Redistributive Taxation and Bankruptcy in US States*

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PRELIMINARY

Abstract

Bankruptcy exemptions and redistributive taxation vary considerably across US states. We present a simple model to understand the interactions between these two policies. In the model redistributive taxation targets intratemporal inequality whereas bankruptcy exemptions target intertemporal inequality. We provide intuitive sufficient conditions under which more redistributive taxation makes bankruptcy exemptions less attractive both with respect to the intratemporal-insurance and intertemporal consumption-smoothing motive. Using data for US states in the time period 1980-99 we find considerable support for our model's predictions controlling for year and state fixed effects: (i) redistributive taxation and bankruptcy exemptions are negatively correlated; (ii) both policies are associated with smaller cross-sectional consumption inequality and (iii) household debt levels are smaller if redistributive taxes compress income.

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1 Introduction

If households face considerable heterogeneous income risk, they would like to share this risk by pooling part of their income. In practise direct risksharing mechanisms where the idiosyncratic component of the change in income is insured are not directly available, but bankruptcy law and redistributive taxes are mechanisms that can usefully replicate some of the useful features of such an insurance scheme. This paper will explore the risksharing properties of these two devices. Our starting point is that bankruptcy exemptions (the assets that may be kept by the debtor when he defaults on his debts) and redistributive taxation vary considerably across the different US states. For example, bankruptcy exemptions are generous in Texas where housing property is exempt but redistributive taxation through the tax and benefit system is low. In contrast, New York has lower exemptions in bankruptcy but taxes are much more progressive.

In this paper we provide a simple theoretical rationalization for why these two policies might be substitutes. We argue that redistributive taxation targets intratemporal inequality whereas bankruptcy exemption targets intertemporal inequality. Bankruptcy legislation provides some insurance, a 'fresh start' (see for example Hynes, 2002), for agents who have been hit by a sufficiently bad shocks. However, such insurance is less important if redistributive taxation already eliminates some of the ex-post inequality in gross income. Moreover, redistributive taxation decreases the expected (ex-ante) inequality between intertemporal income flows and thus the desire to borrow. As a consequence redistributive taxation and bankruptcy exemption are substitutes because redistribution decreases the importance of the insurance motive as well as the smoothing motive which both matter for the benefits derived from bankruptcy exemption. We derive sufficient conditions under which these simple insights apply. Our results are interesting from a positive point of view to understand better the interaction between both policies. Our analysis is also suggestive for normative policy implementation although predictions for the latter are much more difficult to pin down empirically.

We provide empirical evidence that considerably supports the model's hypotheses. We use data from the Consumer Expenditure Survey (CEX) for consumption, the Current Population Survey (CPS) for income and construct measures for bankruptcy exemptions and redistributive taxation for US states in the period 1980-99. Consistent with our theoretical perspective we find that the level of bankruptcy exemption and the extent of redistributive taxation are negatively correlated. High exemptions are associated with relatively little redistribution, suggesting these both policies are substitutes. Moreover, we find evidence that both policies are important for the smoothing and insurance motive as predicted by the model. Borrowing is lower if the tax and benefit system is more redistributive or bankruptcy exemptions are larger, and both the bankruptcy exemption and redistributive taxation are associated with less cross-sectional consumption inequality.

Of course, we are not the first to analyze bankruptcy or redistributive taxation in the US. For example, Gropp et al. (1997) investigates the effect of personal bankruptcy on the amount household's borrow, while Zame (1993) and his references show theoretically how bankruptcy can provide partial insurance against income fluctuations (see also Grant, 2001, for empirical evidence). In the context of the recent bankruptcy reforms Athreya (1999) and Chaterjee et al. (2002) provide numerical models to gauge how the benefits of bankruptcy compare with the costs, such as higher interest rates. It is also well-known that redistributive taxation provides partial insurance quite similar to bankruptcy if financial markets are incomplete (see the seminal paper of Varian, 1980, and the empirical evidence in Grant et al., 2003, and their references). However, to the best of our knowledge this paper is the first attempt to jointly analyze redistributive taxation and bankruptcy exemption levels focussing on the intra- and intertemporal channels of policy interaction. Most related in this respect are the analyses of Athreya and Simpson (2003) and Bertola and Koeniger (2004). As in this paper, Bertola and Koeniger analyze interactions between redistribution and financial market imperfections. They argue that in a second-best world of incomplete financial markets, more compressed labor income can mitigate the adverse welfare effect of credit constraints. The interactions between redistribution and bankruptcy in this paper through the insurance and smoothing motive are similar in spirit. But since we allow for bankruptcy and not only for a risk-free asset, in this paper the interactions between financial market imperfections and redistribution work themselves out both through prices and quantities. Allowing for bankruptcy has the additional advantage that we are able to test the predictions of the model with data on US states in which regulation on bankruptcy and redistribution vary and are available for a substantial time span.

Whereas our simple model allows us to derive some analytical results, Athreya and Simpson (2003) numerically solve a fully dynamic model to analyze interactions between public insurance and bankruptcy. In their model market imperfections such as moral hazard play an important role. On the one hand, bankruptcy might reduce search effort of unemployed agents because it shelters consumption of agents from long-term shocks. On the other hand, lower unemployment insurance increases search effort, reduces the unemployment rate and thus also lowers default rates.

Although problems of hidden action or asymmetric information are certainly important in reality, we show in this paper that such imperfections are not necessary to rationalize that bankruptcy is less attractive if redistribution is more pronounced. Moreover, we do not have the data to exploit a richer modelling framework in the empirical part. Thus, we rather view our approach as complementary to the one chosen by Athreya and Simpson.

The rest of the paper is structured as follows. In Section 2 we present a simple model that analyzes interactions between redistributive taxation and bankruptcy exemption. We describe the data in Section 3 and discuss the econometric specification in Section 4. We present our results in Section 5 before we conclude in Section 6.

2 A model

We construct a simple two-period model with full information in which bankruptcy is modelled in a standard way (see for example White, forthcoming). The simple model structure allows us to derive analytic results that illustrate the interactions between redistributive tax policies and bankruptcy law focussing on the insurance motive and the consumption-smoothing motive.

Concerning the insurance motive, we provide sufficient conditions under which bankruptcy exemption is a substitute to a subsidy that conditions on the endowment of the agent (taken the amount borrowed as given). We then show under which conditions the two policies are also substitutes with respect to the smoothing motive (taking the interest rate as given). Finally, we provide a numerical illustration of the main insights allowing both for endogenous borrowing and interest rates. In particular, we argue that taxes and bankruptcy exemption target different types of inequality. Whereas taxes target *intra*temporal inequality, exemption levels in bankruptcy procedures target *inter*temporal inequality. The two policies interact since more intratemporal redistribution reduces also intertemporal inequality and thus the smoothing motive.

Agents live for two periods. They are risk averse and borrow from a risk neutral bank. Agents have gross endowment ω_1 and ω_2 in period 1 and 2, respectively. Agents know their endowment ω_1 whereas the gross endowment in the second period is uncertain:

$$\omega_2 = \mu + \varepsilon,$$

where ε is i.i.d. with density $f(.)$ and cumulative distribution function $F(.)$. The term μ is the second period income expected in period 1. If $\mu > 0$, the endowment in the second period is expected to be higher than in the first period.

One policy in the model is a lump-sum tax schedule τ. If $\tau < 0$ the agent receives a subsidy. The other policy is the amount x of the second period income that is exempt from repayment obligations if bankruptcy is declared. Both policies have a deadweight cost: we assume that tax collection is costly because it distorts choices such as labor effort. We model this as a fraction $\lambda \in (0,1)$ of the total tax revenue that can be redistributed with subsidies. Moreover, agents incur a cost C when declaring bankruptcy. Without loss of generality, we assume that this cost is paid before the bankruptcy procedure starts so that it is passed on to banks.[1]

We now proceed to show that the insurance provided by the exemption level x is a substitute to a suitably targeted subsidy $\tau < 0$.

2.1 The insurance motive: policy substitutability for given borrowing

Since bankruptcy matters only for agents who borrow in the first period we focus on agents who find it optimal to borrow:

$$u'(\widetilde{\omega}_1) > \beta(1+r)\int_{\omega_2^*}^{\infty} u'(\widetilde{\omega}_2)f(\varepsilon)d\omega_2 \ , \tag{1}$$

where $\widetilde{\omega}_t = \omega_t - \tau_t(\omega_t)$ denotes the net endowment in period t, β is the discount factor, r is the interest rate at which the agent can borrow and ω_2^* is the threshold of the endowment in the second period below which the agent declares bankruptcy. Both r and ω_2^* are endogenous and will be determined below.

The inequality (1) results from the Euler equation evaluated at the net endowment where below we will assume that the tax (or subsidy) depends on the endowment and whether an agent saves or borrows. The latter is done for clarity but it is not difficult to add more realism relaxing this assumption. In the following we drop time indices for taxes and set $\mu = 0$ because the focus in this section is only on the insurance provided in the second period.

[1] If the cost was borne by the agent, for example as pure utility cost, the bankruptcy cost would affect the bankruptcy threshold derived below. The cost would enter in the banks' arbitrage equation (3) below only through its effect on the bounds of the integral but no longer by lowering the agent's payment. Under this assumption the sufficient condition in Remark 1 simplifies to the decreasing hazard property without additional restrictions on the bankruptcy cost. Instead, the derivative of $db/dx|_r$ would have an additional term since the inner derivative $\partial\varepsilon^*/\partial x$ is no longer 1. We prefer to model bankruptcy cost in its current form so that we do not need to make an assumption on the functional form of the utility cost such as convexity.

The agent declares bankruptcy[2] if his second-period net endowment falls below the exemption level x,

$$\omega_2 - \tau - (1+r)b < x \ ,$$

where b is the optimal amount borrowed in the first period. This implies that the threshold of the gross endowment in the second period below which the agent declares bankruptcy is

$$\omega_2^* = x + \tau + (1+r)b.$$

Thus, the agent's utility over the two periods is

$$\begin{aligned} U \ &= \ u(\widetilde{\omega}_1 + b) \\ &+\beta \int_{\omega_2^*}^{\infty} u(\omega_2 - \tau - (1+r)b) f(\omega_2) d\omega_2 + \beta \int_{x+\tau+C}^{\omega_2^*} u(x) f(\omega_2) d\omega_2 \\ &+\beta \int_{-\infty}^{x+\tau+C} u(\omega_2 - \tau - C) f(\omega_2) d\omega_2 \ . \end{aligned} \tag{2}$$

where the density of the distribution is assumed such that expected marginal utility remains finite on the support of the distribution. Note that bankruptcy exemptions provide consumption insurance in the interval $(x + \tau + C; \omega_2^*)$. This insurance has a price: it increases the interest rate if the borrower repays. We now briefly mention how the interest rate is determined and depends on the policy parameters.

Determination of the interest rate The bank's arbitrage equation is

$$\int_{x+\tau+C}^{\omega_2^*} (\omega_2 - \tau - x - C) f(\omega_2) d\omega_2 + \int_{\omega_2^*}^{\infty} (1+r) b f(\omega_2) d\omega_2 = b(1+r_f) \ , \tag{3}$$

where r_f is the exogenous risk-free market interest rate and C is the bankruptcy cost.

Total differentiation of the arbitrage equation neglecting feedbacks on the amount borrowed b, results in

$$\frac{dr}{dx}|_b = \frac{F(\omega_2^*) - F(x+\tau+C) + Cf(\omega_2^*)}{(1-F(\omega_2^*))b - Cf(\omega_2^*)b} > 0 \ ,$$

where the explicit derivation is given in the Appendix. Quite intuitively, a higher exemption level x increases the interest rate per unit borrowed b since banks pass on the higher risk to prices. The size of the effect depends positively on the ratio of the probability of bankruptcy, $F(\omega_2^*) - F(x + \tau + C)$ over the probability of repayment $1 - F(\omega_2^*)$. Moreover, $C > 0$ increases this effect since the bankruptcy cost is borne by the bank.

[2] There is no asymmetric information so that there is no strategic bankruptcy.

Policy interactions We now turn to the welfare effect of x and τ for borrowing agents. Totally differentiating (2) with respect to x we find for given b that

$$\begin{aligned} \frac{dU}{dx}|_b &= -\beta \frac{F(\omega_2^*) - F(x+\tau+C) + Cf(\omega_2^*)}{1 - F(\omega_2^*) - Cf(\omega_2^*)} \int_{\omega_2^*}^{\infty} u'(\omega_2 - \tau - (1+r)b) f(\omega_2) d\omega_2 \\ &\quad + \beta \left(F(\omega_2^*) - F(x+\tau+C) \right) u'(x) \ , \end{aligned}$$

where the explicit derivation is in the Appendix. For $C = 0$, banks insure agents at an actuarially fair price and the sign of $\frac{dU}{dx}|_b$ depends on the sign of

$$u'(x) - \frac{\int_{\omega_2^*}^{\infty} u'(\omega_2 - \tau - (1+r)b) f(\omega_2) d\omega_2}{\int_{\omega_2^*}^{\infty} f(\omega_2) d\omega_2} \ .$$

As in White (forthcoming), this expression is positive for risk-averse borrowers with strictly concave utility at all levels of ω_2^* since

$$\omega_2 - \tau - (1+r)b \geq x \text{ for } \omega_2 \in (\omega_2^*; \infty)$$

and thus

$$u'(x) > u'(\omega_2 - \tau - (1+r)b) \ \forall \omega_2 > \omega_2^*.$$

Thus for $C = 0$, full exemption is optimal. Instead for $C > 0$, insurance is actuarially unfair and the welfare gains from exemptions are bounded. Nonetheless, unless bankruptcy costs are prohibitively high, some exemption will improve the welfare of borrowing agents by reducing consumption fluctuations. However, if redistribution already provides more plentiful resources in the bad states of the world, these welfare gains will be smaller. To make this point formally as simple as possible, we investigate under what conditions a subsidy $\tau < 0$ is a substitute to an exemption x, for a given borrowed amount b. We analyze the case in which borrowing agents with $\omega_2 \leq \omega_2^*$ receive a higher subsidy $\tau < 0$ financed by agents that save. As mentioned above, we choose this specific tax-scheme for clarity. We show the following:

Remark 1: *For a given amount of borrowing b, a transfer in the states of the world in which bankruptcy is declared, decreases the welfare gain of borrowing agents derived from the exemption level x. For a subsidy $\tau < 0$,*

$$\frac{\left(\frac{dU}{dx}|_b \right)}{d\tau} > 0,$$

if the distribution function F satisfies the decreasing hazard property and the bankruptcy cost C is small.

Proof: see Appendix.■

The condition mentioned in Remark 1 is sufficient but not necessary.[3] It implies that redistributive transfers and exemption levels are policy substitutes in providing some insurance to the agent in the second period. The decreasing hazard property is certainly satisfied for realistic income distributions such as the Pareto distribution and in the region of the support of commonly used log-normal distributions which is relevant for low-income agents. The decreasing hazard property implies that the expected cost of bankruptcy in terms of a higher interest payment (when repaying) increases if agents receive a subsidy $\tau < 0$,

$$\frac{\left(\frac{dr}{dx}|_b\right) b}{d\tau} < 0 \; .$$

The subsidy shifts the interval $(x + \tau + C\, ;\, \omega_2^*)$ in which bankruptcy exemption provides insurance "to the left". Whether this shift induces the bank to increase its interest rate depends on the change of the relative probability mass associated with bankruptcy and the mass associated with repayment. With decreasing hazard, the deal gets worse for the bank and thus the interest rate has to increase for the bank to break even. In this case both the increase in the interest cost and the lower marginal utility gains after receiving the subsidy make bankruptcy exemption less attractive.

To simplify the argument we have assumed that the subsidy is financed by agents that have saved. If we assumed instead that borrowing agents pay taxes in good states of the world, $\omega_2 > \omega_2^*$, to finance the subsidy in bad states of the world, $\omega_2 \leq \omega_2^*$, an additional effect would strengthen Remark 1: the higher marginal utility resulting from taxation in the good states increases the welfare cost of bankruptcy resulting from higher interest rates.

We have neglected issues such as borrowing constraints because we condition on b. In our model without market failures like asymmetric information or moral hazard such borrowing constraints would become important if interest rates are capped by a usury law. However, such laws are not effective in practice. For example concerning the empirical analysis for the US below, credit card banks tend to locate in states like Delaware where such laws are least binding (see also Hynes and Posner, 2001).

We have shown how intratemporal redistribution in the second period provides insurance similar to exemption levels granted by bankruptcy laws. Since the policies are substitutes from a second-period perspective, so far the policy implementation entirely depends on which policy implies less

[3] As mentioned in footnote 1 above, the additional restriction on C in Remark 1 is not required if the borrowing agent bears the cost of bankruptcy.

deadweight losses. We now analyze whether these policies are also substitutes if we allow agents to adjust the amounts borrowed in the first period. The attractiveness of each policy then depends on the degree of intratemporal inequality and expected intertemporal inequality.

2.2 The smoothing motive: policy substitutability for a given interest rate

Exemption of income in bankruptcy procedures and redistributive taxation might not only be substitutes in terms of providing insurance. For exemption levels to matter, it is essential that agents borrow to smooth consumption intertemporally. However, redistributive taxation affects the smoothing motive and thus also the welfare gains derived from exemption levels in bankruptcy procedures. In this section we want to analyze this interaction in more detail.

In the previous section we have neglected the effects of x and τ on borrowing in order to derive analytic results. It is well known that no closed form solutions are obtainable unless strong assumptions are imposed on the utility function such as constant absolute risk aversion. The qualitative effect of exemption on borrowing is *a priori* unclear: as mentioned in White (forthcoming), for given interest rates exemption shifts the demand for borrowing up since the precautionary motive becomes less important. But the implied increase in interest rates will decrease borrowing along the credit demand function. In the following analysis we first derive some analytic results conditioning on the interest rate before we provide some numerical examples in which we allow the interest rate to adjust.

We proceed to characterize the effects of taxes or subsidies that redistribute intratemporally. Of course, as long as Ricardian equivalence fails the government can redistribute intertemporally by financing redistribution with debt and postponing taxation. However, it is hard to commit to such intertemporal redistribution *ex ante*. Thus we focus on bankruptcy exemption as an instrument for *inter*temporal redistribution (across agents in the same financial system) and taxation as an instrument for *intra*temporal redistribution (across agents in the same tax system). We start with two examples to illustrate the different scope of the two policy instruments and their interaction.

Example 1: No intertemporal inequality Assume that income is perfectly persistent, $\mu = \omega_1$, and that agents face no uncertainty, $\varepsilon = 0$. It is well known that in equilibrium the agent's discount rate equals the market interest rate in this case. For simplicity assume that the discount factor $\beta = 1$ so that agents consume their current income in each period.

In this scenario, agents do not borrow at all so that an exemption level granted in the case of bankruptcy is useless. However, as long as there is some heterogeneity in the agent's income, at least some redistribution is optimal from an *ex ante* perspective (before ω_1 is known). Thus, in the extreme case of pure intratemporal inequality, there is scope for redistribution via taxation but not for exemption in bankruptcy procedures.

Example 2: No intratemporal inequality Now consider the opposite extreme case. Let us assume that agents have identical endowments in each period but that the endowment differs in the two periods. There is no individual but only aggregate uncertainty. Clearly, in this case there is no scope for intratemporal redistribution but exemption levels in bankruptcy procedures can insure some of the aggregate uncertainty since the risk-neutral bank absorbs some of the risk.

Of course, the interesting case is the one with individual differences in intertemporal inequality: some agents expect to earn a higher income in the future whereas other agents do not. It is in such an environment that intratemporal and intertemporal redistribution interact since intratemporal redistribution also eliminates part of the intertemporal inequality and thus the need for bankruptcy regulation. This interaction is similar in spirit to Bertola and Koeniger (2004) where intratemporal redistribution alleviates capital market imperfections. However, in this paper there are no credit constraints and we allow for bankruptcy.

We now proceed to show that more compressed net income reduces the desire to borrow for workers who expect higher gross income in the future. To make this point formally, we characterize the amount borrowed when the Euler equation

$$u'(\omega_1 - \tau(\omega_1) + b) = \beta(1+r) \int_{\varepsilon^*}^{\infty} u'(\mu + \varepsilon - \tau(\omega_2) - (1+r)b) dF(\varepsilon) \tag{4}$$

is satisfied (implicitly we assume that the parameters are such that agents indeed find it optimal to borrow because they are impatient enough or look forward to higher future income). Recall that $\omega_2 = \mu + \varepsilon$ and take into account that the amount borrowed is only repaid above the bankruptcy threshold ε^* (the effect of borrowing on the margins of the integral in (2) cancel in the derivation of equation (4)). The bankruptcy threshold is defined as

$$\varepsilon^* = x + \tau(\omega_2) + (1+r)b - \mu.$$

This threshold is smaller, if the agent's income is expected to be higher in the second period, $\mu > 0$. We assume that $\tau(\omega_1) = -\lambda\tau$ and $\tau(\omega_2|\omega_2 \geq \omega_2^*) = \tau > 0$ where $0 < \lambda < 1$ summarizes the deadweight loss associated with taxation. The implicit assumption here is that ω_1 is small enough so that the agent receives transfers from the rich in period 1. Instead $\omega_2 \geq \omega_2^*$ implies transfers to the poor in period 2. Other examples could be chosen to convey an analogous qualitative intuition as our example. We show the following:

Remark 2: *For a given interest rate r, $db/dx|_r > 0$, $db/d\tau|_r < 0$; and $db/d\mu|_r > 0$ if utility is concave enough.*

Proof: see Appendix.■

The sign of the derivatives is quite intuitive. A higher exemption level x insures the agent in bad states of the world: he will repay the debt only for relatively higher income realizations when the cost of repayment in marginal utility terms is smaller. This makes borrowing more attractive. Instead, taxation in the good states of the world in which the agent repays, increases the marginal utility cost of repayment in the second period. Moreover, transfers in the first period lower marginal utility. Both effects make borrowing less attractive. Finally, a higher predictable second period income (a higher μ) gives agents more resources in the second period to repay the debt which makes agents willing to borrow more. However, if second period income is predictably higher, agents will also declare bankruptcy less often and this increases the marginal utility in the states of the world in which the agent repays the borrowed amount. As long as the curvature of the utility function is strong enough, the former effect dominates and predictably higher second period income increases the desire to borrow for a given interest rate.

Quite intuitively, if redistribution decreases intertemporal inequality, the desire to borrow falls. This also lowers the welfare gains derived from exemption x. Formally, the interval in which bankruptcy exemption provides insurance in the second period depends positively on b. In the extreme case in which taxes and subsidies eliminate intertemporal inequality, agents do not borrow and exemption in the case of bankruptcy is useless. Thus, the insurance motive is affected by the smoothing motive and vice versa.

We have shown that both for the insurance and consumption-smoothing motive, redistributive taxation and bankruptcy exemption are likely to be substitutes. However, for the derivations on the insurance motive we have conditioned on the amount borrowed whereas for the derivations on the smoothing motive we have conditioned on the interest rate. With both b and r endogenous, an interpretable analytic solution is no longer obtainable. We now illustrate the solution numerically for the case of constant relative risk aversion.

2.3 Numerical solution

In this section we provide numerical examples that by-and-large support the qualitative insights obtained above. The numerical algorithm is simple: given starting values for b and r, we use the Euler equation (4) to iterate for the optimal b. We then update the bankruptcy threshold ε^* and use the arbitrage equation of the bank (3) to solve for r. For the new values of b and r, we restart the algorithm until convergence. Table 1 (displayed at the end of the paper) summarizes the parameter values of the benchmark parametrization.

The parameters are chosen so that borrowing is indeed optimal and the condition on the curvature of the utility function in Remark 2 is satisfied (the agent expects 30% higher income in the second period and is impatient). Instead the condition of decreasing hazard in Remark 1 is certainly violated, since ε is normally distributed. Nonetheless, the result of Remark 1 continues to hold in the numerical example below, making explicit that the condition of Remark 1 is sufficient but not necessary. For illustration purposes we choose an exemption level x of 90% in percent of first-period income. Finally, we parametrize utility as log-utility, $\sigma = 1$. This facilitates the interpretation of the numerical results since the income and substitution effect of changes in the interest rate exactly cancel. Thus, interest rates only affect borrowing through the wealth effect.

Table 2 summarizes the equilibrium values of interest for the benchmark parametrization in column (1). Columns (2)-(6) display the results for some parameter changes. Since $\omega_1 = 1$, borrowing is expressed in percent of first-period income. In the benchmark case, the agent borrows an amount equivalent to 18% of this income and defaults on the debt with a probability of .05. The interest rate on the debt is .035, 75% higher than the risk-free rate r_f.

As in Remark 2, more redistribution through taxes and subsidies decreases the amount borrowed (see column (2)). Moreover, the default probability and thus also the interest rate fall. For log-utility, the direct negative effect of redistribution on borrowing dominates the feedback effect through the interest rate.

Instead, in column (3) a fall in the exemption level leaves the amount borrowed unchanged and does not decrease it as in the comparative statics of Remark 2. The reason is that in our numerical example, lower exemption decrease the probability of default by so much that the interest rate falls substantially. The resulting wealth effect makes borrowing more attractive and cancels the direct negative effect on borrowing.

In column (4) we display the effect of higher second-period income. Not surprisingly, borrowing increases. However, the more plentiful resources in the second period also decrease the probability of default so that the interest rate falls. In column (5) we increase the cost of bankruptcy that is borne by the bank to 5% of first-period income. Quite intuitively, this increases the interest rate charged by the bank, slightly decreases borrowing and also default. Finally, in column (6) we increase risk aversion of the agent. This decreases the amount borrowed, the probability of default and thus also the interest rate.

We also illustrate the prediction on the welfare gains of exemption and its interaction with redistribution. Figure 1 (displayed at the end of the paper) plots utility as a function of exemption on the interval $x \in [.85; 1]$ for two different values of τ. As predicted by Remark 1, the Figure shows that the slope of $U(x)$ becomes flatter as redistribution increases. Also, redistribution decreases utility since we assume that the agent pays a tax τ in the good states of the world in which he repays the debt and receives a subsidy $\lambda\tau$ in the bad states in which he declares bankruptcy. For the parameters we chose in Table 1, the default rate is small so that the redistributive scheme makes the agent worse off. Of course, these are just numerical examples. Whether redistribution and exemption levels granted by bankruptcy procedures are policy substitutes or not is ultimately an empirical issue which we will investigate in some detail below. Before we turn to the empirical analysis, we discuss briefly the potential determinants of policy choice in light of the model.

2.4 Policy choice

After having characterized the policy interactions between redistributive taxation and bankruptcy exemption, we now discuss how the insights above might translate into more aggregate outcomes of policy choice. The analysis above has made quite clear that the policy interaction crucially depends on how much is at stake in terms of the borrowed amounts. However, besides the intensive margin, the policy choice will also be affected by the extensive margin, that is how prevalent borrowing is in the population. In order to capture the latter in a simple way we assume that the first-period income of agents is randomly drawn from the distribution $F(.)$. We define as ω_1^+ as the value of first period endowment at which

$$u'(\omega_1^+ - \tau_1(\omega_1^+)) = \beta(1+r)\int_{\varepsilon^*}^{\infty} u'(\mu + \varepsilon - \tau_2(\omega_2))f(\varepsilon)d\varepsilon\ .$$

This equation defines the level of gross endowment in the first period at which agents find it optimal to hold no assets at all, $b = 0$. The mass of the population that finds it optimal to borrow is given by $F(\omega_1^+ - \tau_1(\omega_1^+))$. Trivially, if poor agents in the first period with $\omega_1 \leq \omega_1^+$ receive a subsidy in the first period, $\tau_1(\omega_1^+) < 0$, the mass of the population that borrows decreases, ceteris paribus. Thus, the effect of redistribution makes bankruptcy regulation less attractive both at the intensive and extensive margin. This interaction will affect aggregate policy choice as long as borrowers have a positive weight in the political choice mechanism.

Empirically we will first try to detect the conditional correlation between the policies across US states. It is more difficult to get at the deeper problem how the policy mix is determined in the first place. This would be even so if we found exogenous shifters of inequality related to the examples at the beginning of the last section. For example, in states in which intratemporal permanent inequality of gross income increases for exogenous reasons, taxes should become more desirable *ex ante*. However, *ex post* more agents with persistently high income imply a stronger resistance to redistributing income whereas granting insurance through bankruptcy exemption levels is feasible. Instead in states with more intertemporal inequality, bankruptcy exemption is more attractive. We will discuss these issues further below after we have presented the data.

3 Data

In this second part of the paper we present empirical support for the model's hypotheses after we have discussed the data sources and the econometric specification. The Consumer Expenditure Survey (CEX) is used to construct a measure of consumption. This is a widely used survey of US households that has operated on a continuous basis since 1980. It contains detailed information on both consumer expenditure and the demographic and other characteristics of the household, but it contains less accurate information on saving and secured borrowing. The Bureau of Labor Statistics (BLS) collects the data to construct the consumer price index and hence the data-set contains extremely detailed information on the sub-components of consumption and, crucially, the state of residence of the household. The survey is designed as a rotating panel, with households being interviewed 5 times at quarterly intervals (although the first is a contact interview from which no information is made available). Each quarter, households reaching their fifth interview drop out and are replaced by a new household. Since the survey records detailed information on several expenditure items, we can construct a measure of non-durable consumption which includes food and beverages, tobacco, housekeeping services, fuel, public utilities, repairs, public transport, personal care, entertainment, clothing and books, each deflated by the appropriate price index. We restrict the sample to those households for which full state information is available, who were interviewed between 1980-1999 and where the head is between the ages of 25 and 55. For confidentiality reasons, state information is sometimes suppressed in the survey, and moreover, in some states relatively few households are sampled. For reasons that will become apparent attention is restricted to households resident in the 24 largest states only. Farming households are excluded since they have a specific chapter of the bankruptcy code that applies to them. We also exclude the self-employed for two reasons: differences between business and personal income and consumption are hard to distinguish; and our exercise is aimed at looking at the role of consumption is insuring consumers risk, not entrepreneurial risk.

Information on household level income and transfers is obtained from the March supplement of the Current Population Survey (CPS), also managed by the BLS, which is designed to give very detailed and accurate information on the household's current income and demographics. Income is defined as total household labor income. We use income data from the CPS because it has the advantage of being a much larger survey than the CEX. Another advantage is that measurement error from income and consumption are likely to be uncorrelated when they are measured in two different surveys. This point will be discussed further below.

The CPS also contains information on transfers, which includes social security and railroad retirement income, supplementary security income, unemployment compensation, worker's compensation and veterans payments, public assistance or welfare, and the value of food stamps received, and some summary statistics of the annual amount that households receive are reported in table 3. The table shows that 94.3 percent of the sample households were receiving at least some wage income, and that the average level of wage income was $34,700. The average wage among wage-earners was slightly higher, amounting to $36,800. On average the households in the sample received just under $1,000 of public transfers, although amongst the 23 percent of households that received at least some income, this amounted to $4,250. The table also shows some of the most important components of this transfer income, which shows that when this type of income is received, 'social security' amounts to $6,600 while the other categories are smaller. However, less than four percent of households receive this category of transfer, and the most widely received transfer is unemployment benefit or workers compensation, where an average amount of nearly $2,700 is received by over 13 percent of households. Among all households in the sample, the average level of unemployment benefit was around $350 dollars, and amounts to more than one third of all the public transfers that were received.

3.1 Measuring taxes

Constructing a measure of the tax burden in each state is not a trivial task and a number of problems must be addressed in the process. US households are subject to taxes levied at the federal and state levels, by county administrations, and by schoolboards; these taxes include income taxes, sales taxes, property taxes and duty. We concentrate on income tax, which is raised at both the federal and state level. Property taxes and sales taxes are not included in our assessment of the tax system since they are largely levied at the county, schoolboard, and city level, which we can not identify in our data. Moreover, sales taxes are paid at the place of sale and not that of residence, which makes it extremely difficult to devise a measure of sales taxes levied on the households within the state if cross-border shopping takes place. We do not believe that excluding sales taxes is too problematic since the spending figure recorded in the CEX excludes sales taxes, making the recorded level of spending comparable across states.

Table 4 (displayed at the end of the paper) shows the federal tax schedule in 1998, the second last year in our sample. The marginal tax rate varies from 15 percent for single filers whose income is below $26,250 to 39.6 percent for incomes over $288,350. The income at which these rates applied are slightly lower for couples filing separately, while if the couple filed jointly the brackets started at twice the income of the couple filing separately. These tax rates, and the tax brackets themselves vary substantially from year to year. Prior to 1996 the bottom bracket was set at zero, which meant that between 15 and 20 percent of the lowest income households paid no federal income tax. Furthermore, in 1987, the number of brackets was considerably reduced.

Columns two, three and four of table 6 displays the 1998 tax rates applicable in some of the different US states. Eight US states, including Texas and Florida in the table, do not levy any income tax on their residents. Two others which are not in the table, New Hampshire and Tennessee only charge tax on dividend and interest income. The other states have a variety of income tax bands that are applicable. Of those states that charge income tax, these taxes differ in their progressivity. In California, the lowest tax bracket is at one percent, and the highest is at 9.3 percent. In contrast, Pennsylvania has a flat rate income tax rate of 2.8 percent, and there is no exempt income. However, in most states the marginal tax rate increases with income, and in many states there are a variety of tax allowances (which will depend on such things as whether the taxpayer has a spouse or other dependents) to which households are entitled, although some states, such as California, have a tax credit, rather than a level of exempt income. These exemptions can sometimes be quite large: Minnesota allows the first $2,900 to be exempt for single filers.

To construct the level of taxes that each household pays on their income we exploit the TAXSIM 4.0 program developed by Freenberg (see Freenberg and Coutts (1993) for details) that is available for use from the NBER. This programme uses a variety of household variables, including a husband's and wife's earnings, interest, dividends and other income, and information about the household's characteristics (such as the number of dependant children) and other deductibles (like property costs) as well as the year and state of residence as inputs, and calculates both the state and the federal tax bracket, tax liability, and marginal tax rate for each household in the sample, while explicitly controlling for a variety of allowances to which the household is entitled.

Having constructed each household's tax liability, the problem is to summarize the tax system in each state. If the marginal tax rate was the same for all households in the state in each given year, then this would be the natural measure of redistributiveness. However, marginal taxes differ substantially across agents even in the same year and state. Furthermore, agents have many exemptions, allowances, and transfers available to them that depend upon their characteristics. Rather than explicitly model all the different effective marginal taxes (and transfers) that are available, we will instead reduce the problem to constructing an index that summarizes how much redistribution there is in each state in each year. Given the heterogeneity across agents, no completely satisfactory measure of redistributiveness exists, but several measures are possible from our information on each household's tax liability. One obvious measure is the mean marginal tax rate across all the households within each year t and state s. Table 6 shows how these rates vary across some of the largest states, where the measure of the marginal tax rate accounts for both federal and state taxes. Texas and Florida have the lowest mean marginal tax rates in the table, reflecting the fact that there is no state income tax in these states. Rates are higher in Maryland and Minnesota, at around 25 percent rather than 19 percent in Texas. This shows that there is substantial variation across states.

However, a problem with using the mean marginal tax rate is that it does not account for heterogeneity amongst household tax rates. For instance, a mean marginal tax rate of 20 per cent could be due to all paying a marginal tax rate of 20 per cent; or to the bottom fifth of the population paying 100 percent and the rest nothing; or to the top 20 per cent paying 100 percent and the rest nothing. These three cases have substantially different implications for the amount of redistribution within the state and year, something that we would like the tax measure to capture.

Moreover, the mean marginal tax rate completely ignores the level of transfers that households might be receiving. In order to better account for this heterogeneity in taxes, we also construct a more direct measure of how much the tax system redistributes income, which we call the 'income compression measure:

$$1 - \frac{s.d._{st}\,(\text{income}_{ist} - \text{tax liability}_{ist} + \text{transfers}_{ist})}{s.d._{st}(\text{income}_{ist})} \tag{5}$$

where i denotes the household. The above measure, computed for each state s and year t is constructed as one minus the ratio of the standard deviation of income after tax and transfers compared to the standard deviation of income before tax and transfers. If all households faced the same marginal tax rate, and there were no allowances, then this constructed measure would exactly equal the marginal tax rate (and also the average tax rate), and it would not matter which measure was used. However, given the variation is marginal tax rates and transfers across households, we prefer this income compression measure as a measure of how redistributive the tax system is in each state and year. Table 6 shows that of the states tabulated, Texas and Florida again have the lowest level of redistributiveness, while the figure is highest in New York, Minnesota, and California. These highest states have values nearly a third higher than in the lowest states. The ordering of states is similar across the two measures (the correlation coefficient is 0.78), but there are some differences. California and New York have more redistribution than is implied by the mean marginal tax rate since they are two states which have a much more progressive tax system (their marginal tax rates increase with income) than some of the other states. We will nevertheless report results for both the measures discussed in this section.

3.2 Federal Bankruptcy Law

Within the United States, bankruptcy is regulated by the Federal Bankruptcy Act of 1978 which contained two chapters specific to non-farming households. Individuals could choose to file for personal bankruptcy under either Chapter 7 or under Chapter 13, in cases which were not deemed a 'substantial abuse' of the bankruptcy regulations. That is, it was the right of the debtor to file for bankruptcy, and to choose under which chapter he preferred to file. The aim of the act was to allow households to discharge their debts and make a 'fresh start', but in contrast to other legal jurisdictions, there was no regard to whether the household was genuinely unable to pay or whether repayment would result in substantial hardship.[4] Under chapter 7 of the act, the debtor had all his debts expunged, but had to surrender all his assets except those deemed by the court necessary for him to make his 'fresh start'. This necessary amount is the 'exemption'. Where the asset value was in excess of this exemption, it would be sold and the excess amount went to satisfy the debt. Cash up to the value of the exemption is retained by the debtor, although in some cases the courts insisted that the money had to be re-invested in an exempt asset within a certain amount of time. Under Chapter 13, the debtor agreed a repayment schedule for part or all of the debt: in practice a ceiling to how much was going to be repaid under Chapter 13 was set by the amount that the debtor could be forced to surrender under Chapter 7, since the debtor could choose to file under that chapter. Many courts preferred the debtor to file under chapter 13, but enforced purely nominal repayment schedules. Around 70 percent of personal bankruptcy cases resulted in a filing for Chapter 7, with the remainder under Chapter 13.

The federal exemptions are shown in table 5.[5] As the table shows, the level of exemptions has been revised from time to time, and from April 1998 the bankruptcy act was amended to allow the dollar amounts to be increased in line with the retail price index. The federal exemption shows that the 1978 Act allowed the house or homestead to be exempt up to the value of $7,500 while other exempt assets included a car of $1,200, household goods to $200 for each item, jewelry to $500, other property to $400 and any unused homestead exemption, and 'tools of trade' to $750. This last item refers to work material or assets needed in order to practise professionally (although some, but not all jurisdictions allowed transport to and from work to be included in this category). Throughout the analysis, we will exclude the 'tools-of-trade' exemption since, it does not give rise directly to consumption. Including it in our analysis does not substantively change the results. The table shows that these dollar amounts have been revised periodically. The 1984 reform placed an upper limit on the total value of assets that could be claimed as exempt in the household goods category, and reduced the amount of unused homestead that could be claimed in the other goods category. The 1994 revision doubled the dollar amounts in each category, while from starting in 1998, the amounts have been revised upwards with the inflation rate every three years. In households headed

[4]However, debts arising from court orders (such as alimony and child support but not tort judgements), taxes or student loans could not be evaded through bankruptcy. Nor could the household avoid surrendering their security when the debt was secured.

[5]The latest legislation on bankruptcy was passed in 2003, but this year lies outside our sample period and hence it will not be discussed.

by a married couple who filed jointly, they were each separately allowed to claim the exempt amount in each category.

3.3 State Exemptions

Since bankruptcy had traditionally been regulated by the individual states, the 1978 Act allowed states to set their own level of exemptions and to disallow the federal exemption levels (California has two separate exemption levels, either of which may be chosen). As for the federal exemptions, each state has set a variety of things that are exempt from seizure or forced sale for the satisfaction of a debt. The federal law demanded that the state exemptions should act in the same way as the federal exemptions, except in regard to what was exempt, and to what value. In many cases the courts have chosen to interpret legislation in slightly different ways. Naturally, in cases where he had the option, the debtor would choose the larger of the state and the federal exemption. These differences across states, and across time, allows us to empirically test the implications of changing the punishment for default. Table 6 gives some details of the exemption levels in seven large states for single filers (many states allowed larger exemptions for couples and for dependents). It shows the exemption level on the homestead, and on other assets (excluding the 'tools-of-trade' exemption) in 1985 and 1997. The table shows that in Florida and Texas, the homestead was fully exempt from seizure (although there is an acreage limit). However, these two states differ as to what other assets may be exempt. In 1995, Texas allowed \$30,000 worth of other assets to be exempt, and this was doubled for a couple filing jointly. Florida, in contrast, allowed only \$1,000 worth of personal property and a car worth up to \$1,000 in value. It also did not allow the federal exemptions to be claimed. Obviously, bankruptcy would be a poor option to renters in Florida, but much more attractive to home-owners. Minnesota allowed the homestead to be fully exempt in 1985, but in 1993 this was changed to a value of \$200,000. The non-homestead exemption increased from \$6,500 to 11,050 during the same period, Minnesota upgraded the exemption level in line with the retail price index every two years. Other states set the exemption level much lower. The table shows that in Pennsylvania, only \$300 of property was exempt from seizure in bankruptcy, although such things as clothing was also exempt. However, Pennsylvania allowed households to claim the federal exemption, and obviously they would do so. Maryland also has low exemptions, allowing \$2,500 of real or personal property to be exempt, \$3,500 in other items. The real or personal property exemption is actually a reduction from \$4,500 that was enacted in 1982. Moreover, Maryland does not allow the federal exemptions.

The courts have also allowed debtors substantial room for manoeuvre in fully exploiting all the exemptions available: in most cases they have allowed the debtor to re-arrange his portfolio of assets prior to default and substitute exempt assets for non-exempt assets (some limit is placed on the ability to re-arrange assets by 'abuse/fraud' provisions). Since there is considerable scope for substituting between assets when filing for bankruptcy, the exemptions have been added together, to arrive at a total money value of the exemption for each state. Households were only allowed the housing exemption if they owned their own house (either outright or through a mortgage). This paper has summed the exemption on the homestead (if they owned their house) to the exemption on all other assets. A more detailed assessment of the household's asset position is not possible given the information in the CEX. In cases where no specific monetary limit was put on a category of goods (for instance Pennsylvania allowed "all necessary wearing apparel") a value was assigned to the exemption of the good which roughly corresponded to the maximum amount allowed in that category in those jurisdictions that had a limit (see Grant, 2001 for details). The exception to this was the homestead exemption, where a dummy was included in the regression where there was no limit. The calculated exemption level took cognizance of the household's age, the number of dependents, and whether the household was headed by a couple. If the federal exemption is allowed, and is higher, then the household was assigned this exemption rather than the state exemption.

4 Econometric Specification

We will estimate three different equations with different dependent variables but otherwise similar controls. The dependent variables are household debt, cross-sectional inequality and its changes, and a measure of redistributive taxation. The first estimated equation shall give some insight on the effect of the two policies on the smoothing motive. The second set of equations are estimated to show how both policies matter for the insurance motive. Finally, we directly look at correlations between redistribution and exemption levels in order to find out whether there is some suggestive evidence that these two policies are substitutes.

Some explanation might be useful to understand why we use both cross-sectional inequality and its changes in the second set of regressions. The cross-sectional level of inequality is not the best measure of the insurance effect since it confuses *ex-ante* and *ex-post* inequality. However, insurance will affect the evolution of inequality over time. If markets are complete then the cross-sectional distribution of inequality for a fixed membership group should not change over time. Deaton and Paxson (1994) test, and reject, this implication of complete markets. However, a useful corollary is that if markets are incomplete then this cross-sectional measure should increase. Moreover, if the shocks are the same across groups, the rate at which this inequality changes over time should be larger for those groups in which there is less risksharing.

Except in the last set of regressions where the measure of redistribution is the dependent variable, the regressions take the form:

$$y_{st} = \beta_0 + \beta_1 \tau_{st} + \beta_2 x_{st} + f_s + f_t + \varepsilon_{st} \tag{6}$$

where s is the state, t is the time period, τ is the measure of the tax system, x is the exemption level and y_{st} denotes the respective dependent variable. The error is composed of a state fixed affect f_s and an idiosyncratic component ε_{st}. The state fixed affect will capture any systematic differences across states in inequality that are not accounted for by the policy variables. Of interest is whether the estimated coefficients on β_1 and β_2 are negative. The state fixed effects will be estimated by including additional state dummies in the regression; consistent estimation of $\beta = [\beta_0 \beta_1 \beta_2]'$ thus requires a large number of time periods. Since other developments such as the deregulation of the banking industry might have influenced consumer credit in our sample period (see Stiroh and Strahan, forthcoming), some regressions also control for year effects f_t.

For each regression, cells have been constructed for each state and year combination and these state averages have been used in the regression. Since this results in small cell sizes for some states, we have selected the 24 largest states for our analysis, where the average cell size over the sample period was at least 40. The sample size is 464. Moreover, we have normalized the bankruptcy exemptions by dividing through by average income in the state in the year the exemptions are in force.

Concerning the problem of measurement error, note that when regressing consumption inequality on a measure of redistribution for example, the measure of the tax system is constructed using the CPS while consumption is taken from the CEX. This has a number of advantages. The CPS survey is larger than the CEX survey. This means when the mean marginal tax rate is constructed, for instance, averaging over a larger sample means that any small sample bias in constructing the cell averages is likely to be reduced. Moreover, if both measures had been taken from the same sample, measurement errors caused by the small when constructing the mean marginal tax rate and the standard deviation of consumption, for example, would be correlated. Measurement error in both the left hand side and right hand side of a regression that are correlated will not only bias the estimates, but this bias will not be signable in general. By constructing the group averages from different data sets this problem will not appear.

4.1 Instrumental Variables

A problem with estimation of equation (6) is that the policy variables are likely to change at the same time as the left-hand side variables, as is well known in the literature (see for instance Besley and Case, 2000, and in particular Berglöf and Rosenthal, 2000, and Nunez and Rosenthal, 2002, for bankruptcy legislation). For example, if a state received a productivity shock, then this is likely to affect the state's budget (and hence their tax requirements). The productivity shock will also affect the before tax permanent income of the households in the state, and thus the level of consumption of households in that state. That is, some of the changes in the left hand side variables may be due to the same underlying exogenous causes as changes in the right hand side variables, in which case the variables are likely to be co-determined, and any inference about causality derived from the OLS regression is likely to be spurious. That is, we need to use instruments in order to capture the direct affect of changes in the level of the bankruptcy exemptions, and in the amount of redistribution in the state tax and transfer system, on consumption inequality.

Inference can be made if there is some instrument that can predict the policy variables τ and x, that does not itself affect the variable on the left-hand side. We experiment with two possible instrument sets. One possibility is to use lagged values of taxes and the exemption level to their current level. We also experiment with using a set of political variables that aim to capture tastes rather than economic fundamentals, and the efficiency of the local tax system. This will be explained in more detail below.

5 Results

The results are contained in Tables 7 to 9 displayed at the end of the paper. Table 7 contains regression results on the relationship of both policies on the level of unsecured debt held by households. Table 8 displays how both taxes and the exemptions are associated with inequality and changes in inequality over time. Finally, Table 9 directly looks at the correlation between the level of the bankruptcy exemptions and the tax and benefit system.

5.1 Taxes, the exemption level and household debt

Table 7 summarizes the results when the tax system and the exemption level are both regressed against the mean level of unsecured household debt in the state in each year. The first four columns of the table use our constructed measure of redistribution through the tax and benefit system, while columns 5-8 use the more conventional, but less appealing, mean marginal tax rate as the measure of redistribution through taxes in the state.

Each regression included the level of the exemption, and a dummy for the unlimited homestead exemption, and a constant. All the columns except the first, second, fifth and sixth include state fixed effects in the regression. In the basic regression, in the first column, the tax system (using the income compression measure we discussed earlier), is highly significant and negative. This is in line with our theoretical model in which redistributive taxation decreases intertemporal inequality and thus the smoothing motive. Moreover, we find that the exemption level is not significant, although the coefficient is negative. In light of the theoretical model above this suggests that the direct positive effect of exemption on borrowing is offset by the negative equilibrium effect of higher interest rates. Furthermore, the dummy for those states with the house fully exempt is significant and negative, at the 5% level. In the second column, taxes and the exemption level are instrumented by their lagged values. The results are almost exactly as in the first column. Again, the tax system reduces the level of unsecured debt that is held, and again the dummy for the homestead being fully exempt is significant, but the exemption level on other goods is not significant.

In column three, we add some state fixed effects to the regression. This changes the results for the exemption level. The estimated coefficient on taxes is similar to that in the second column, and it remains significant at the 1% level. However, the coefficient on the exemption is now both larger in absolute size, and significant at the 1% level. This regression suggests that, after controlling for other differences across states (which will be captured by the inclusion of state dummies), a higher level of exemptions significantly reduces the level of borrowing.

Including state fixed effects and the unlimited homestead exemption means that the latter variable is identified only from states in which this unlimited homestead exemption changed over time. The only state which changed this exemption was Minnesota, which abolished their unlimited homestead exemption in 1993 and replaced it by a homestead exemption of $200,000 instead. Hence, this variable is not likely to be well identified. Indeed, in the regression, the estimated coefficient is no longer significant when state dummies are included in the regression. Since identification is so poor for this variable, we will rarely comment on the estimated effect of this variable in the analysis.

In column 4, a set of political variables are included as instruments, as well as the state dummies. The instrument set includes the political affiliation of the state governor and the state legislature, the relative proportion of voters in each state for the democratic rather than the republican party candidate in the presidential elections (all lagged) and two measures of how effective the state is at raising tax revenue: the tax fiscal capacity of the state in each period, and the tax intensity or effort in each period. For the years up to 1991 the data are available from ACIR (Advisory Commission on Intergovernmental Relations, 1993), while subsequent data are taken from Tannenwald (2002), although it was necessary to linearly interpolate the two series for some years. A full discussion of these variables is contained in these two references. The IV results in column 5 show that the exemption level is no longer significant and the estimated coefficient is small.

The political variables make useful instruments because they reflect tastes for taxes, redistribution, and exemptions that are not related to current changes in the economy (since we lag the political variables by one period). The ACIR index is even more natural as an instrument as it measures how efficient the state is at raising tax revenue. A state which is less efficient at raising tax revenue is more likely to resort to a generous bankruptcy exemption rather than attempt to increase redistribution through the tax and benefit system.[6] The results in the fourth column of table 7 are not entirely convincing. While the tax measure enters the regression both negatively and significantly, the coefficient on the bankruptcy exemption is rather small.

The last four columns repeat the analysis but this time for the mean marginal rate as dependent variable. This is despite our caveats about using this measure. The results for the mean marginal tax rate are similar to the results for the income compression measure. For the most part, the tax system enters the regression both negatively and significantly. Moreover, the coefficient is similar to that estimated for the income compression measure.

5.2 Consumption inequality

Table 8 reports results for consumption inequality in each state, where inequality is measured by the standard deviation of log consumption. In the basic regression in column 1, which only includes state dummies, taxes and the exemption level are both negative, but only the bankruptcy

[6] Lagged values of taxes and the exemptions are also a possible instrument. This is pursued in some of the regressions below.

exemptions are significant (at the 5 percent level). The second column instruments the tax system and the exemption level by their lags. Now the situation is reversed: again both coefficients are negative but the coefficient of the tax system is significant whereas the coefficient of the exemption level is not. Column 3 includes year dummies as well as state dummies, and the results are very similar to those in the first column. Both the tax system and the exemption level enter negatively, but only the coefficient for the exemption level is significant. Columns 4-6 repeat the analysis of columns 1-3 but use the mean marginal tax rate as dependent variable. As in column 1 (the basic regression with the state dummies only) both the tax system and the exemptions are negative, but only the exemptions enter the regression significantly. When we instrument using lagged values, as in column 5, then the tax system is significant but the exemption level is not. Finally, including both year dummies and state dummies results in both tax system and the exemption level entering the regression significantly at the 5% level. This suggests both are reducing the inequality of consumption.

However, cross-sectional inequality is not the best way to measure insurance. As already stated, changes in consumption inequality are a more direct measure of the relative level of insurance that taxes and the exemption level are providing in each state. In columns 7-10 we report the results of regressions for the standard deviation of the change in consumption. Column 7 shows the result for the basic specification without state fixed effects using the income compression measure of the tax system. The coefficient of the measure for income redistribution is not significant. Instead the coefficient of the exemption level is negative and significant at the 5 percent level. Column 8 is our preferred regression, which includes state fixed effects which will account for other unobserved insurance mechanisms in each state. Now both the tax system and the exemption level are negative and significant. We obtain even more significant results when using the mean marginal tax rate as dependent variable. The results are reported in columns 9 and 10.

5.3 Taxes and Exemptions as Substitutes

We have found that both redistribution and the level of the bankruptcy exemptions are associated with a smaller level of debt, and less consumption inequality. This suggests that both policies are substitutes at least to some extent. In table 9 we directly look at the correlation between these two policies in a controlled regression framework. In column 1 of table 9 we regress the measure of redistribution on the exemption level including a set of state dummies. We find that the exemption level is negatively correlated with the extent of redistribution. That is, having a large amount of redistribution through the tax system is associated with lower levels of exemption. Columns 2 and 3 instrument the exemption level first with lagged values of the exemption, and then with the political variables. The results are similar to the basic result in column 1. In column 2 the result is significant at the 5 percent, but in column 3 the result just fails to be significant at the 5 percent level (although it is significant at the 10 percent level). The last three columns use the mean marginal tax rate, and the exemption level is significant at the 1 percent level throughout.

6 Conclusion

We have shown in a simple modelling framework that bankruptcy regulation and redistributive taxation interact in non-trivial ways. Even if redistributive taxation is supposed to reduce intratemporal inequality whereas bankruptcy exemption lowers intertemporal inequality, both policies interact through the insurance and smoothing motive of agents. We provide sufficient conditions under which both policies are substitutes and search for empirical support using data on US states in the period 1980-99. Consistent with our theoretical perspective, we find that (i) more redistribution is associated with a smaller level of household debt; (ii) both redistribution and bankruptcy exemption are correlated negatively with consumption inequality; and (iii) the extent of redistribution and the size of the bankruptcy exemption level are negatively correlated in our sample.

These results suggests that the variation of the two policies in the US states can be rationalized within a simple economic model. Although normative conclusions cannot be drawn with the current empirical evidence, the results of the regressions with instrumental variables suggest that there possibly is an interesting policy trade-off in that bankruptcy exemption is less effective in increasing welfare if redistributive taxation is already quite pronounced.

Appendix

Derivation of $dr/dx|_b$**:**

Totally differentiation of the arbitrage equation (3) yields

$$\left[\frac{\partial\omega_2^*}{\partial r}(\omega_2^*-\tau-x-C-(1+r)b)f(\omega_2^*)+\int_{\omega_2^*}^{\infty}\left(b+(1+r)\frac{\partial b}{\partial r}\right)f(\omega_2)d\omega_2-\frac{\partial b}{\partial r}(1+r_f)\right]dr$$
$$+\left[\frac{\partial\omega_2^*}{\partial x}(\omega_2^*-\tau-x-C)f(\omega_2^*)+\int_{x+\tau+C}^{\omega_2^*}(-1)f(\omega_2)d\omega_2\right]dx$$
$$+\left[-\frac{\partial\omega_2^*}{\partial x}(1+r)bf(\omega_2^*)+\int_{\omega_2^*}^{\infty}(1+r)\frac{\partial b}{\partial x}f(\omega_2)d\omega_2-\frac{\partial b}{\partial x}(1+r_f)\right]dx=0\ .$$

Since

$$\omega_2^*=x+\tau+(1+r)b\ ,$$

$$\left[\left(b+(1+r)\frac{\partial b}{\partial r}\right)(-C)f(\omega_2^*)+\int_{\omega_2^*}^{\infty}\left(b+(1+r)\frac{\partial b}{\partial r}\right)f(\omega_2)d\omega_2-\frac{\partial b}{\partial r}(1+r_f)\right]dr$$
$$+\left[(-C)f(\omega_2^*)+\int_{x+\tau+C}^{\omega_2^*}(-1)f(\omega_2)d\omega_2+\int_{\omega_2^*}^{\infty}(1+r)\frac{\partial b}{\partial x}f(\omega_2)d\omega_2-\frac{\partial b}{\partial x}(1+r_f)\right]dx=0\ .$$

and rearranging yields

$$\frac{dr}{dx}=\frac{F(\omega_2^*)-F(x+\tau+C)-[(1-F(\omega_2^*))(1+r)-(1+r_f)]\frac{\partial b}{\partial x}+Cf(\omega_2^*)}{(1-F(\omega_2^*))b+[(1-F(\omega_2^*))(1+r)-(1+r_f)]\frac{\partial b}{\partial r}-Cf(\omega_2^*)\left(b+(1+r)\frac{\partial b}{\partial r}\right)}\ .$$

Neglecting feedbacks on b this simplifies to the expression in the text.

Derivation of $dU/dx|b$**:**

Totally differentiating (2) with respect to x we find

$$\frac{dU}{dx}=u'(\omega_1-\tau+b)\frac{db}{dx}-\beta\frac{\partial\omega_2^*}{\partial x}u(x)f(\omega_2^*)$$
$$-\beta\left((1+r)\frac{db}{dx}+\frac{dr}{dx}b\right)\int_{\omega_2^*}^{\infty}u'(\omega_2-\tau-(1+r)b)f(\omega_2)d\omega_2$$
$$+\beta\left(\frac{\partial\omega_2^*}{\partial x}u(x)f(\omega_2^*)-u(x)f(x+\tau+C)\right)+\beta\int_{x+\tau+C}^{\omega_2^*}u'(x)f(\omega_2)d\omega_2+\beta u(x)f(x+\tau+C)$$
$$=\ u'(\omega_1-\tau+b)\frac{db}{dx}-\beta\left((1+r)\frac{db}{dx}+\frac{dr}{dx}b\right)\int_{\omega_2^*}^{\infty}u'(\omega_2-\tau-(1+r)b)f(\omega_2)d\omega_2$$
$$+\beta\int_{x+\tau+C}^{\omega_2^*}u'(x)f(\omega_2)d\omega_2\ .$$

Neglecting feedbacks on b this simplifies to the expression in the text.

Proof of Remark 1:

We drop the discount factor β in what follows since it does not matter for the sign of the derivatives. We now analyze the effect of a change of τ for $\omega_2 \leq \omega_2^*$:

$$\begin{aligned}\frac{d\left(\frac{dU}{dx}|_b\right)}{d\tau} &= -\frac{\left(f(\omega_2^*)+Cf'(\omega_2^*)\right)\left(1-F(x+\tau+C)\right)-f(x+\tau+C)\left(1-F(\omega_2^*)-Cf(\omega_2^*)\right)}{\left(1-F(\omega_2^*)-Cf(\omega_2^*)\right)^2} * \\ &\quad * \int_{\omega_2^*}^{\infty} u'(\omega_2-(1+r)b)f(\omega_2)d\omega_2 \\ &\quad + \left[f(\omega_2^*)-f(x+\tau+C)+\frac{F(\omega_2^*)-F(x+\tau+C)+Cf(\omega_2^*)}{1-F(\omega_2^*)-Cf(\omega_2^*)}\right]u'(x).\end{aligned}$$

where the derivative of

$$\frac{F(\omega_2^*)-F(x+\tau+C)+Cf(\omega_2^*)}{1-F(\omega_2^*)-Cf(\omega_2^*)}$$

with respect to τ is

$$\frac{\left(f(\omega_2^*)+Cf'(\omega_2^*)\right)\left(1-F(x+\tau+C)\right)-f(x+\tau+C)\left(1-F(\omega_2^*)-Cf(\omega_2^*)\right)}{\left(1-F(\omega_2^*)-Cf(\omega_2^*)\right)^2}.$$

It is easy to see that $d\left((dU/dx)\,|b\right)/d\tau > 0$ if this term is negative. This is the case if

$$\frac{f(x+\tau+C)}{1-F(x+\tau+C)} > \frac{f(\omega_2^*)+Cf'(\omega_2^*)}{1-F(\omega_2^*)-Cf(\omega_2^*)}.$$

For $C=0$, this corresponds to the decreasing hazard property.■

Proof of Remark 2:

Totally differentiating the Euler equation (4) holding the interest rate r constant,

$$\begin{aligned}&\left[u''(\omega_1-\tau(\omega_1)+b)+\beta(1+r)^2\left(\int_{\varepsilon^*}^{\infty}u''(\mu+\varepsilon-\tau(\omega_2)-(1+r)b)dF(\varepsilon)+u'(x)\right)\right]db \\ =\;& \beta(1+r)\left[\int_{\varepsilon^*}^{\infty}u''(\mu+\varepsilon-\tau(\omega_2)-(1+r)b)dF(\varepsilon)+u'(x)\right]d\mu\end{aligned}$$

and thus

$$\frac{db}{d\mu}|_r = \frac{\beta(1+r)\left[\int_{\varepsilon^*}^{\infty}u''(\mu+\varepsilon-\tau(\omega_2)+(1+r)b)dF(\varepsilon)+u'(x)\right]}{u''(\omega_1-\tau(\omega_1)+b)+\beta(1+r)^2\left(\int_{\varepsilon^*}^{\infty}u''(\mu+\varepsilon-\tau(\omega_2)-(1+r)b)dF(\varepsilon)+u'(x)\right)}.$$

Similarly,

$$\frac{db}{dx}|_r = -\frac{\beta(1+r)u'(x)}{u''(\omega_1-\tau(\omega_1)+b)+\beta(1+r)^2\left(\int_{\varepsilon^*}^{\infty}u''(\mu+\varepsilon-\tau(\omega_2)-(1+r)b)dF(\varepsilon)+u'(x)\right)}.$$

Now assume that $\tau(\omega_1) = -\lambda\tau$ and $\tau(\omega_2|\omega_2 \geq \omega_2^*) = \tau > 0$. In this case,

$$\frac{db}{d\tau}|_r = -\frac{\lambda u''(\omega_1 - \tau(\omega_1) + b) + \beta(1+r)\left(\int_{\varepsilon^*}^{\infty} u''(\mu + \varepsilon - \tau(\omega_2) - (1+r)b)dF(\varepsilon) + u'(x)\right)}{u''(\omega_1 - \tau(\omega_1) + b) + \beta(1+r)^2\left(\int_{\varepsilon^*}^{\infty} u''(\mu + \varepsilon - \tau(\omega_2) - (1+r)b)dF(\varepsilon) + u'(x)\right)} ,$$

where $0 < \lambda < 1$ captures the deadweight loss of taxation.

The Euler equation implies that b is optimally chosen. Thus, the derivative of the Euler equation with respect to b is negative for strictly concave utility functions. This implies that the denominator of the total derivatives is negative so that $db/dx|_r > 0$ and for the tax-subsidy scheme we assumed, $db/d\tau|_r < 0$, as long as $\lambda(1+r) \leq 1$. The inequality only ensures that redistributing one dollar today and taxing one dollar tomorrow is no “money-machine”.

The effect of the persistence of labor income on borrowing is less clear. We find that for $\omega_1 > 0$, $db/d\mu|_r > 0$ if

$$-\frac{\int_{\varepsilon^*}^{\infty} u''(\mu + \varepsilon - \tau(\omega_2) + (1+r)b)dF(\varepsilon)}{u'(x)} > 1 .$$

Strict concavity of the utility function implies that a necessary condition for this inequality to hold is

$$-\frac{u''(x)}{u'(x)} > 1$$

since

$$\mu + \varepsilon - \tau(\omega_2) + (1+r)b \geq x \text{ for } \varepsilon \geq \varepsilon^*.$$

■

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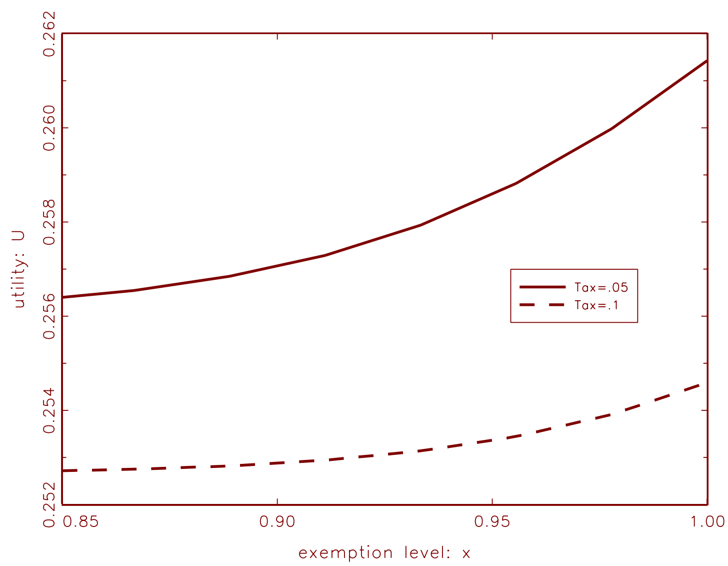

Figure 1: Utility as a function of exemption level x for different taxes τ

Table 1: Benchmark Parameters

$r_f = .02$	$\omega_1 = 1$	$C = 0$	$x = .9$	$\sigma = 1$
$\beta = (1 + .1)^{-1}$	$\mu = 1.3$	$\tau = 0$	$\varepsilon \sim N(0, .1 * \omega_2)$	

Table 2: Equilibrium values of borrowing b, interest rate r, and default probability

Variables	*Benchmark*	$\tau = .1$	$x = .75$	$\mu = 1.4$	$C = .05$	$\sigma = 2$
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
borrowing b	.183	.090	.184	.235	.175	.162
interest rate r	.035	.0204	.021	.028	.047	.031
default prob.	.052	.001	.003	.032	.047	.037

Table 3: The level of wages and transfers for households in the US:

	average	average if received	% receive
wages	34,696	36,789	94.3
social security	261	6,601	3.9
supplementary security income	77	4,161	1.8
unemployment/workers compensation	353	2,688	13.1
public assistance / welfare	176	3,712	4.7
food stamps	128	1,571	8.1
total transfer	997	4,250	23.4

Data is constructed from reported responses in the March supplement of the CPS for the years 1980-1999. Total transfer refers to the sum of social security benefits, supplementary security benefits, unemployment or workers compensation, welfare or other public assistance, and food stamps. The CPS questionnaire conflates social security benefits with railroad retirement income, and worker's compensation with veterans payments.

Table 4: Income thresholds for 1998 federal tax brackets:

Tax Rate	Tax Bracket			
(%)	single	married jointly	married separately	% paying
15	0	0	0	58.2
28	26,250	43,850	21,925	34.2
31	63,550	105,950	52,975	5.2
36	132,660	161,450	80,725	1.8
39.6	288,350	288,350	144,175	0.3

The data was made available by the Federation of Tax Administrators at 444 N. Capital Street, Washington DC. In the table 'single' refers to single filers, 'married jointly' refers to married couples filing jointly, while 'married separately' refers to married couples who file separate tax returns. 'Paying refers to the proportion of households in the tax bracket. The amounts for the tax bracket refer to the income at which the tax bracket starts.

Table 5: Chapter 7 Exemptions under the Federal Bankruptcy Act.

Description	Amount $	Comments
1978 Exemptions:		
1. House	7,500	
2. Car	1,200	
3. Household Goods		no limit on aggregate amount that can be claimed under this category.
4. Jewelry	500	personal use only.
5. Other Property		Allowed all of unclaimed exemption from (1).
6. Tools of Trade	750	Items needed for job.
Revised Exemptions of 1984:		
3. Household Goods	4,000	$200 each item. (furnishings, goods, clothes, appliances, books, animals, musical instruments) for personal use only.
5. Other Property	400	+ $3,750 of (1) that is unused.
Revised Exemptions of 1994:		
1. House	15,000	
2. Car	2,400	
3. Household Goods	8,000	$400 each item.
4. Jewelry	1,000	
5. Other Property	800	+ $7,500 of (1) that is unused.
6. Tools of Trade	1,500	
Revised Exemptions of 1998:		
1. House	16,150	
2. Car	2,575	
3. Household Goods	8,625	$425 each item.
4. Jewelry	1,075	
5. Other Property	850	+ $8,075 of (1) that is unused.
6. Tools of Trade	1,625	
Revised Exemptions of 2001:		
1. House	17,425	
2. Car	2,775	
3. Household Goods	9,300	$450 each item.
4. Jewelry	1,150	personal use only.
5. Other Property	925	+ $8,725 of (1) that is unused.
6. Tools of Trade	1,750	

Source: Title, 11, Section 522(d) of the annotated federal code. Section 104 specified that the amounts were to be updated with the inflation rate every 3 years, commencing on April 1st 1998. While not recorded, the federal legislation also allowed (with some limits) insurance policies, pensions and annuities, social security payments, and awards adjudicated by the courts to be exempted.

Table 6: Tax redistributiveness and bankruptcy exemptions by state:

State	Taxes					Bankruptcy Exemptions				
	min. bracket	max. bracket	exempt	marginal rate	income compression	house '84	other '84	house '98	other '98	fed
California	1.0	9.3	72	22.8	34.3	30,000	5,200	50,000	10,900	1984
Florida		no state income tax		19.2	27.0	no limit	1,000	no limit	2,000	1979
Maryland	2.0	4.75	1,850	25.1	32.6	2,500	3,500	2,500	3,500	1982
Minnesota	5.35	7.85	2,900	24.6	34.3	no limit	6,500	200,000	11,050	
New York	4.0	6.85	-	22.1	35.5	10,000	7,400	10,000	7,400	1982
Pennsylvania	2.8	2.8	-	21.0	29.8		300		300	
Texas		no state income tax		19.0	26.9	no limit	15,000	no limit	30,000	

The tax brackets are those applicable in 1998, while the exemption is the income exempt from taxation for single filers. The California exempt amount refers to a tax credit. Tax data is constructed using income from the March supplement of the CPS for 1980-1999, and using taxes reported from the NBER TAXSIM programme. 'Marginal tax rate' refers to the mean marginal tax rate across households, the 'tax bracket' is the mean tax bracket across households while 'income compression' refers to 1 minus to the ratio of the standard deviation of income before taxes to the standard deviation of income after taxes (and transfers). The income compression measure accounts for both state and federal taxes. The bankruptcy exemptions are those applicable on 1 January in 1984 and 1998, while 'other' refers to the money amount on all assets excluding housing and 'tools of trade'. The last column 'fed' refers to the year in which the federal exemption was not allowed. California refers to system I exemptions.

Table 7: The effect of taxes and bankruptcy exemptions on unsecured debt.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
tax	-15.725	-20.858	-20.428	-21.734	-16.862	-17.724	-19.248	-13.523
	(0.930)	(1.433)	(0.916)	(7.136)	(0.732)	(0.925)	(0.702)	(4.688)
exempt	-0.274	-0.076	-1.357	-0.041	0.011	-0.251	-0.015	-0.969
	(0.306)	(0.401)	(0.441)	(3.433)	(2.667)	(0.336)	(0.403)	(3.670)
exdum	-0.593	-0.776	-0.296	5.126	-0.419	-0.415	-0.381	6.634
	(0.174)	(0.201)	(0.244)	(3.873)	(0.151)	(4.132)	(0.167)	(0.217)
constant	6.424	8.012	7.066	8.387	5.234	5.486	5.138	4.813
	(0.288)	(0.428)	(0.340)	(1.893)	(0.151)	(0.203)	(0.251)	(1.669)

Standard errors in parentheses. The sample size was 464, and exdum refers to whether the state allows the home to be exempt from seizure regardless of its value. The first four columns measure the tax system by how much it compresses the income distribution, while the last four column use the mean marginal tax rate. Columns 3, 4, 7, and 8 include state dummies. In columns 2 and 6, taxes and the exemptions are instrumented by their lags, while in columns 4 and 8 they are instrumented by a set of political variables.

Table 8: The effect of taxes and bankruptcy exemptions on inequality.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
tax	-0.014	-0.214	-0.110	-0.067	-0.165	-0.442	-0.130	-0.269	-0.339	-0.371
	(0.062)	(0.096)	(0.117)	(0.053)	(0.061)	(0.197)	(0.140)	(0.125)	(0.102)	(0.107)
exempt	-0.094	-0.043	-0.110	-0.083	-0.039	-0.110	-0.088	-0.277	-0.068	-0.237
	(0.029)	(0.042)	(0.034)	(0.030)	(0.041)	(0.033)	(0.037)	(0.060)	(0.036)	(0.061)
exdum	-0.013	-0.023	-0.019	-0.011	-0.021	-0.014	0.016	0.027	-0.001	0.034
	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)	(0.021)	(0.033)	(0.021)	(0.033)
constant	0.555	0.615	0.586	0.563	0.581	0.666	0.517	0.507	0.548	0.502
	(0.023)	(0.033)	(0.044)	(0.019)	(0.023)	(0.056)	(0.035)	(0.046)	(0.023)	(0.038)

Standard errors in parentheses. The sample size was 464, and exdum refers to whether the state allows the home to be exempt from seizure regardless of its value. The first three columns and columns 7-8 measure the tax system by how much it compresses the income distribution, while the remaining columns use the mean marginal tax rate. In columns 1-6, the LHS variable is the standard deviation of consumption, while columns 7-10 use the standard deviation of the the growth rate of consumption. All except columns 7 and 9 include state dummies. Columns 2 and 5 instrument taxes and the exemption level by their lags, while columns 3 and 6 include year dummies in the regression.

Table 9: The relationship between taxes and bankruptcy exemptions.

	(1)	(2)	(3)	(4)	(5)	(6)
exempt	-0.056	-0.059	-0.132	-0.079	-0.106	-0.500
	(0.021)	(0.024)	(0.069)	(0.025)	(0.028)	(0.105)
exdum	-0.001	-0.011	0.045	0.001	-0.007	0.087
	(0.013)	(0.013)	(0.058)	(0.015)	(0.015)	(0.089)
constant	0.369	0.369	0.240	0.286	0.298	0.114
	(0.016)	(0.017)	(0.040)	(0.020)	(0.020)	(0.062)

Standard errors in parentheses. The sample size was 464, and exdum refers to whether the state allows the home to be exempt from seizure regardless of its value. The first three columns measure the tax system by how much it compresses the income distribution, while the remaining columns use the mean marginal tax rate. All regressions include state dummies. In columns 2 and 5, the bankruptcy exemptions were instrumented by their lags, while in columns 3 and 6, they were instrumented by a set of political variables.