans as the dependent variable in our specification.

[16] The state fixed effects control for state-specific factors that are fixed over time, and the year fixed effects control for factors that vary over time but are common accros all states.

$$\ln(L_{it}) = \alpha + \beta_1(ef.pun_{it}) + \beta_2(ef.pun_{it})^2 + \boldsymbol{\beta}\mathbf{X}_{it} + \varepsilon_{it} \tag{4}$$

$$\ln(L_{it}) = \alpha_i + \psi_t + \beta_1(ef.pun_{it}) + \beta_2(ef.pun_{it})^2 + \boldsymbol{\beta}\mathbf{X}_{it} + \varepsilon_{it}. \tag{5}$$

In the specification without fix effects the vector of control variables is composed by GSP (in logs), population (in logs), unemployment rate of previous year[17] and dummies for American regions (Farwest is the excluded category)[18]. We control for total GSP on the theory that larger economies may have bigger credit markets because of economies of scale in organizing the supporting institutions. Inserting the population variable we also control by itself and for GSP per capita (log (GSP) - log (population) = GSP per capita). The state unemployment rate in the previous year controls for the labor market activity and for the potential bankruptcy by bad fortune. Finally, we use dummy variables for regions to account for potential geographic variation in credit markets. Except for the dummies for regions, we use the same controls in the fixed effect specification because there may be some variation that is not state- and time-specific[19].

The disadvantage of this approach, the parametric method, is the imposition of a functional form to the model, which may generate problems relative to the bad specification. To check the robustness of our results, we will run semi-parametric regressions in addition to the parametric

[17] The data source of Gross State Product (GSP), population and unemployment rate is the U.S. Bureau of Economic Analysis.

[18] The regions used as dummies are: Mideast, New England, Plains, Rocky Mountain, Southeast, Great Lakes, Southwest and Farwest.

[19] We also run the regressions without the controls, only with the fixed effects. The varibles of interest present only marginal changes in their coefficient values and significancy if compared with the specification that insert the controls.

regressions. We will do this following two steps: first, we regress the dependent variable that measures the credit market development on the set of controls; them, using the non-parametric method[20] we regress the residuals on the punishment variable:

$$E(residuals_{it} \ / \ punishment_{it}) = f(punishment_{it})$$

$$E(residuals_{it} \ / \ ef.\ punishment_{it}) = f(ef.\ punishment_{it}).$$

But there exists an important econometric question: should the exemption levels be endogenous? Exemption levels can be treated as exogenous to the development of the credit-market. The U.S. Congress adopted a new Bankruptcy Code in 1978 which specified uniform federal bankruptcy exemptions that were applicable all over the United States, but also allowing states to opt out of the federal exemption by adopting their own bankruptcy exemption. The code went into effect in late 1979, and all the states adopted their own bankruptcy exemptions within a couple of years thereafter, although about one-third of the states allowed their residents to choose between the state's exemption and the federal exemption. Since the early 80s, the pattern has been that only a few states changed their exemption levels each year, mainly to correct nominal exemption levels for inflation. From 1992 to 1997, states changed their homestead exemptions 11 times and changed their personal property exemptions 10 times. Many of these changes were very small. In addition, the Federal bankruptcy exemption was raised in 1994 and this raised exemption levels in six states that allow their residents to use the Federal exemption. The fact that most states adopted their bankruptcy exemptions within a short period after the

[20] To run the non-parametric regressions we use the Gaussian kernel, that is defined as $(2\pi)^{-1/2}\exp(-\varepsilon^2/2)$, and a bandwidth of 0.3375. This bandwidth value comes from the fact that $h_n = cn^{-\frac{1}{(k+4)}}$, where n is the sample size and k is the number of densities. The optimal value of the constant c is 1.06. See Bierens (2002).

code went into effect and that few states changed their exemption levels each year suggests that individual states' bankruptcy exemptions can be treated as exogenous to the state credit market behavior.

5.1 Tests for Individuals' loans

Table 3 reports the coefficient values of running an ordinary least-squares, with and without state and year fixed effects, aiming at explaining the relationship between individual' credit market development and debtors' punishment (or creditors' protection). For all types of loans (personal loans, credit card loans and total individuals' loans) and econometric specifications, the coefficients describing debtors' punishment are highly significant, and since the first coefficient is positive and the second is negative, the relationship has a concave form.

Figure 1, that illustrates the non-monotonic shape of the studied relation, shows that there is an intermediary penalty that is optimal for the development of the states credit market.[21] Similar shapes hold for all three measures of individuals' credit.

Notice that as we claim in the theoretical section, there is an intermediary level of debtors' punishment − and consequently of creditors' protection − that maximizes the level of individuals' credit negotiated in the economy. For higher levels of punishment (lower exemptions) the demand for credit is inhibited since the debtors fear the consequences of bankruptcy (proposition 3), producing an underdevelopment in the individuals' private credit market. As the punishment reduces, the demand for credit is motivated due to the availability of a new asset with the option of no-repayment at a lower cost (bankruptcy cost), and despite the terms of credit offered by the lenders tend to worsen (see proposition 2), the equilibrium level of credit

[21] The coefficients used to illustrate the relationship are from the regression with fixed effects.

will increase. As the punishment approaches to zero, the debtors higher incentive to file for bankruptcy strategically and the lower expected recovery of creditors reduces (or even kills) the supply of credit (see proposition 1). Therefore, there is an intermediary level that is optimal for the credit market development.

Table 2 enters here

Figure 1 enters here

It is possible to estimate a confidence interval for the optimal level of debtors' punishment using the result obtained by the regression (total individuals' loans with fixed effects). With 90% of confidence, the optimal level of punishment holds between 0.192 and 0.223.

Confidence Interval: optimal level of punishment and exemption

	90%	95%
debtors' punishment	$(0.192; 0.223)$	$(0.188; 0.226)$
bankruptcy exemption	$(\$24,663; \$28,645)$	$(\$24,336; \$29,255)$

Moreover, since the bankruptcy exemption is a function of debtors' punishment, we can calculate the confidence intervals for the levels of bankruptcy exemptions that provide the maximal level of development in the individuals' credit market.

We can say with 90% of confidence that the optimal bankruptcy exemption level for an American state that maximizes total individuals' credit in the economy belongs to the interval $(\$24,663; \$28,645)$. Observe that it is not optimal for the economy a punishment to be neither sufficiently harsh nor sufficiently lenient.

In 1992, only eight states in the U.S. apply a punishment to debtors that are within the optimal range, while twenty-five apply a punishment below this range and eighteen above it.

Until 1997 the set of states with punishment below the optimal range increases dramatically to thirty-four, while the number states with punishment within and above the optimal range falls to two and fifteen respectively. Thus, the most significant feature is that there are several states that apply extremely low bankruptcy exemptions, giving a strong incentive to file for bankruptcy.

It is observable that between 1991 and 1998 the median net value of holdings[22] of an individual fluctuates within a fairly narrow range from 40,000 to 46,000 dollars[23]. Applying the optimal punishment (exemptions of $26,500) it is possible to provide both a fresh start to failed debtors − since they will still hold approximately $26,500 dollars of their goods − and a significant recovery to lenders (between $13,500 - $19,500 dolars) since the median amount of debts that debtors hold when they file for Chapter 7 bankruptcy is approximately 32,000 dollars[24] (between 42% and 61% of the debt). However, because of the higher levels of exemptions in most states − which provides a weak protection to creditors − what really happens is that debtors are motivated to file strategically for default, and creditors do not receive a significant amount of the debt (in 20 states the bankruptcy exemption is bigger than the median value of holdings).

To exemplify the effect of the optimal punishment on individuals' credit market, suppose that a state that applies a bankruptcy exemption of 200,000 dollars (like Minnesota in 1997) decides to modify its bankruptcy exemption to the optimal level (approximately 26,500). Such a change, according to the regression results, tends to produce an increase of 30% in the level of credit, raising the level of individuals' loans/GSP from 0.0975 to 0.127. Conversely, states

[22] Values in constant 1997 levels.
[23] See Orzechowski, S. and Sepielli, P. (2003)
[24] See Barron, J. M. and Staten, M. E. (1997)

with too low exemptions (or high debtors' punishment and creditors' protection), like Nebraska with a bankruptcy exemption of 12,500 dollars, produces an increase of almost 54% boosting the individuals' private credit from 0.10[25] to 0.154.

Checking the robustness of the functional form used in our parametric regression, now we present the semi-parametric results of the relationship between credit market development and debtors' punishment (see Figure 2). Notice that qualitatively the results don't change, which means that the maximal level of credit market development for individuals is reached with an intermediary level of debtors' punishment.

Figure 2 enters here

Running the same test for effective debtors' punishment, table 4 shows that the results are again highly significant, independent of the specification. For the three measures of individuals' private credit, the result of intermediary optimal level of debtors' punishment still holds, meaning that even considering the penalty as a portion of individuals' income (a real variable instead of a nominal variable) our claim is also valid. Figure 3 illustrates the non-monotonic shape when we consider the relationship between credit market development and effective debtors' punishment.

Figure 4 presents the semi-parametric results of the relationship between credit market development and effective debtors' punishment. Qualitatively, the results don't change as the previous case, which means that the maximal level of credit market development for individuals is reached with an intermediary level of effective debtors' punishment.

[25] This value refers to 1992.

Table 3 enters here

Figure 3 enters here

Figure 4 enters here

5.2 Tests for Small Businesses' loans

Table 5 reports the results of running a OLS regressions explaining how the debtors' punishment affects small business' credit. The *SBL1* columns report the regression when the dependent variable is loans under \$100,000, the *SBL2* and *SBL3* columns report results for loans between \$100,000 and \$250,000, and \$250,000 and \$1,000,000 respectively. Finally the *SBL* columns report the total amount of loans to small businesses.

The coefficients describing debtors' punishment are significant at the 99% level in all cases, and since the first coefficient is positive and the second is negative, the relationship has a concave form. Moreover, since the debtors' punishment varies in an interval between 0 and 1, there is an intermediary punishment that maximizes the volume of loans for small businesses. Figure 5 that illustrates the shape of the studied relation shows the intermediary penalty that is optimal for the development of the small businesses' credit market.[26] The intuition behind this result is the same that the individuals' case.

Using the result obtained by the regressions, we estimate − for the aggregated level of small business' credit − a confidence interval for the optimal level of debtors' punishment and for the bankruptcy exemption since it is function of debtor' punishment.

Confidence Interval: optimal level of punishment and exemption

[26] The coefficients used to illustrate the relationship are from the regression with fixed effects.

	90%	95%
debtors' punishment	$(0.273; 0.285)$	$(0.272; 0.286)$
bankruptcy exemption	$(\$19,300; \$20,146)$	$(\$19,230; \$20,220)$

We can say with 90% of confidence that the optimal level of punishment and the bankruptcy exemption for an American state that maximizes the small business' credit in the economy belongs to the interval $(0.273; 0.285)$ and $(\$19,300; \$20,146)$ respectively. Again, notice that is not optimal for the economy a punishment to be neither sufficiently harsh nor sufficiently lenient.

Table 4 enters here

Figure 5 enters here

Considering the confidence interval of the optimal punishment for the period 1992 to 1997, only one state in U.S. apply a punishment that belongs to the optimal range, while more than two-third (thirty-six in 1992 and thirty-seven in 1997) of the states apply punishments below this range. This feature means that the 1978 Bankruptcy Reform worked to push the debtors' punishment to extremely low and inefficient levels in most states, allowing them to keep a significant share of their wealth. It contributes to worsen the credit market conditions in several states since the protection of creditors interests in case of bankruptcy is very low.

To exemplify the effect of the optimal debtors' punishment on small business' loans, suppose that a state that apply a bankruptcy exemption of 200,000 dollars (like Minnesota in 1997) decide to modify its bankruptcy exemption to the optimal level (approximately 20,000), increasing the creditors' protection. Such change, according to the regression results, tends to produce an increase of 68% in the amount of loans (loans below $100,000 increases 101%). On the other

side (higher levels of punishment), if Nebraska decide to modify its exemption raising it from \$12,500 to \$20,000, reducing the creditors' protection, the total amount of loans increases 24%, with the biggest push coming from the loans below \$100,000 that raises approximately 58%.

As we did in the individuals' case, to check the robustness of the functional form we also present the semi-parametric results of the relationship between credit market development for small business and debtors' punishment (see Figure 6). Again, qualitatively the results don't change, which means that the maximal level of small business' credit is reached with an intermediary level of debtors' punishment.

Figure 6 enters here

Table 5 enters here

Running the same test for effective debtors' punishment, table 6 shows that results are again significant in all classes of loans. For all measures of credit market development the result of intermediary optimal level of debtors' punishment still holds, which means that even considering the penalty as a portion of the agents' income our claim is still valid. Figure 7 illustrates the results.

Figure 8 presents the semi-parametric results of the relationship between small business' credit and effective debtors' punishment. Despite the diffences in the shape of the relationship, qualitatively the results don't change, as the previous case, which means that the maximal level of credit market development for small business is reached with an intermediary level of effective debtors' punishment.

Figure 7 enters here

Figure 8 enters here

6 Conclusion

The objective of this paper was to add empirical evidences about the theories that links bankruptcy and credit. Dubey, Geanakoplos and Shubik (2005), using a General-Equilibrium model with incomplete markets show that an intermediate level of penalty to debtors in case of bankruptcy is optimal in the sense that it provides a higher level of individuals' credit and welfare in the economy. The main goal of this paper was to approach this problem empirically taking advantage of changes provided by the Personal Bankruptcy Reform Act of 1978 that redefined the degree of penalty to debtors in case of bankruptcy through the bankruptcy-exemption.

To analyze this issue, we started with a simple model that provides some predictions about the behavior of the demand and supply of credit. On the supply side, the model predicts that as the debtors' punishment (or creditors' protection) diminishes, the interest rates charged to borrowers increase, and when it is sufficiently low the supply of credit disappears. This is explained by the lower expected repayment and the higher possibilities of strategic bankruptcy. On the demand side, the fear of an extremely harsh punishment in bankruptcy states makes debtors avoid borrowing, reducing their demand for credit. As the debtors' punishment decreases the demand for credit is motivated due to the option provided by the legal system to debtors who tailor another asset, aligned with their personal interests, to substitute the original debt contract at a cost of the bankruptcy punishment. To analyze the equilibrium we simulate the model for different levels of punishments. The results show that both extreme levels of punishments (high and low) provide an underdevelopment in the credit market. Thus, there is an intermediate level of punishment that maximizes the level of credit and welfare in the economy. Therefore, the equilibrium of the volume of credit is a non-monotonic function of the debtors' punishment

levels (or creditors' protection levels) and therefore there is an intermediary level of punishment that is optimal for the credit market.

After the theoretical approach, we aimed at empirically verifying the effect of a punishment on individuals and small businesses' private credit market. We found a non-monotonic relationship between debtors' punishment and the small businesses and individuals' private credit market development. Moreover, there is an intermediary level of debtors' punishment that maximizes the ratio Private Credit/Gross State Product for both groups of loans (individuals and small business). It means that low levels of creditors' protection are too lenient with debtors, providing an incentive for bankruptcy which produces a negative effect on the supply of credit, since lenders expect to receive less in these states. On the other hand too high levels of creditors' protection provide to debtors a harsh punishment in case of bankruptcy, inhibiting their demand for credit, fearing the bad states of nature. Therefore, the optimal punishment is the one that allows a fresh re-start for debtors and a significant recovery for lenders in case of bankruptcy.

To conclude, we found that the results are robust to the measure used to define credit market loans, the measure of debtors' punishment and the functional form used to describe the relationship.

References

[1] Aghion, Philippe, and Bolton, P., 1992. An Incomplete Contracts Approach to Corporate Bankruptc. *Review of Economic Studies* 59, 473-490.

[2] Araújo, A., Monteiro, P. K., Páscoa, M. R., 1998. Incomplete Markets, Continuum of States and Default. *Economic Theory* 11, 205-213.

[3] Araújo, A., Páscoa, M. R., 2002. Bankruptcy in a Model of Unsecure Claims. *Economic*

Theory 20, no. 3, pp. 455-481.

[4] Barron, J. M. and Staten, M. E., 1998. Personal Bankruptcy: A Report on Petitioners' Ability-to-Pay. Credit Research Center, Georgetown University School of Business, Unpublished working paper.

[5] Bierens, Herman J., 2002. Normal Kernel Density Estimation. Unpublished working paper.

[6] Dubey, P., Geanakoplos, J., Shubik, M., 1989. Default an Efficiency in a General Equilibrium Model with Incomplete Markets. *Cowles Foundation Discussion Paper* 879R.

[7] Dubey, P., Geanakoplos, J., Shubik, M., 2005. Default and Punishment in a General Equilibrium. *Econometrica* 73, n^{o}1, 1-38.

[8] Dubey, P., J., Shubik, M., 1979. Bankruptcy and optimality in a closed trading mass economy modelled as a noncooperative game. *Journal of Mathematical Economics* 6, 115-134.

[9] Elias, S., Renauer, A., Leonard, R., Michon, K., 2004. How to file for Chapter 7 Bankruptcy. Nolo Press, 11th edition.

[10] Galindo, Arturo, 2001. Creditor Rights and Credit Market: Where do we Stand? Seminar: Towards Competitiveness: The Institutional Path, Chile.

[11] Hart, Oliver, and Moore, J., 1994. A Theory of Debt Based on the Inalienability of Human Capital. *Quarterly Journal of Economics* 109, 841-879.

[12] Hart, Oliver, and Moore, J., 1998. Default and Renegotiation: A Dynamic Model of Debt. *Quarterly Journal of Economics* 113, 1-42.

[13] Jaffe, Dwight M. and Russell, T., 1976. Imperfect Information, Uncertainty and Credit Rationing. *Quarterly Journal of Economics* 90, 651-666.

[14] Jappelli, Tullio, and Marco Pagano, 2002. Information Sharing, Lending, and Defaults:

Crosscountry Evidence. *Journal of Banking and Finance* 26, 2017-2045.

[15] La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, Robert W., 1998. Law and Finance. *Journal of Political Economy 106*, pp. 1113-1155.

[16] La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, Robert W., 1997. Legal Determinants of External Finance. *Journal of Finance* 52, pp. 1131-1150.

[17] Lin, E. Y., White, M., 2001. Bankruptcy and the Market Mortgage and Home Improvement Loans. *Journal of Urban Economics* 50, pp. 138-162.

[18] Orzechowski, S. and Sepielli, P., 2003. Net Worth and Asset Ownership of Households: 1998 and 2000. Household Economic Studies, U.S. Cesnus Bureau.

[19] Stiglitz, Joseph, and Weiss, A., 1981. Credit Rationing in Markets with Imperfect Information. *American Economic Review* 71, 393-410.

[20] Shleifer, A., Djankov, S., McLiesh, C., 2007. Private Credit in 129 Countries", *Journal of Financial Economics,* 84(2): 299-329.

[21] Townsend, R., 1979. Optimal Contracts and Competitive Markets with Costly State Verification. *Journal of Economic Theory* 21, 1-29.

[22] White, Michelle, 2007. Abuse or Protection: The Economics of Bankruptcy Reform under BAPCPA. *University of Illinois Law Review (forthcoming).*

[23] Williamson, S., 1986. Costly Monitoring, Financial Intermediation, and Equilibrium Credit Rationing. *Journal of Monetary Economics* 18, 159-179.

[24] Williamson, S., 1987. Costly Monitoring, Loan Contracts, and Equilibrium Credit Rationing. *Quarterly Journal of Economics* 102, 135-145.

[25] Yan,Y., 1996. Credit Rationing, Bankruptcy Cost, and Optimal Debt Contract for Small Business. Federal Reserve Bank of Cleveland, mimeographed.

A Appendix

Proof of Proposition 1. Let

$(1+r_f)B = p(C1)(1+r)B + \sum_s p_s\left[\iota_s\iota_d + (1-\iota_s)\right]\left[\max(w_{2s}+\delta D - E, 0) - \gamma B\right]$ be the function that determines the supply of credit. Let E^* be equal $w_{2S} + \delta D$. Thus, for every E above E^* the borrowers will file for bankruptcy in every state of nature since $\iota_d = 1$ for all s, making $p_{bankruptcy} = \sum_{s=1}^{S} p_s = 1$. Also, $\max(w_{2s} + \delta D - E, 0) = 0$, making the supply function $(1+r_f)B = -\gamma B$. The only value of B that satisfies this expression is $B = 0$. ■

Proof of Proposition 2. Let

$$(1+r_f)B = p(C1)(1+r)B + \sum_s p_s\left[\iota_s\iota_d + (1-\iota_s)\right]\left[\max(w_{2s}+\delta D - E, 0) - \gamma B\right]$$

Suppose that the bankruptcy exemption E decreases. Thus, $w_{2s} + \delta D - E$ will increase as well as the probability of solvency since there will be more states of nature that $(1+r)B \leq \max(w_{2s} + \delta D - E, 0)$.Both forces work to increase the expected return of lenders. To hold the equality of the supply function it is necessary to reduce r. ■

Proof of Proposition 3. To prove it by contradiction let us suppose that if E increases to E', B decreases. This condition means that $u'_E(c_1) < u'_{E'}(c_1)$, because $w_1 + D + B > w_1 + D + B'$.

By the individuals' maximization problem, if $u'_E(c_1) < u'_{E'}(c_1)$ holds, we have $\sum_{s=h}^{S} p_s u'_E(c_{2s}) < \sum_{s=i}^{S} p_s u'_{E'}(c_{2s})$, where h and i are the worst states of nature that the agent chooses not file for default for E and E' respectively.

But if $B > B'$, the marginal utility at the second period for E is bigger than for E' − that is $u'_E(c_{2s}) > u'_{E'}(c_{2s})$− because $w_{2s} + \delta D - (1+r)B < w_{2s} + \delta D - (1+r)B'$. Also, since E' is bigger, the states of nature that the agents file for default increase (or at least remain the same), thus $i \geq h$ meaning that the debtors pay their debts in less states $(S - h \geq S - i)$.

Hence, $u'_E(c_{2s}) > u'_{E'}(c_{2s})$ and $i \geq h \Rightarrow \sum_{s=h}^{S} p_s u'_E(c_{2s}) > \sum_{s=i}^{S} p_s u'_{E'}(c_{2s})$, what is a contradiction. Therefore, if E increases B increases too.

Moreover, if $E \to \infty$ the marginal cost of the debt is zero ($u'_{E'}(c_1) = 0$) since $\min[(1 + r)B, \max(w_{2s} + \delta D - E, 0)] = 0$. Thus, $c_1 \to \infty$ and since $w_1 + D$ are constant $B \to \infty$.

Therefore, an increase in the bankruptcy exemption makes the demand for credit increase.

■

Table A - Bankruptcy Exemptions 1992				
State	Homestead	Personal Property	Wild Card	Federal Exemptions Allowed?
Alabama	5,000*	3,000	3,000	no
Alaska	54,000	3,000	0	no
Arizona	100,000	1,650*	0	no
Arkansas	unlimited	1,700	500*	yes
California	75,000	5,000	400*	no
Colorado	30,000*	1,000	0	no
Connecticut	0	1,500	400	yes
Delaware	5,000*	0	500	no
District of Columbia	0	500	0	yes
Florida	unlimited	1,000	1,000*	no
Georgia	5,000*	1,400	400	no
Hawaii	20,000	1,000	0	no
Idaho	50,000	1,500	800	no
Illinois	7,500*	3,200	2000	no
Indiana	7,500*	4,100	4,000*	no
Iowa	unlimited	5,100	100	no
Kansas	unlimited	20,000	0	no
Kentucky	5,000	3,500	1,000	no
Louisiana	15,000	20,000	0	no
Maine	7,500*	6,100	400	no
Maryland	0	0	5,500	no
Massachusetts	100,000	1,675	0	yes
Michigan	3,500	1,000	0	yes
Minnesota	unlimited	3,000	0	yes
Mississippi	75,000	10,000	10,000	no
Missouri	8,000	1,750	1,250	no
Montana	40,000	1,200	0	no
Nebraska	10,000	0	0	no
Nevada	95,000	6,000	0	no
New Hampshire	30,000	1,000	0	no
New Jersey	0	0	0	yes
New Mexico	20,000*	4,500	500	yes
New York	10,000*	4,900	0	no
North Carolina	10,000*	5,000	0	no
North Dakota	80,000	6,200	0	no
Ohio	5,000	2,200	400	no
Oklahoma	unlimited	0	0	no
Oregon	15,000	8,700	400*	no
Pennsylvania	0	0	300	yes
Rhode Island	0	0	0	yes
South Carolina	5,000*	1,200	0	yes
South Dakota	30,000*	4,000	2000*	no
Tennessee	7,500	4,000	4000	no
Texas	unlimited	0	0	yes
Utah	8,000	1,500	0	no
Vermont	30,000*	10,600	7400	yes
Virginia	5,000*	2,000	0	no
Washington	30,000	2,600	2000	yes
West Virginia	7,500*	1,600	800	no
Wisconsin	40,000	2,200	0	yes
Wyoming	10,000*	2,000	0	no
Federal	7,500*	5,350*		

*Indicates that the exemption doubles (or raised) for married couples.

Cont.	
Changes in 1993	State
Homestead Exemptions	Connecticut: from 7,500 to 75,000
	New México: from 20,000 to 30,000
	Oregon: from 15,000 to 25,000
Personal Property exemptions	Minnessota: from 3,000 to 3,200
	Missouri: from 1,750 to 2,250
	Oregon: from 8,700 to 9,200
Changes in 1994	State
Homestead Exemptions	All States with feredal exemptions from 7,500 to 15,000
Personal Property exemptions	from 5,350 to 10,700
Changes in 1995	State
Homestead Exemptions	Maine: from 7,500 to 12,500
	Vermont: from 30,000 to 75,000
Personal Property exemptions	Maine: from 6,100 to 7,400
Changes in 1996	State
Homestead Exemptions	Minnesota: from unlimited to 200,000
Personal Property exemptions	California: from 2,500 to 5,000
Changes in 1997	State
Homestead Exemptions	Montana: from 40,000 to 60,000
	Nebraska: from 10,000 to 12,500
	Nevada: from 95,000 to 125,000
	Utah: form 8,000 to 10,000
	West Virginia: from 7,500 to 15,000
Personal Property exemptions	Nevada: from 6,000 to 9,000
	Utah: form 1,500 to 2,500
	West Virginia: from 1,600 to 3,200
	Wyoming: from ,2000 to 2,400

B Tables

Table 1: Simulation Results - Individuals

E	*B*	*(1+r)*	*E(u)*
0	0.12	1.05	-0.05
0.77	0.31	2.11	0.03
1.50	0.13	>2.11	-0.03
>1.77	0.00	-	-0.07

Table 2: OLS Regression - pooled cross-section with 306 observations

Dependent variable	*PL*		*CCL*		*TIL*	
constant	-10.20[a]	62.00[a]	-4.75[b]	-2.18	-5.80[a]	6.51
	(0.75)	(19.11)	(2.11)	(35.08)	(1.34)	(23.47)
Debtors' Punishment	1.78[a]	3.99[a]	5.20[a]	5.67[c]	3.21[a]	3.35[b]
	(0.36)	(1.12)	(1.15)	(2.95)	(0.67)	(1.56)
Debtors' Punishment^2	-2.09[a]	-6.48[a]	-5.45[a]	-13.06[b]	-3.57[a]	-8.04[b]
	(0.44)	(1.84)	(1.47)	(5.84)	(0.82)	(3.19)
ln(GSP)	-2.00[a]	1.25	-1.09[a]	1.98	-1.88[a]	2.13
	(0.15)	(1.12)	(0.41)	(2.39)	(0.26)	(1.36)
ln(population)	1.99[a]	-5.91[a]	0.99[b]	-1.70	1.71[a]	-2.30
	(0.15)	(2.01)	(0.42)	(3.66)	(0.27)	(2.42)
unemployment(-1)	-0.09[a]	-0.10[a]	-0.36[a]	-0.14[c]	-0.22[a]	-0.11[a]
	(0.02)	(0.03)	(0.05)	(0.08)	(0.04)	(0.04)
Fixed Effects	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Dummies of regions	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
R-square	0.56	0.82	0.23	0.85	0.35	0.87

Note: Standard errors and covariance robust to heteroskedasticity.
Standart errors are in parentheses.
a-significant at 1%, b-significant at 5%, c-significant at 10%.

Table 3: OLS Regression - pooled cross-section with 306 observations

Dependent variable	*PL*		*CCL*		*TIL*	
constant	-10.22[a]	64.33[a]	-5.08[b]	12.26	-5.94[a]	11.13
	(0.76)	(18.97)	(2.09)	(35.84)	(1.34)	(23.78)
Ef. Debtors' Punishment	0.36[a]	0.64[a]	1.17[a]	1.41[a]	0.69[a]	0.52[a]
	(0.07)	(0.16)	(0.23)	(0.41)	(0.13)	(0.20)
Ef. Debtors' Punishment^2	-0.09[a]	-0.12[a]	-0.27[a]	-0.49[a]	-0.17[a]	-0.17[a]
	(0.02)	(0.03)	(0.06)	(0.08)	(0.03)	(0.04)
ln(GSP)	-2.04[a]	1.33	-1.29[a]	2.19	-1.99[a]	2.34[c]
	(0.15)	(1.12)	(0.42)	(2.32)	(0.27)	(1.34)
ln(population)	2.03[a]	-6.14[a]	1.16[a]	-2.97	1.80[a]	-2.81
	(0.16)	(2.00)	(0.43)	(3.64)	(0.28)	(2.41)
unemployment(-1)	-0.10[a]	-0.10[a]	-0.36[a]	-0.14[c]	-0.22[a]	-0.11[a]
	(0.02)	(0.03)	(0.06)	(0.08)	(0.04)	(0.04)
Fixed Effects	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
Dummies of regions	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
R-square	0.56	0.83	0.24	0.86	0.35	0.87

Note: Standard errors and covariance robust to heteroskedasticity.
standart errors are in parentheses
a-significant at 1%, b-significant at 5%, c-significant at 10%

Table 4: OLS Regression - pooled cross-section with 306 observations

Dependent Variable	*SBL1*		*SBL2*	
constant	-8.42[a]	43.90[a]	-7.64[a]	11.60
	(0.64)	(15.05)	(0.53)	(11.85)
Debtors' Punishment	0.91[a]	6.90[a]	0.50[a]	3.71[a]
	(0.29)	(1.34)	(0.19)	(0.83)
Debtors' Punishment^2	-1.27[a]	-13.50[a]	-0.67[a]	-5.44[a]
	(0.31)	(3.15)	(0.21)	(1.30)
ln(GSP)	-2.04[a]	0.32	-1.10[a]	-0.33
	(0.13)	(0.81)	(0.12)	(0.73)
ln(population)	1.82[a]	-3.91[a]	1.05[a]	-1.03
	(0.13)	(1.35)	(0.12)	(1.24)
unemployment (-1)	-0.07[a]	-0.045	-0.06[a]	-0.04[c]
	(0.02)	(0.03)	(0.02)	(0.025)
Fixed Effect	**No**	**Yes**	**No**	**Yes**
Dummies of regions	**Yes**	**No**	**Yes**	**No**
R-Square	0.78	0.94	0.59	0.86

Note: Standard errors and covariance robust to heteroskedasticity.
Standart erros are in parentheses.
a-significant at 1%, b-significant at 5%, c- significant at 10%.

Table 4 (*Cont.)*: OLS Regression - pooled cross-section with 306 observations

Dependent Variable	*SBL3*		*SBL*	
constant	-7.03[a]	11.01	-6.45[a]	22.57[b]
	(0.43)	(14.90)	(0.44)	(11.02)
Debtors' Punishment	0.72[a]	3.87[a]	0.59[a]	4.58[a]
	(0.21)	(1.00)	(0.19)	(0.88)
Debtors' Punishment^2	-0.87[a]	-5.10[a]	-0.85[a]	-8.20[a]
	(0.22)	(1.53)	(0.20)	(1.74)
ln(GSP)	-0.91[a]	-0.23	-1.34[a]	0.06
	(0.11)	(0.91)	(0.10)	(0.68)
ln(population)	0.92[a]	-1.00	1.26[a]	-2.02[c]
	(0.11)	(1.54)	(0.10)	(1.13)
unemployment(-1)	-0.06[a]	-0.05[c]	-0.06[a]	-0.05[b]
	(0.02)	(0.03)	(0.01)	(0.02)
Fixed Effect	**No**	**Yes**	**No**	**Yes**
Dummies of regions	**Yes**	**No**	**Yes**	**No**
R-Square	0.50	0.75	0.68	0.88

Note: Standard errors and covariance robust to heteroskedasticity.
Standart erros are in parentheses.
a-significant at 1%, b-significant at 5%, c- significant at 10%.

Table 5: OLS Regression pooled cross-section with 306 observations

Dependent Variable	*SBL1*		*SBL2*	
constant	-8.34[a]	43.60[a]	-7.58[a]	11.96
	(0.63)	(16.47)	(0.53)	(11.67)
Ef. Debtors' Punishment	0.15[a]	0.62[a]	0.074[b]	0.51[a]
	(0.05)	(0.18)	(0.037)	(0.12)
Ef. Debtors' Punishment^2	-0.05[a]	-0.12[a]	-0.022[b]	-0.08[a]
	(0.01)	(0.03)	(0.008)	(0.02)
ln(GSP)	-2.04[a]	0.70	-1.10[a]	-0.26
	(0.13)	(0.88)	(0.11)	(0.73)
ln(population)	1.82[a]	-4.14[a]	1.04[a]	-1.09
	(0.13)	(1.36)	(0.12)	(1.21)
unemployment(-1)	-0.07[a]	-0.03	-0.06[a]	-0.03
	(0.02)	(0.03)	(0.02)	(0.02)
Fixed Effect	**No**	**Yes**	**No**	**Yes**
Dummies of regions	**Yes**	**No**	**Yes**	**No**
R-Square	0.73	0.93	0.59	0.86

Note: Standard errors and covariance robust to heteroskedasticity.
t-statistics are in parentheses
a-significant at 1%, b-significant at 5%, c- significant at 10%

Table 5 (*Cont.*): OLS Regression pooled cross-section with 306 observations

Dependent Variable	*SBL3*		*SBL*	
constant	-7.01[a]	11.26	-6.40[a]	22.65[b]
	(0.44)	(14.57)	(0.45)	(11.36)
Ef. Debtors' Punishment	0.13[a]	0.57[a]	0.093[b]	0.48[a]
	(0.03)	(0.14)	(0.039)	(0.12)
Ef. Debtors' Punishment^2	-0.035[a]	-0.08[a]	-0.03[a]	-0.076[a]
	(0.01)	(0.03)	(0.008)	(0.02)
ln(GSP)	-0.92[a]	-0.20	-1.35[a]	0.26
	(0.11)	(0.90)	(0.10)	(0.70)
ln(population)	0.94[a]	-1.04	1.26[a]	-2.16[c]
	(0.11)	(1.51)	(0.11)	(1.11)
unemployment(-1)	-0.06[a]	-0.05[c]	-0.06[a]	-0.04[c]
	(0.01)	(0.03)	(0.01)	(0.022)
Fixed Effect	**No**	**Yes**	**No**	**Yes**
Dummies of regions	**Yes**	**No**	**Yes**	**No**
R-Square	0.49	0.74	0.65	0.88

Note: Standard errors and covariance robust to heteroskedasticity.
t-statistics are in parentheses
a-significant at 1%, b-significant at 5%, c- significant at 10%

C Figures

Figure 1: Debtors' Punishment x Individuals' Loans/GSP

Parametric Approach

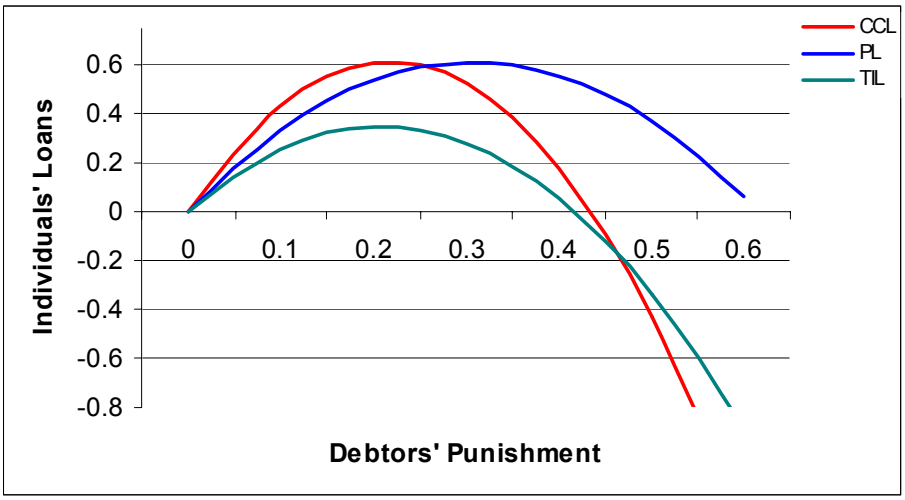

Figure 2: Debtors' Punishment x Individuals' Loans/GSP

Semi – Parametric Approach

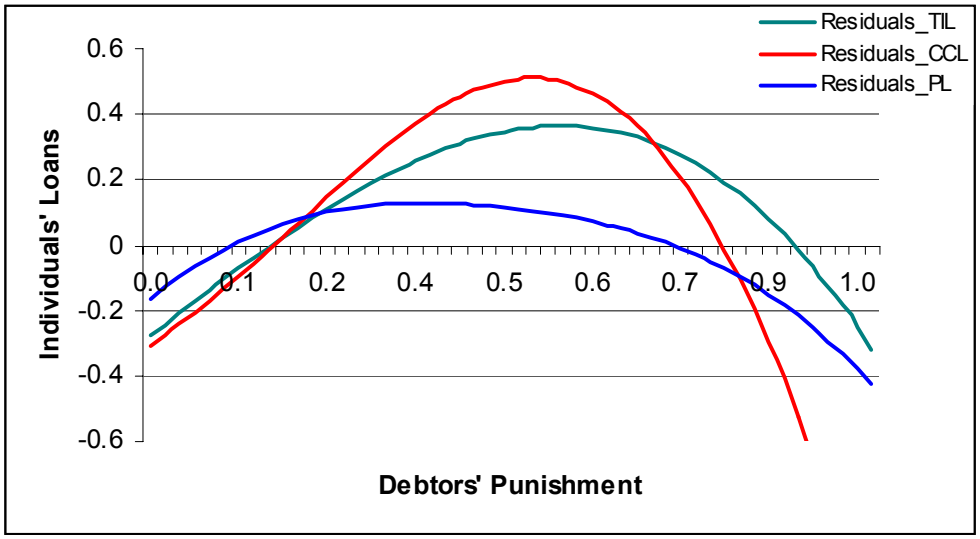

Figure 3: Effective Debtors' Punishment x Individuals' Loans/GSP

Parametric Approach

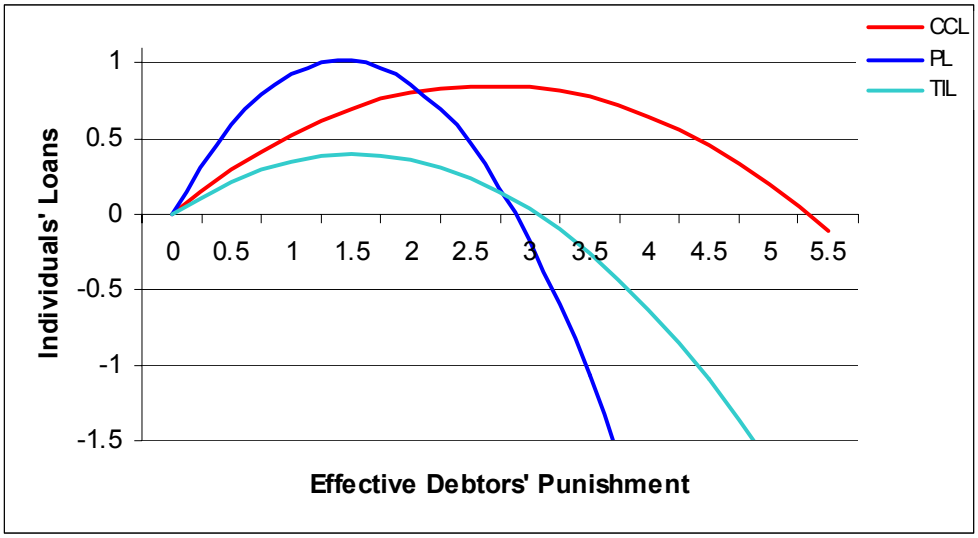

Figure 4: Effective Debtors' Punishment x Individuals' Loans/GSP

Semi – Parametric Approach

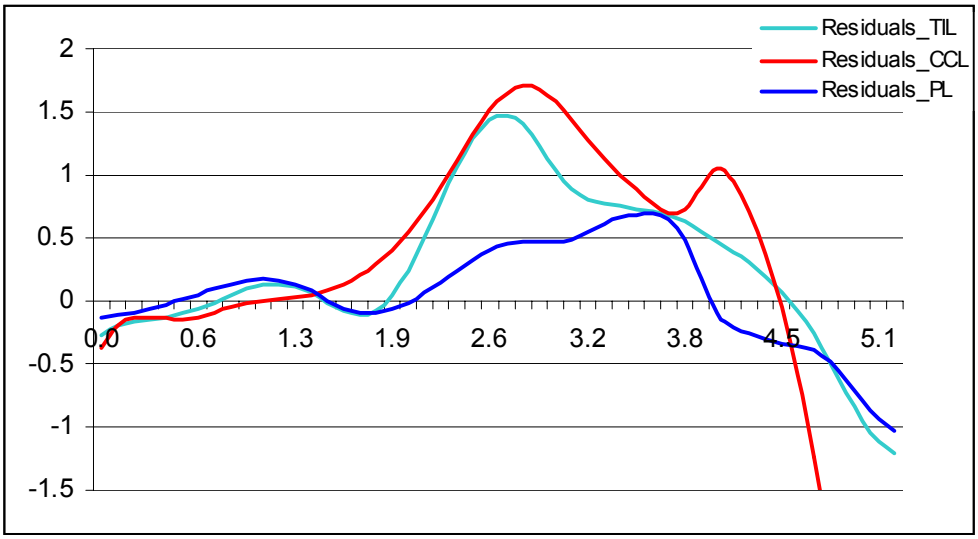

Figure 5: Debtors´ Punishment x Small Businesses' Loans/GSP

Parametric Approach

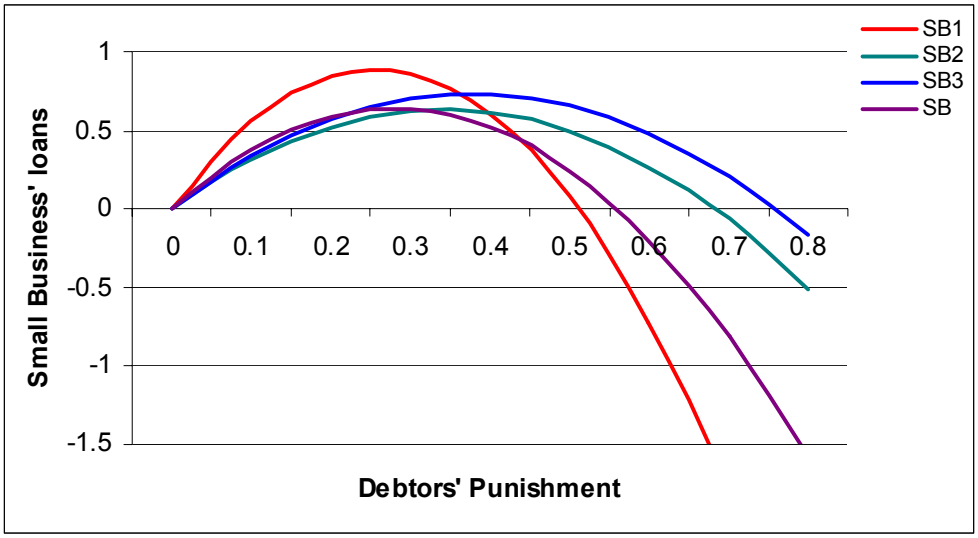

Figure 6: Debtors' Punishment x Small Business' Loans/GSP

Semi – Parametric Approach

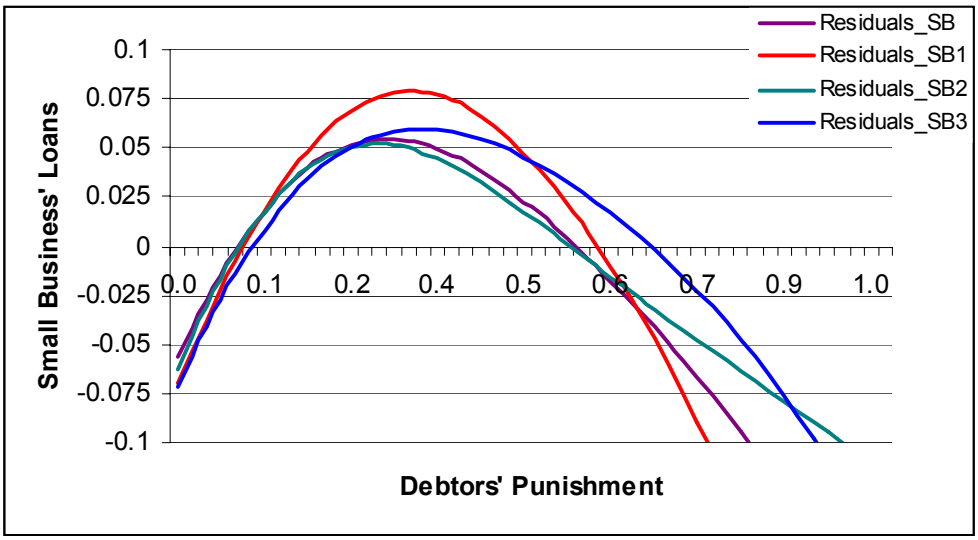

Figure 7: Effective Debtors' Punishment x Small Business' Loans/GSP

Parametric Approach

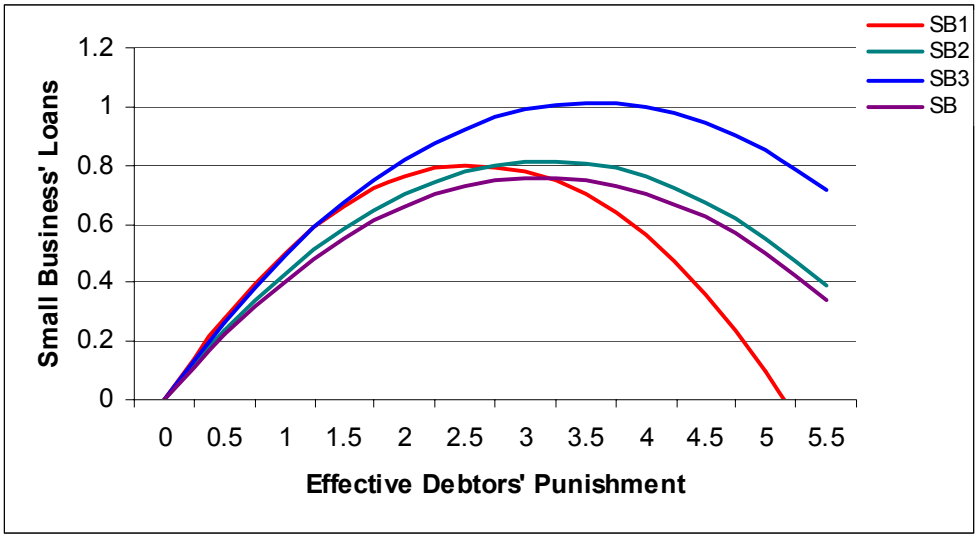

Figure 8: Effective Debtors' Punishment x Small Business' Loans/GSP

Semi – Parametric Approach