Redistributive Taxation and Personal Bankruptcy in US States*

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Abstract

Both personal bankruptcy and redistributive taxes can insure households' consumption risk and both vary considerably across US states. We derive sufficient conditions under which more redistributive taxation makes bankruptcy exemptions less attractive both for the intra-temporal insurance and for inter-temporal consumption smoothing. Exploiting data variation over time for 18 US states 1980-2003, we find considerable support for our model's predictions: (i) redistributive taxation and bankruptcy exemptions are negatively correlated; (ii) both policies are associated with more equal consumption growth whereas the effect on unsecured household debt is less clear-cut.

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1 Introduction

Bankruptcy regulation and redistributive taxation are both important policies in the US. The average US household receives $1,000 in direct transfers per year (see the authors' calculation based on the CPS in table 2). At the same time, roughly 1.5% of US households have filed for personal bankruptcy in each recent year; in 2003 households defaulted on approximately $120 billion or $1,100 per household each year (see White, forthcoming). Besides the aggregate importance of both policies, there is substantial variation in the regulation of bankruptcy and redistributive taxation across US states. For example, bankruptcy exemptions (the assets that may be kept by the debtor when he defaults on his debt) are generous in Texas where housing property is fully exempt (subject to an acreage limit) regardless of value but redistribution through taxes and transfers is less pronounced. In contrast, New York allows for much smaller bankruptcy exemptions but has a more generous redistribution scheme through taxes and transfers.

This paper argues that this negative correlation between the two policies can be explained. If markets are incomplete (for empirical evidence see, for example, Attanasio and Davis, 1996, or Blundell *et al.*, 2004), both policies help households to insure some of the income fluctuations that they are not otherwise able to insure. Both personal bankruptcy and redistributive taxes are attractive for agents in this second-best world but this attraction is reduced in the presence of the other policy. This is far from obvious since the main motive for taxes and transfers is to redistribute resources intratemporally whereas the bankruptcy exemption is crucially associated with intertemporal consumption-smoothing (it is only important if agents save and borrow across time). Although, in reality, a tax and transfer system could be used to reallocate resources across time (think of a pension scheme), we abstract from this in our model. This allows us to contrast the crucial differences between the two policies in a simple stylized way. Of course, while in principle a tax system could be devised that replicates the redistribution implied by a bankruptcy law, it is not practically possible since it would require conditioning taxes and transfers on who would otherwise default. For this the government would need to know not only the current asset position but also information on the consumption and saving decision requiring information on discount rates and expected future income.

Bankruptcy legislation provides a 'fresh start' for agents who have been hit by a sufficiently bad shock (see for example Hynes, 2002). Bankruptcy provides insurance since households receiving bad shocks can default, while households without bad shocks repay at higher interest rates. We show that redistributive taxes and transfers make this fresh start less attractive as they eliminate some of the ex-post inequality in gross income. Moreover, redistributive taxation decreases agents' expected differences in income across time and thus their desire to borrow. Besides these intuitive and straightforward interactions, the model describes more subtle ways in which redistributive taxation changes the costs and benefits of personal bankruptcy. For example, both policies affect the bankruptcy decision and thus the risk premium over the risk-free interest rate. We also derive intuitive sufficient conditions under which both policies are substitutes in providing partial insurance. These results help us to better understand the interaction between both policies at the micro level.

An important contribution of this paper is that we construct new data on bankruptcy exemptions for 18 US states over a long time period, 1980-2003. 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.[1] Since all our data have time variation, we can control for state specific unobserved heterogeneity. We provide empirical evidence that supports the model's hypotheses. We find that the level of the bankruptcy exemption and the extent of redistributive taxation are negatively correlated. A generous exemption is associated with less redistribution through taxes and transfers, suggesting that both policies are substitutes. Moreover, to support our theoretical perspective, we provide more direct evidence that both policies are important for the smoothing and insurance motive. Both the bankruptcy exemption and redistributive taxation are associated with less inequality in consumption growth (which directly measures consumption insurance); whereas empirical evidence for the effect of both policies on unsecured household debt is less clear-cut.

Of course, we are not the first to analyze bankruptcy or redistributive taxation in the US. For example, Gropp et al. (1997) and Pavan (2005) investigate the effect of personal bankruptcy procedures on households' assets, while Zame (1993) and his references show theoretically how bankruptcy can provide partial insurance against income fluctuations. In the context of the recent bankruptcy reforms, Athreya (1999, 2005) and Chaterjee *et al.* (2002) calibrate 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 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 to jointly analyze redis-

[1] We use the income information in the CPS because more households are surveyed than in the CEX so that state averages are better measured. Moreover, measurement error in income and in consumption will be uncorrelated if information is obtained from different surveys.

tributive taxation and bankruptcy exemptions, focussing on the intra- and inter-temporal channels of policy interaction, and to empirically quantify their effects. Most related in this respect are the analyses of Hansen and Imhoroglu (1992), Bertola and Koeniger (2004) and Athreya and Simpson (2003). The first two papers analyze interactions between government redistribution and financial market imperfections. They argue that in a second-best world of incomplete financial markets, more government redistribution can mitigate the adverse welfare effect of credit constraints. The interactions between redistribution and bankruptcy in this paper are similar in spirit. But since we allow for bankruptcy, the interactions between financial market imperfections and redistribution now have effects on both the interest rate and the level of borrowing. Allowing for bankruptcy has the additional advantage that we are able to test the predictions of the model with data on US states which vary with respect to bankruptcy exemptions as well as redistribution through taxes and transfers.

Our simple model allows us to derive some analytical results for a quite general class of utility functions and probability distributions. We show that parametric assumptions on the shape of the probability distributions are not innocuous for the sign and size of the policy interaction. Athreya and Simpson (2003) instead numerically solve a fully dynamic model to analyze interactions between public insurance and bankruptcy quantitatively. 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 the consumption of agents especially 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 the real world, we show in this paper that such imperfections are not necessary to rationalize why bankruptcy is less attractive if redistribution is more pronounced, and we believe it is important to understand this simpler environment with fewer parametric assumptions. 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 empirical results in Section 5 before we conclude in Section 6.

2 A stylized model

We construct a simple model with two periods labelled 1 and 2 in which the bankruptcy decision is modelled in a standard way (see, for example, White, forthcoming), motivating our empirical analysis. Its simple structure allows us to derive some analytic results for a relatively general class of utility functions and probability distributions that illustrate the interactions between a linear redistributive tax/transfer scheme and a bankruptcy exemption.

Agents are risk-averse and either borrow at interest rate r_2 from risk-neutral banks, or lend at the world risk-free interest rate r_f. The interest rate r_2 is endogenously determined and incorporates the bank's expectation about the agent's repayment behavior in period 2. Thus, the interest rate r_2 will depend on each agent's circumstances (we drop the agent-specific index for convenience). In contrast, the world interest rate r_f is exogenous and constant.[2] Since the probability of default is weakly larger than zero, $r_2 \geq r_f$.

Agents are born in period 1 with endowment ω_1. We focus on a representative borrower whose choices are a function of these resources and of expected future endowment draws in period 2. This focus is justified since the median household owes some unsecured debt in all US states. Moreover, the choices of savers that hold assets at a risk-free rate r_f are rather uninteresting since they are not directly affected by bankruptcy procedures. Some results for savers are summarized in Appendix A.2.

Timing Given the endowment ω_1 (which we normalize to one without loss of generality), agents decide how much to borrow and consume in the first period. They know that in period 2 they will receive an uncertain endowment

$$\omega_2 = \mu + \varepsilon_2 \ ,$$

where μ is known and ε_2 is random with mean zero. Agents expect their endowment to grow in period 2 if $\mu > 1$.

After the endowment draw in period 2, agents decide whether to declare bankruptcy and how much to consume. Given this setup, total resources in period 2 (before the decision to declare bankruptcy) are defined as

$$\rho_2 = \begin{cases} \omega_2 - (1 + r_t)b_1 & \text{if borrow} \\ \omega_2 + (1 + r_f)a_1 & \text{if save.} \end{cases}$$

[2]This is a common assumption in the literature. For example, Athreya (2005) motivates this assumption by noting that the ownership of wealth is fairly concentrated. Thus an exogenous interest rate can be motivated assuming a small group of agents which holds all assets, and is unaffected by bankruptcy procedures.

Depending on whether the agent has carried positive assets a_1 or debt b_1 from the previous period, the total resources are larger or smaller than the current endowment ω_2. Total resources in period 1, ρ_1, trivially equal the endowment ω_1.

Government policy The government is responsible for bankruptcy law and for taxes and transfers. Agents are taxed or receive transfers depending on the level of their resources ρ_t. We define ρ^+ so that agents with resources $\rho_t < \rho^+$ receive transfers whereas agents with resources $\rho_t > \rho^+$ are taxed. To make the model interesting we assume that government redistribution cannot be conditioned on assets or the agent's consumption/saving choice. Otherwise the distinction between redistributive taxes and transfers and resources redistributed because of bankruptcy filings would be arbitrary. In particular, we assume a tractable linear tax/transfer schedule

$$\tau(\rho_t - \rho^+). \tag{1}$$

Thus, net resources are defined as

$$\widetilde{\rho}_t \equiv \rho_t - \tau(\rho_t - \rho^+).$$

This tax-schedule conveniently summarizes redistribution via the parameter τ, which is constant over time. A larger τ not only implies a larger marginal tax rate in good states (e.g. for high draws of ε_t) but also larger transfers in bad states. Notice that the assets of agents are taxed, and debt and its interest can be deducted as is realistic in the US for most of our sample period although tax reforms have implemented some changes (see Makin, 2001). Moreover, we do not explicitly model the deadweight loss resulting from this policy. We will discuss this issue further below.

The second policy in the model is the bankruptcy exemption x, the level of resources that can be kept when the household defaults. We focus on this important variable since while bankruptcy is regulated at the federal level, states are allowed to set their own level of exemptions (we describe the bankruptcy law in more detail below).

Bankruptcy decision Agents declare bankruptcy in period 2 if they have borrowed and their total net resources fall below the exemption level x,

$$\widetilde{\rho}_2 < x.$$

Note that we implicitly assume that the agent first pays taxes and receives transfers before he makes the bankruptcy decision. This is realistic since US households cannot default on taxes. The critical level of gross resources below which the agent declares bankruptcy is

$$\rho_2^* = \frac{x - \tau\rho^+}{1 - \tau}.$$

Not surprisingly, agents with more resources declare bankruptcy if the exemption level x is higher. In contrast, the effect of τ on ρ_2^* depends on whether agents are net tax payers or receive transfers at the exemption level x (whether ρ^+ is greater than or less than x). If agents with resources higher than the exemption level receive transfers, if $\rho^+ > x$, then $\partial\rho_2^*/\partial\tau < 0$. In contrast, $\partial\rho_2^*/\partial\tau \geq 0$ if $\rho^+ \leq x$. For later reference note that the critical value in terms of endowments is given by

$$\omega_2^* = \frac{x - \tau\rho^+}{1-\tau} + (1+r_2)b_1. \tag{2}$$

In our simple model bankruptcy only matters for agents who borrow. Thus we focus on these agents in our analysis (below we discuss the effect of redistributive taxes on savers). We analyze the borrower's problem backwards. We first characterize the effect of taxes τ and the exemption x on expected utility in the second period for a given level of borrowing b_1.[3] This allows us to explore how the two policies interact in providing insurance in the second period. We then analyze how the level of borrowing in period 1 depends on the two policies x and τ, for a given interest rate r_2. From this we learn how the two policies affect intertemporal smoothing motives. We are able to provide analytic results for a general class of utility functions and probability distributions. However, we need to parameterize both utility and probability in order to characterize the equilibrium and optimal exemption level in period 1 (for endogenous b_1 *and* r_2).

2.1 Intratemporal insurance and policy substitutability

Personal bankruptcy only matters in period 2 if agents have borrowed in period 1. Borrowing is optimal if the marginal utility in period 1, evaluated at net resources $\widetilde{\rho}_1$=$\widetilde{\omega}_1$, is larger than the expected marginal utility in period 2 conditional on repayment (evaluated at the net endowment). That is:

$$u'(\widetilde{\omega}_1) > \beta(1+r_2)\int_{\omega_2^*}^{\infty} u'(\widetilde{\omega}_2)f(\omega_2)d\omega_2, \tag{3}$$

where $u(.)$ is a strictly concave, continuous and differentiable utility function, primes denote derivatives, ω_2^* is the endowment below which the agent declares bankruptcy, β is the discount factor, r_2 is the interest rate at which the agent can borrow in period 1, and $f(.)$ is the probability density. Moreover, $\widetilde{\omega}_2 = \omega_2 - \tau(\omega_2 - \rho^+)$ is the net endowment in the second period if the agent has zero assets (no debt).

[3] The tax schedule is determined by two parameters in equation (1). We focus on τ, but in Appendix A.3 we show that changing ρ^+ has similar effects.

The expected utility of a borrower for period 2 is

$$\begin{aligned} u_2^b &= \int_{\omega_2^*}^{\infty} u((\underbrace{\omega_2 - (1+r_2)b_1}_{=\rho_2})(1-\tau) + \tau\rho^+) f(\omega_2) d\omega_2 \\ &+ \int_{\rho_2^*}^{\omega_2^*} u(x) f(\omega_2) d\omega_2 \\ &+ \int_{-\infty}^{\rho_2^*} u(\omega_2(1-\tau) + \tau\rho^+) f(\omega_2) d\omega_2 \end{aligned} \tag{4}$$

where the probability density is assumed such that expected marginal utility remains finite on the support of the distribution.

The first line of expression (4) contains the utility of a borrowing agent if he repays in period 2. The second line is the utility if the bankruptcy exemption provides full consumption insurance. And the third line is the utility if the endowment in period 2 is so low that the bankruptcy exemption only provides partial insurance. Note that, as is realistic, agents who default on their debt cannot default on tax payments and can no longer tax deduct their debt and interest payments.

We illustrate the insurance provided by the bankruptcy exemption in the left picture of Figure 1 (we discuss the figure further after Remark 2 below). We plot consumption (the solid line) and net resources (the dashed line) as a function of the gross endowment. The bankruptcy exemption reduces consumption in good states (in equilibrium, agents pay more interest when they repay as we derive below) and provides insurance in bad states. Thus, the bankruptcy exemption facilitates intertemporal consumption smoothing by redistributing resources across states in the second period. If the gross endowment is in the interval $(\rho_2^*; \omega_2^*)$ the bankruptcy exemption provides full insurance so that consumption is flat at x. Agents default partially on their debt. For endowments $\omega_2 < \rho_2^*$ agents fully default on their debt (the consumption increase afforded by bankruptcy is largest as measured by the distance between the solid and dashed line at a given endowment level) but consumption is no longer constant so that insurance is only partial. That is, although the agent defaults on more debt in this region, his level of consumption is falling together with his endowment. We now show how the interest rate r_2 of the borrowers is determined and depends on the policy parameters.

2.1.1 Determination of the interest rate

A risk neutral bank in a competitive banking market sets the interest rate r_2 so that it receives the same expected return as lending on the world market at the risk free rate r_f.

The arbitrage condition is

$$\int_{\rho_2^*+\frac{C}{1-\tau}}^{\omega_2^*} (\omega_2 - x - C - \tau(\omega_2 - \rho^+))f(\omega_2)d\omega_2 + \int_{\omega_2^*}^{\infty} (1+r_2)b_1 f(\omega_2)d\omega_2 = b_1(1+r_f) \quad (5)$$

where C is the deadweight bankruptcy cost. This cost is borne by the bank, and reflects deadweight administrative and judicial costs.[4] The first integral in the arbitrage equation is the expected repayment in the states of the world in which the agent partially defaults whereas the second integral is the expected repayment in the states of the world in which the agent fully repays.[5]

Totally differentiating equation (5) using Leibniz rule, we find that for a given level of borrowing:

$$\left.\frac{dr_2}{dx}\right|_{b_1} = \frac{F(\omega_2^*) - F(\rho_2^* + \frac{C}{1-\tau}) + \frac{C}{1-\tau} f(\omega_2^*)}{(1-F(\omega_2^*))\, b_1 - C f(\omega_2^*) b_1} > 0 \;, \quad (6)$$

where $F(.)$ is the cumulative distribution function. The derivation is given in Appendix A.3. The intuition is that a higher exemption level x makes the agent default in more states of the world (recall equation 2). This increases the interest rate which reflects the higher risk of default. If there is no deadweight loss, so that $C = 0$, the size of the effect depends positively on the ratio of the probability of bankruptcy with partial default, $F(\omega_2^*) - F(\rho_2^*)$, over the probability of full repayment $1 - F(\omega_2^*)$. Notice that the interest rate is only affected by the bankruptcy exemption through those states of nature in which the household repays some, but not all, its debts. Only for these states can the exemption reduce the repaid amount, and states with full default are not relevant. For $C > 0$, $dr_2/dx|_{b_1}$ increases since the bankruptcy cost is borne by the bank. Furthermore, we can show the following:

Remark 1: *For a given level of borrowing b_1 and negligible bankruptcy cost ($C = 0$), a higher tax/transfer τ increases the costliness of the exemption in terms of larger interest payments:*

$$\frac{d\left(\frac{dr_2}{dx}|_{b_1} b_1\right)}{d\tau} > 0 \quad (7)$$

[4] If the cost was borne by the agent, for example as a pure utility cost, the bankruptcy cost would affect the threshold ω_2^*. In this case, the cost would enter the arbitrage equation (5) only through its effect on the bounds of the integral but no longer by lowering the payment of the agent. In this case the sufficient condition of Remark 1 simplifies to the decreasing hazard property without additional restrictions on the bankruptcy cost.

[5] Note that we implicity assume that the bank does not incur the bankruptcy cost if the agent fully defaults. This assumption is not essential but is reasonable in our model since it is unclear why the bank should care to start costly procedures if it knows that it does not receive any net payment.

if

$$\frac{f(\rho_2^*)}{1-F(\rho_2^*)} > \frac{f(\omega_2^*)}{1-F(\omega_2^*)} \left| \frac{\partial \omega_2^*/\partial \tau}{\partial \rho_2^*/\partial \tau} \right| .$$

If $|\partial \omega_2^*/\partial \tau| > |\partial \rho_2^*/\partial \tau|$ *a necessary condition is that the probability distribution has decreasing hazard on the interval* $(\rho_2^*; \omega_2^*)$. *Otherwise decreasing hazard is a sufficient condition.*

Proof: see Appendix A.1.

The decreasing hazard property implies that the expected cost of bankruptcy increases in terms of larger interest payments (in the states of nature in which the agent repays). If agents receive transfers at resources smaller or equal than the bankruptcy threshold, the interval $(\rho_2^*\ ;\ \omega_2^*)$ in which the bankruptcy exemption provides full insurance "shifts to the left". With decreasing hazard, this shift makes the interest rate more sensitive to changes in the exemption level because the relative probability mass associated with bankruptcy and partial default increases relative to the mass associated with repayment. Recall that in the interval of endowments with partial default the bank still receives some payment which decreases as exemptions become more generous. If $C > 0$, the condition to sign the derivative in Remark 1 can no longer be interpreted in a straightforward way. As inspection of equation (6) suggests, for $C > 0$ the shape of the density also becomes important. Thus, parametric assumptions on the probability distribution in quantitative models are important for the size and sign of the policy interaction on the "cost-side".

2.1.2 Policy interactions

We now turn to the *ex ante* welfare effect of x and τ for borrowers. Totally differentiating (4) with respect to the exemption x we find for given b_1 that

$$\begin{aligned} \frac{du_2^b}{dx}|_{b_1} &= -(1-\tau) b_1 \frac{dr_2}{dx}|_{b_1} \int_{\omega_2^*}^{\infty} u'((1-\tau)\rho_2(\omega_2) + \tau \rho^+) f(\omega_2) d\omega_2 \\ &\quad + \left(F(\omega_2^*) - F(\rho_2^*)\right) u'(x), \end{aligned} \tag{8}$$

where more details on the derivation are in Appendix A.3. The first line of the derivative captures the cost of the bankruptcy exemption because of higher interest payments in the good states of the world. This effect is less important if much of the interest payment can be tax deducted. The second line contains the benefit of a higher exemption in the bad states in which bankruptcy provides full insurance. For $C = \tau = 0$, equation (6) implies that banks insure agents at an actuarially fair price and the sign of $du_2^b/dx|_{b_1}$ depends on the sign of

$$u'(x) - \frac{\int_{\omega_2^*}^{\infty} u'(\widetilde{\rho}_2(\omega_2))f(\omega_2)d\omega_2}{\int_{\omega_2^*}^{\infty} f(\omega_2)d\omega_2}$$

As in White (forthcoming), this expression is positive for risk-averse borrowers with strictly concave utility since

$$\widetilde{\rho}_2(\omega_2) \geq x \text{ for } \omega_2 \in (\omega_2^*; \infty)$$

and thus

$$u'(x) > u'(\widetilde{\rho}_2(\omega_2)) \ \forall \ \omega_2 > \omega_2^*$$

Thus, for $C = 0$, full exemption is optimal. Instead for $C > 0$ and $0 < \tau < 1$, insurance is actuarially unfair and the welfare gains from the exemptions are bounded. Nonetheless, unless bankruptcy costs are prohibitively high, some exemption will improve the welfare of borrowing agents by reducing consumption fluctuations.

Totally differentiating (4) with respect to the τ we find for given b_1 that

$$\begin{aligned} \frac{du_2^b}{d\tau}|_{b_1} &= -(1-\tau)b_1\frac{dr_2}{d\tau}|_{b_1}\int_{\omega_2^*}^{\infty} u'((1-\tau)\rho_2(\omega_2) + \tau\rho^+)f(\omega_2)d\omega_2 \\ &- \int_{\omega_2^*}^{\infty} (\rho_2 - \rho^+)u'((1-\tau)\rho_2(\omega_2) + \tau\rho^+)f(\omega_2)d\omega_2 \\ &- \int_{-\infty}^{\rho_2^*} (\omega_2 - \rho^+)u'(\omega_2(1-\tau) + \tau\rho^+)f(\omega_2)d\omega_2 \end{aligned} \tag{9}$$

The sign of this derivative depends on the parameters τ and ρ^+ of the tax/transfer schedule. The expected marginal-utility cost in the good states of the world in which the agent pays taxes needs to be compared with the expected gains in the bad states in which the agent receives transfers (the second and third line of the derivative). Finally, redistribution also affects the bankruptcy decision and thus the interest rate (the first line of the derivative). For later reference it is important to note that redistributive taxes and transfers lower consumption inequality and thus *ex ante* provide some insurance to agents.

We can now investigate whether the welfare gains of the bankruptcy exemption are smaller if government redistribution already provides more plentiful resources in the bad states of the world. Differentiating expression (8) with respect to τ, we can show the following:

Remark 2: *For given borrowing b_1 and negligible bankruptcy cost ($C = 0$), redistributive taxation lowers the welfare gains derived from a higher bankruptcy exemption:*

$$\frac{d\left(\frac{du_2^b}{dx}|_{b_1}\right)}{d\tau} < 0,$$

if consumers cannot tax-deduct their debt, the probability distribution has increasing density and satisfies the sufficient condition in Remark 1.

Proof: see Appendix A.1.

The interaction between redistribution and the bankruptcy exemption in period 2 can be decomposed into five different effects (which correspond to the five lines of the derivative in the proof in Appendix A.1). The first four effects show how more government redistribution alters the cost of the bankruptcy exemption whereas the last effect captures changes in the benefits of the bankruptcy exemption:

(i) Larger transfers *increase the cost* of the bankruptcy exemption in terms of higher interest rates in the good states of the world, $\omega_2 \in (\omega_2^*; \infty)$. The sign of the effect follows from Remark 1.

(ii) A higher marginal tax rate *decreases the cost* of the bankruptcy exemption in terms of higher interest rates if consumers can tax deduct interest payments on their debt in the good states of the world. This makes the bankruptcy exemption more attractive if the marginal tax rate is higher. In Remark 2 we rule out this policy complementarity as is realistic for most of the sample period in the empirical part (see Makin, 2001).

(iii) Larger transfers in the bad states of the world imply higher taxes in the good states of the world when debt is repaid (for $\rho_2 > \rho^+$ if $\omega_2 > \omega_2^*$). The higher interest payment resulting from the bankruptcy exemptions then becomes *more costly* in marginal-utility terms.

(iv) Larger transfers imply that agents who receive transfers declare bankruptcy only at a lower endowment ω_2 (the integration bounds shift). This increases the probability mass of states of the world in which the debt is repaid, and thus *increases the cost* of the exemption in terms of a larger expected debt burden.

(v) Transfers change the probability mass of the states of the world in which the exemption fully insures. If

$$f(\omega_2^*) - f(\rho_2^*) > 0$$

the probability mass decreases which makes exemption less attractive. Thus, for increasing density, more redistribution *decreases the benefits* of bankruptcy exemption.

Figure 1 illustrates our findings. Recall that the picture on the left plots consumption (the solid line) and net resources (the dashed lined) as a function of the gross endowment. The bankruptcy exemption reduces consumption in good states (because of a higher interest rate) and provides insurance in bad states. The picture on the right in Figure 1 shows how redistributive transfers and taxes affect consumption. We have specified parameters such that the agent receives transfers in all states in which he defaults. This tilts the consumption function upwards in the bad states of the world and also shifts the bankruptcy threshold to the left (the consumption function is flat for relatively smaller endowments). Whether this shift of the consumption function implies that bankruptcy is less desirable cannot be deduced from the graph immediately. This is because net resources also tilt clockwise and the interest rate changes. Furthermore, it should be clear that the interaction between the two policies crucially depends on the probability mass and the changes in marginal utility attached to the shift of the consumption functions at each level of resources.

In our model we would expect redistributive taxes and the exemptions to be substitutes in period 2. With concave utility, one would suspect that more consumption in bad states of the world raises expected utility, but that the marginal increase is lower if more is redistributed towards these states. However, we have shown that the intratemporal interactions between the two policies are relatively rich. Redistributive transfers/taxes do not only lower the marginal benefit of bankruptcy exemptions but also change the threshold at which agents declare bankruptcy and thus the cost of bankruptcy exemption in terms of higher interest rates. We have shown that one crucial determinant of the sign of the policy interaction is the shape of the probability distribution, in particular the importance of increasing density and decreasing hazard. Such a shape of the probability distribution is of interest because decreasing hazard and increasing density are properties on the support left of the mode of realistic and commonly used log-normal distributions. We would expect that bankruptcy exemptions are relevant especially in that region of the support.

In Remark 2 we have derived comparative statics analyzing τ. A similar exercise could be performed by exploring changes in ρ^+. The insights are similar and are relegated to Appendix A.3 below.

The model does not allow either policy to affect the other's deadweight loss. It would be easy to model this interaction, for example, if we allowed for endogenous labor supply that is distorted by both policies. However, even with separable preferences over consumption and leisure, the sign of the interaction then depends on the sign and size of third-order derivatives of the utility function with respect to consumption and leisure. Thus, we abstract from such interactions for clarity.

We have shown under what conditions intratemporal redistribution in the second period makes exemption levels granted by bankruptcy laws less attractive. We now analyze how these policies interact 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. In particular, more borrowing increases the size of the interval $(\rho_2^*; \omega_2^*)$ in which bankruptcy provides full insurance. Thus, depending on how redistributive are taxes or how the bankruptcy exemption changes the borrowed amounts, the exemption may become more or less attractive in period 2.

2.2 Intertemporal smoothing and policy substitutability

The exemption of income in bankruptcy procedures and redistributive taxation do not only interact in terms of providing insurance in the second period. In our model, exemption levels are more important if resources are quite unequal intertemporally whereas redistribution through taxation is more effective if inequality is intratemporal. Of course, the interesting case has both intra- and inter-temporal inequality. In this case, intra-temporal redistribution can eliminate part of the inter-temporal inequality and thus the need for bankruptcy regulation. Redistributive taxation then affects the smoothing motive and thus also the welfare gains derived from the exemption levels. In the next two subsections we analyze this interaction in more detail. We first derive analytic results conditioning on the interest rate r_2. This is useful in order to better understand the subsequent numerical example in which we allow the interest rate to adjust.

We want to show that compressing the distribution of net income reduces the desire to borrow for agents who expect higher gross income in the future. To make this point formally, we characterize the amount borrowed when the Euler equation

$$u'(\widetilde{\omega}_1 + b_1) = \beta(1 + r_2) \int_{\varepsilon_2^*}^{\infty} u'(\underbrace{\mu + \varepsilon_2 - (1 + r_2)b_1}_{=\rho_2} - \tau(\rho_2 - \rho^+))dF(\varepsilon_2) \tag{10}$$

is satisfied (implicitly we assume that the parameters are such that agents find it optimal to borrow because they are impatient enough or anticipate higher future income). Recall that $\omega_2 = \mu + \varepsilon_2$ and that the amount borrowed is only repaid above the bankruptcy threshold ε_2^* (the effect of borrowing on the margins of the integral in (4) cancel in the derivation of equation (10)). The bankruptcy threshold is defined as

$$\varepsilon_2^* = \frac{x - \tau\rho^+}{1 - \tau} + (1 + r_2)b_1 - \mu$$

This threshold depends negatively on expected income in the second period, μ. We show:

Remark 3: *For a given interest rate* r_2

- $db_1/dx|_{r_2} > 0$;
- $db_1/d\tau|_{r_2} < 0$ *if intertemporal resources are compressed (*$\rho^+ > \rho_1$*,* $\rho_2 > \rho^+$*) and all agents with resources less than the exemption level receive transfers (*$\rho^+ \geq x$*).*

Proof: see Appendix A.1.

The sign of the derivatives is intuitive. A higher exemption level x insures the agent in the bad states of the world in period 2: he will repay the debt only for relatively higher endowment realizations when the cost of repayment in marginal-utility terms is smaller. As is well known, this makes borrowing more attractive (see, for example White, forthcoming).

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; and transfers in the first period lower marginal utility. Both effects make borrowing less attractive. Furthermore, if a larger τ decreases the bankruptcy threshold ε_2^*, for $\rho^+ > x$, debt is repaid in states with higher marginal utility which makes borrowing less attractive.

Intuitively, if redistribution through taxes and transfers decreases intertemporal inequality, the desire to borrow falls.[6] This lowers the welfare gains derived from the exemption x. Formally, the interval in which the bankruptcy exemption provides insurance in the second period depends positively on b_1. In the extreme case in which taxes and subsidies completely align the marginal utility of present consumption with the discounted expected marginal utility of future consumption, agents do not borrow and bankruptcy exemption is useless. We now provide a numerical example on the policy interaction allowing for borrowing b_1 and the interest rate r_2 to be jointly determined.

2.3 Numerical solution

We have shown under what conditions redistributive taxation and the bankruptcy exemptions are substitutes. However, for the derivations on the intratemporal insurance motive in period 2 we have conditioned on the amount borrowed b_1 whereas for the derivations on the intertemporal smoothing motive in period 1 we have conditioned on the interest rate r_2. With both b_1 and r_2 endogenous, an interpretable analytic solution is no longer obtainable

[6] The same holds for saving as shown in Appendix A.2.

unless strong assumptions are imposed on the utility function, such as constant absolute risk aversion. This section numerically illustrates the period 1 equilibrium for constant relative risk aversion utility:

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}. \tag{11}$$

Moreover, we compute the indirect utility of a borrowing agent as a function of the policy parameters in order to show how the optimal exemption level depends on redistributive taxes and transfers.

The numerical algorithm to solve for the equilibrium in period 1 is simple: for given starting values for b_1 and r_2, we use the Euler equation (10) to iterate for the optimal b_1. We then update the bankruptcy threshold ε_2^* and use the bank's arbitrage condition (5) to solve for r_2. For the new values of b_1 and r_2, we restart the algorithm until convergence.[7]

For illustration purposes we choose an exemption level x of 90% of first-period resources which is in the range of plausible values for US states (see the data in Tables 4 and 5 and their discussion below). We assume that $\rho^+ = 0.9 = x$ so that the comparative statics for taxes τ in Remark 3 apply and set the marginal tax rate $\tau = 0.2$ which equals the mean marginal tax rate for Texas (see Table 5). We assume a rather small bankruptcy cost C of 1.5% in terms of first-period resources. Finally, the coefficient of relative risk aversion $\sigma = 2$, which is well in the range of commonly used values. The parameters are chosen in order to illustrate the main qualitative insights of our stylized model for borrowing agents rather than seriously attempting to calibrate a more comprehensive model to US data. With the chosen parameters, borrowing is optimal (the agent is impatient and expects his income to rise 40 percent in the second period). Instead the decreasing hazard condition of Remark 1 is certainly violated, since ε_2 is assumed to be normally distributed. Nonetheless, the results of Remark 1 and 2 continue to hold in the numerical example below, making explicit that this decreasing hazard condition is sufficient but not necessary.

Table 1 summarizes the equilibrium values of interest for the benchmark parametrization in column (1). Columns (2)-(6) display the results when we change some of the parameters. Since the first period endowment $\omega_1 = 1$, borrowing is expressed as a fraction of it. In the benchmark case, the agent borrows an amount equivalent to 19% of these resources

[7] The equilibrium need not always exist. If the exemptions x are so high that the agent is certain to default, there is no interest rate which clears the market. Moreover, note that in the numerical algorithm we do not explicitly check whether the government budget constraint is balanced. This would not add any new insight since the constraint could always be satisfied by making a suitable assumption about the distribution of initial assets.

and defaults on the debt with a probability of 0.014, which is close to empirically observed frequencies as mentioned in the Introduction. Although the default rate is small, the interest rate on the debt is 0.032, which is 60% higher than the risk-free rate r_f.

In column (2) of Table 1, we increase marginal taxes/transfers to $\tau = 0.25$, approximately the mean marginal tax rate of US states like Maryland or Minnesota (see Table 5 below). In our numerical example there are two effects. More redistribution through transfers/taxes decreases the amount borrowed (as pointed out in Remark 3) and thus the default probability, but agents are taxed for some endowments where they partially default. Thus the bank appropriates less in the case of default and overall the interest rate increases slightly in this example, despite lower frequency of default.

Column (3) shows that a fall in the exemption level to $x = 0.85$ leaves the amount borrowed nearly unchanged and does not decrease it as in the comparative statics of Remark 3. The reason is that in our numerical example, the lower exemption level decreases the probability of default by so much that the interest rate falls substantially. The resulting wealth, income and substitution effects make borrowing more attractive and cancel the direct negative effect on borrowing.

In column (4) we lower expected second-period income. Not surprisingly, the direct effect is that borrowing decreases as mentioned in Remark 3. This effect is strengthened by an indirect effect: the less plentiful resources in the second period imply a higher probability of default so that the interest rate rises. 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 although the effects are quantitatively small. Finally, in column (6) we decrease the risk aversion of the agent. Not surprisingly, this increases the amount borrowed, the probability of default and thus also the interest rate.

After having characterized the equilibrium numerically, we are interested in computing the optimal exemption level based on the indirect utility function of the borrower in period 1. We consider the benchmark case with $\tau = 0.2$ and the case of higher marginal taxes/transfers $\tau = 0.25$. It turns out that higher marginal taxes/transfers decrease the optimal exemption level from $x^* = 0.871$ to $x^* = 0.845$. The implied elasticity is -0.12. This confirms the conditional results of Remarks 2 and 3 which showed qualitatively how redistribution through the tax system can lower the welfare gains derived from bankruptcy exemption through an intra- and intertemporal effect.

2.3.1 The role of shock persistence

In models with more than two periods, the persistence of shocks will affect the tradeoff between the two policies; redistributive taxes and bankruptcy exemptions. In a previous version of the paper we extended the model to three periods maintaining the assumption that bankruptcy has no effect on access to the credit market beyond the current period (that is, there are no dynamic costs of bankruptcy such as exclusion from the credit market in future periods).[8]

We found that as shocks become more persistent, bankruptcy becomes more attractive for a given level of debt and a given interest rate. However, increasing the persistence of shocks also makes the asset market less useful in smoothing consumption over time (see Deaton, 1991). Moreover, higher persistence makes banks less willing to lend if they know that bad shocks persist in the next period and thus negatively affect expected repayment behavior. Overall, increasing persistence has an ambiguous effect on the optimal exemption level. We further find that the overall effect of persistence on the optimal exemption level is mitigated if more pronounced redistribution through taxes and transfers already provides some insurance.

Assuming dynamic costs of bankruptcy instead, Athreya and Simpson (2003) find a negative welfare effect of bankruptcy exemptions because exemptions exacerbate the moral hazard problem of unemployed agents. Athreya and Simpson show in their calibration that more persistent shocks make bankruptcy less costly. Similarly, calibrating a life-cycle model, Livshitz *et al.* (2004) find that bankruptcy decreases welfare if income shocks are transitory but, in contrast to Athreya and Simpson, they find that bankruptcy increases welfare if shocks are persistent. Thus, whether and how persistence changes the attractiveness of bankruptcy is an empirical issue. Unfortunately the available US data did not allow us to construct a measure for shock persistence that varies across states and over time. Hence we leave this issue for future research.

We do not explicitly model how the interaction of the two policies analyzed above translate into policy choices. This would be straightforward if we modelled policy choices in a probabilistic voting model in which agents decide about policies once and for all in period 1 (however, one should be careful with normative conclusions, since we treat the respective

[8]See Chaterjee *et al.* (2002) or Livshits *et al.* (2004) for dynamic models of bankruptcy including such costs. Empirical evidence by Musto (1999) or Staten (1993) suggests, however, that a substantial fraction of agents has access to credit in the year immediately after bankruptcy although the stored bankruptcy information seems to constrain borrowing behavior to some extent.

deadweight losses of the two policies as exogenous in our model). If agents with liabilities in period 1 have the full weight in such a model, all of the insights above immediately translate into a model of policy choice. This is not unrealistic since the median household in the US states holds unsecured debt (see the empirical part below for further details).

Ultimately, it is an empirical question whether redistributive taxation and bankruptcy exemption are substitutes and if so whether their effect on the inter- and intratemporal insurance motives highlighted by our model can explain why. In particular, we will now investigate empirically whether both policies matter for consumption insurance and the level of unsecured household debt.

3 Data

We have provided a model that has described channels of interaction between redistributive taxation and the level of bankruptcy exemption. We now provide empirical evidence using interesting variation of the two policies across US states in the period 1980-2003, but first we discuss the data sources and the econometric specification. Using various data sources, we construct a sample of state-year cells (except in our debt equations where we use the household level data). We only mention the most important issues concerning our empirical application and refer to Appendix B for more detailed information on the data sources.

When constructing year-state cells we restrict the sample to those households for whom complete state information is available and where the head is aged between 30 to 60. Moreover, farming households are excluded since they have their own bankruptcy regulations. As frequently done in the literature, we also exclude the self-employed since differences between business and personal income are hard to distinguish. Furthermore, we are interested in consumer's risk and not entrepreneurial risk and self-employed households have motivations for borrowing other than to smooth consumption. For confidentiality reasons, state information is sometimes suppressed in the survey and in some states relatively few households are sampled. Hence, to ensure that there are enough observations used to construct each cell, our sample only contains households resident in the 18 largest US states. Appendix B lists the included states, which cover the full range of US states in terms of geography, taxes and bankruptcy exemptions.

We use the Consumer Expenditure Survey (CEX) to construct a measure of non-durable consumption and debt for each household. Our measure of unsecured debt uses separate questions that were asked about debts held in revolving credit accounts (including store, gasoline, and general purpose credit cards), in installment credit accounts, credit at banks or savings and loan companies, in credit unions, at finance companies, unpaid medical bills, and other credit sources. Our measure also includes negative balances held in checking or brokerage accounts. We sum these different sources of unsecured credit to construct gross unsecured debt for each household.[9] Excluded from the total are mortgage, and other secured debts so that the debts analyzed differ from those in Gropp *et al.* (1997). This is important because the impact of bankruptcy exemptions on secured and unsecured debt ought to be very different (see Berkowitz and Hynes, 1999). While mortgage (and other secured) debt is also likely to be important for the household, the creditor has an additional claim to such assets and can always recover the house (or other security) if the debtor defaults. The housing, or other exemption will not affect the creditors rights in this case, and hence it does not make sense to include such debts in the analysis. Consumption and debt have been deflated by a consumer price index and are in real 1984 dollars. The mean level of debt in the survey is $2,151 (the median is $331, while the 75th percentile is $2,211). Around 60 percent of people hold at least some unsecured debt, and this proportion is similar across all states (see the last column in table 5). Thus the median household in each state holds at least some unsecured debt.

Information on household level income and transfers is obtained from the March supplement of the Current Population Survey (CPS). To measure the level of income taxes that each household pays, we exploit the TAXSIM 4.0 program developed by Freenberg (see Freenberg and Coutts, 1993, for details) that is available from the NBER. We construct two alternative measures of the tax system which account for both federal and state level legislation on income taxes and transfers: the mean marginal tax rate and an 'income-compression measure' that compares the inequality of gross with net income.[10] We prefer the latter measure because it better accounts for transfers and the different tax rates among agents even within the same state (see Appendix B for details).

Using legislative data we construct the bankruptcy exemption level for each household in the CEX sample, which we normalize by dividing the exemption by average income in each state-year cell. While bankruptcy law is regulated at the federal level, congress allowed each state to set its own exemption level (those assets, up to some maximum value, that are

[9]We concentrate on gross rather than net unsecured debt because this is the amount that is not repaid in bankruptcy.

[10]We also experimented with an inverse poverty index which was defined as one minus the proportion of households whose after-tax and transfer income is below half the median. The results presented below were robust to using this alternative measure.

exempt from seizure by the creditor when the debtor filed for Chapter 7 bankruptcy). Thus, state and federal legislation caused exemption levels to differ across household types, across states, and across time. We exploit this variation to identify the effect of these exemptions on consumption insurance and unsecured debt holdings.

Table 5, discussed further in Appendix B, shows how much both taxes and the exemptions vary across states. Taking federal and state taxes together, redistribution through the tax and transfer system (using the income compression measure) is over a third higher in New York than in Texas. The table also shows the large differences in the exemption level between generous states, such as Texas, and stricter states like Maryland. The last column shows that the median household in each state always holds unsecured debt, which justifies our focus on borrowers in the theory section.

Our merged data set contains unsecured debt, consumption, consumption growth, bankruptcy exemption levels and tax redistribution for households in 18 US states during the period 1980-2003.[11] Our debt regressions use the household level data, but for the other regressions we aggregate the data into 420 state-year cells (we include all states with an average cell-size of at least 60 - although some states are not identified in the first year or two of the CEX). This aggregation is necessary to construct measures for consumption inequality.

We construct for each state-year cell both the standard deviation of log consumption and of consumption growth as a measure for consumption insurance. The standard deviation of consumption measures the cross-sectional level of consumption inequality. This is a rather imperfect way to proxy consumption insurance because it does not distinguish between *ex-ante* and *ex-post* inequality. However, Deaton and Paxson (1994) noted that if markets are complete then the cross-sectional distribution of consumption inequality should not change over time for a group with fixed membership. They rejected this implication of full insurance using US data. 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 risk sharing. While Deaton and Paxson looked at the change in the cross-section of consumption inequality, the same implications arise for the standard deviation of consumption growth. That is, if markets are complete, consumption should increase for all households by the same amount. Hence if consumption is growing by different amounts for different households (in which case the variance of consumption growth is positive), then we can

[11]For unsecured debt, we only have data from 1988, the first year for which these data are included in the CEX.

again reject complete insurance and moreover, we know that markets provide less insurance if the variance of consumption growth is larger. Thus, we compute consumption growth taking the difference between the household's level of log-consumption in the fifth interview from the level of log-consumption in the second interview (the household is interviewed five times in successive quarters in the CEX survey, but no information is released from the first interview). This measure solves the problem that states may differ in *ex-ante* within state consumption inequality.

4 Econometric specification

We estimate three different sets of equations with different dependent variables but otherwise similar controls. The first regresses unsecured household debt against household characteristics, the bankruptcy exemptions, and, in separate regressions, the two different measures of the tax system. This investigates the effect of the two policies on the intertemporal smoothing motive. We also regress proxies for consumption insurance against the policy variables. This quantifies the importance of the two policies in providing consumption insurance. Finally, we investigate the relationship between the exemption levels and our measures for tax/transfer redistribution in order to discover whether these two policies are substitutes.

Of course, these specifications do not exploit all the theoretical implications that were explored, due to the limited number of observations in our data (we only have up to 420 state-year cells and, in some cases, only 60 observations in each cell). However, the reduced-form regressions allow us to investigate whether the data are broadly consistent with our theoretical hypotheses.

The consumption insurance regressions on the state-year cells take the form:

$$y_{st} = \beta_0 + \beta_1 \tau_{st} + \beta_2 x_{st} + f_s + \varepsilon_{st} \tag{12}$$

where as before s is the state, t is the time period, τ is the measure for redistribution through the tax system, x is the bankruptcy exemption level and y_{st} denotes the dependent variable. The error is composed of a state fixed effect f_s and an idiosyncratic component ε_{st}. Since the dependent variable is the standard deviation of consumption (or consumption growth), we have removed the between state variation in consumption. This variation would affect the mean level of consumption in each state, and is removed when constructing the standard deviation. The state fixed effects capture fixed differences over time in the within state consumption inequality: they control for all remaining unobserved heterogeneity across states that is not accounted for by the policy variables. For instance, in the regression using the standard deviation of consumption growth rates, including state fixed effects controls for differences across states in the variance of permanent income shocks. The state fixed effects are 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.

We use the CEX to construct our measure of consumption and the CPS for our measure of the tax system. This has a number of advantages. Since the CPS is a larger survey than the CEX, cell averages are measured more precisely so that the small sample bias is reduced. Moreover, if both measures had been taken from the same sample, measurement error of the dependent variable and the regressor would be correlated. This would not only bias the estimates but the bias in general would have an ambiguous sign. Constructing the cell averages using different data sets circumvents this problem.

4.1 Instrumental Variables

Another estimation issue of equation (12) is that the policy variables may change at the same time as the dependent variables, as is well known in the literature (see for example Besley and Case, 2000). If a state is hit by a productivity shock, for example, this is likely to affect the state's budget (and hence tax requirements) but also gross income of the households in that state and their level of consumption. Thus, we need to use instruments that can predict the policy variable τ but do not affect the dependent variable. Instead, we do not instrument the bankruptcy exemptions for two reasons. Changing the exemptions does not directly affect the state budget constraint, and changes in the exemptions take longer to implement.[12] Hence it is plausible to treat the bankruptcy exemptions as predetermined in the regressions.

We experiment with two possible instrument sets: lagged values of the redistribution measures, and a set of political variables (capturing tastes rather than economic fundamentals) together with measures on the efficiency of the tax system in the state. This instrument set includes the political affiliation of the state governor and the state legislature, the relative proportion of voters in each state voting for the democratic rather than the republican party candidate in the presidential elections 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 data on these two variables are available

[12]Except the automatic updates due to inflation that the federal government and some states implement at regular intervals.

from ACIR (Advisory Commission on Intergovernmental Relations, 1993), while subsequent data are taken from Tannenwald (2002) and Tannenwald and Turner (2004), although it was necessary to linearly interpolate the two series for some years. However, these data are not available for the latest three years in our sample. A full discussion of the variables is contained in the references mentioned above.

The political variables make useful instruments because they reflect tastes for taxes, redistribution. The ACIR measures are even more natural as an instrument as they measure how efficient the state is at raising tax revenue. States that are more efficient, in the sense that a given marginal tax rate raises a higher proportion of income from households (accounting for the cost of raising the revenue, and the amount of revenue that is raised) will have a larger tax-efficiency measure using the ACIR index. Alternatively, to raise a fixed proportion of income takes less effort by the local tax authorities. 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.

5 Results

The results are contained in Tables 6 to 8. Table 6 contains regression results on the relationship between both policies and the level of unsecured household debt. Table 7 displays results on how both taxes and the exemptions are associated with the standard deviation of consumption and consumption growth. Finally, Table 8 directly looks at the correlation between the level of the bankruptcy exemptions and the tax and benefit system.

5.1 Unsecured household debt

Table 6 shows the estimates of the effect of government redistribution through taxes and transfers and of the bankruptcy exemptions on the level of unsecured debt. In column (1) we use the income compression measure and in column (2) we use mean marginal tax rates as a regressor. The regression uses household level data in 1984 prices, with unsecured debt and the exemption level in logs, or rather as the $\log(1+b)$ and $\log(1+x)$. We include and report estimates for a full set of household characteristics which control for observable heterogeneity that relates to permanent income and life-cycle circumstances and tastes among other things, and a set of state, year, and month dummies.[13]

[13]Since we include an age polynomial and a set of year dummies, this precludes using dummies for year of birth because they are not linearly independent.

Since households cannot report negative debts - such households report zero debts - estimation must solve this censoring problem. Rather than using a tobit regression, which imposes that the errors are normally distributed, we estimate the effect of taxes and of exemptions by a censored least absolute deviation (CLAD) regression as proposed by Powell (1984).[14] This semi-parametric estimator only imposes the weaker assumption that the error term in the latent regression is symmetrically distributed, and consistently estimates the median effect.[15]

The main focus of the analysis is the effect of the bankruptcy exemption and the tax system. Since we have household level data we can estimate the separate effects of the exemption on homeowners and on renters. This allows us to at least partially condition on the assets that the household owns. Hence each regression includes the exemption level, included separately for homeowners and non-homeowners, and a dummy for the unlimited homestead exemption for homeowners. This is motivated by Gropp *et al.* (1997) who showed that the effect of the bankruptcy exemptions were different for high asset households and low asset households.[16]

The estimated effect of redistribution through taxes and transfers is positive but not significant for both measures of the tax system in columns (1) and (2). This positive sign is surprising in light of Remark 3 and the numerical exercise: if taxes and transfers reduce intertemporal inequality, then increasing the amount of redistribution of the tax system should lower the need to borrow and save to smooth consumption over time. However, the estimated coefficient is not significant.

The bankruptcy exemption enters negatively for renters and positively for homeowners. However, the negative effect for renters is small (the coefficient implies that a 10 percent increase in the exemption reduces debts by 0.3 percent using the income compression measure, and 0.5 percent using the mean marginal tax rate). These small effects for renters are neither statistically nor economically significant. The estimated effect on those households who own their house is significant at the 5 percent level, and the coefficient suggests that unsecured debts increase by over 2 percent when the bankruptcy exemption increases by 10 percent. These results are qualitatively similar to those obtained by Gropp *et al.* (1997)

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[14] Results for tobit regressions are qualitatively similar for most regressors and are available on request from the authors.

[15] The true sample errors of the estimates depend on the unknown density of the errors at the median. Hence we calculate the standard errors of the estimated coefficients by bootstrapping using 100 draws.

[16] The difference in the effect of the housing and non-housing exemption on debt held by homeowners was not significant in our estimations. These results, omitted for brevity, justify adding the housing and non-housing exemptions together.

who found that the bankruptcy exemptions had a negative effect on low asset households and a positive effect on high asset households (although, in contrast to Gropp *et al.*, we only assign the housing exemption to homeowners in constructing our exemption measure).

The dummy for the unlimited homestead exemption is also positive and significant in the regression at the 5 percent level. The implied effect is that households have over 50 percent more debt if they own their own home and live in a state in which the home is fully exempt from seizure should they declare bankruptcy. However, controlling for state fixed effects, as in the regression, means that the coefficient of the unlimited homestead exemption dummy is identified only from states in which this dummy changes over time. This happened only once when Minnesota abolished the unlimited homestead exemption in 1993 and replaced it with a homestead exemption of $200,000. Hence, the coefficient of the dummy is not well identified. Given the poor identification, we will rarely comment on the estimated effect of this variable in the discussion of the results.

The effect of household characteristics is very similar for both measures of the tax system. Table 6 reports that younger households (those around 30) have more unsecured debt and that debts decline steadily with age. This is consistent with standard life-cycle models of consumer behavior in which income increases over the working life. The table also shows that better educated households have more debt. This seems reasonable since these households have higher levels of permanent income relative to current income which they might want to bring forward at the early stage of their life-cycle. However, households where the head has completed a full college degree have less unsecured debt than if the head has only had some college education. Black and female households have lower levels of unsecured debt, as do married couples. Family size increases the level of debt, but family size squared reduces it. A similar pattern is apparent for income, and our results show that debts increase with income over the range of households in our survey. The regression also includes the real risk-free municipal bond rate as a proxy for the interest rate (we do not observe the interest rate in the debt contract). The coefficient is negative but statistically insignificant.

5.2 Consumption insurance

Table 7 reports results for consumption inequality for both measures of the tax system, including state dummies to control for fixed differences across the states. Controlling for state fixed effects means that identification exploits changes in the policy variables to estimate their effect on within state inequality. Recall that taking the standard deviation removes the between group variation. Columns (1) and (5) use the standard deviation of log consumption as the dependent variable. In these regressions, market completeness would imply that neither taxes nor the bankruptcy exemptions will be significant. Hence if they are significant we will reject full insurance, as in the Deaton and Paxson test we discussed earlier.

Column (1) uses our preferred measure of the tax system, the income compression measure. In this regression both the tax system and the bankruptcy exemptions enter negatively (as predicted by our model in which markets are incomplete), but while the bankruptcy exemption is significant at the 1 percent level, the tax system is not significant. Column (5) uses the mean marginal tax rate as the measure of the tax system and in this regression the tax system and the bankruptcy exemption are both significant at the 1 percent level. In both regressions the coefficient on the unlimited homestead exemption is negative and significant (although the coefficient is only identified by the 1993 Minnesota reform).

Using the estimates in column (1), the difference between the state with the least and the state with most income compression explains one tenth of the differences in within state consumption inequality of the states in our sample (our estimates say nothing about between state inequality, which would be reflected in differences in the mean of consumption across states). Instead, taking the difference between the smallest and the largest exemption level can explain about one quarter of the differences in within state consumption inequality.

The estimated effect is sizeable, but is not implausible even though currently only 1.5 percent of US households formally file for bankruptcy each year. Firstly, we have deliberately chosen rather homogeneous groups to construct our sample (we have removed the self-employed, farmers, households over 60 or under 30, for example) and for the selected sample the cross-sectional variation in consumption is likely to be smaller than in the general population. That is, the fraction of explained variation is larger since we remove much of the variation due to differences in the underlying populations in the different states from the denominator. Secondly, although only 1.5 percent of households file for bankruptcy, substantially more households default on their debts - and bankruptcy legislation is relevant for these households since it sets the punishment they would receive if they were pursued. Moreover, around 23 percent of households in our sample receive public transfers. This means that many households directly benefit from the redistribution that results from the two policies. Thirdly, people who do not receive transfers, and do not default, are still affected by the legislation since they pay higher taxes and pay more interest. Lastly, if prudence matters, then the consumption behavior of all households is affected by the insurance that the two policies provide.

As we stated above, the inequality in consumption growth better measures the pure insurance effect of both policies, and this insurance effect is fundamentally what is of interest to us here. In particular, differences in consumption growth are less contaminated by *ex ante* consumption inequality as mentioned above. The rest of the table reports results for this regression, including state fixed effects. In the OLS regression the tax system is always significant at the 1 percent level regardless of which measure of the tax system is used. Moreover, the bankruptcy exemption is significant at the 1 percent level in column (2) and at 5 percent in column (5). The unlimited homestead exemption, while no longer significant, remains negative. However, a concern with these regressions is that taxes and income or consumption shocks may be co-determined. Given the fairly short time frames in which taxes are decided, they might respond to changes in business conditions in the state. Instead, bankruptcy exemptions are more difficult to change. Hence we attempt to instrument the tax redistribution measures using their lags, and using a set of what we call political variables which are discussed above. In all cases the rank test is passed for conventional significance levels. Instrumenting the tax measures with their second-order lags gives very similar results. Again both the tax system and the bankruptcy exemption are significant, and both reduce the variance of consumption changes, as predicted by our model with incomplete markets. Lastly, we instrument the tax measures using the political variables we discussed earlier (see columns 4 and 8). We find that taxes enter the regression significantly, but the bankruptcy exemptions are no longer significant. Moreover, when we instrument using these variables we cannot reject the over-identifying restrictions (the Sargan test was passed). In column (4), the point estimates imply that both policies have an effect of similar size, with the type of differences across the US states implying around a quarter of a standard deviation reduction in inequality growth rates when moving from a generous state to an ungenerous state in each case. Again, while this effect may seem large, we believe it is plausible for the reasons mentioned above.

These results relate to recent work by Krueger and Perri (2005) who argue that private provision of credit is enhanced if income is more uncertain; and that households have increased incentives to repay their borrowing since they value access to credit in the future. In contrast, our paper emphasises that default itself is a useful insurance mechanism in the presence of uncertainty, notwithstanding possible crowding out of private provision of credit. This is especially important if income shocks are permanent.

5.3 Redistribution and bankruptcy exemption

We have found mixed evidence on how redistribution through taxes and transfers is associated with unsecured debt but both policies seem to provide some consumption insurance. This suggests that both redistributive tax-transfer schemes and bankruptcy exemption might be substitutes according to the hypotheses put forward by the model. In Table 8 we provide more direct evidence for this hypothesis looking at the correlation between these two policies in a controlled regression framework. In column (1) of Table 8 we regress the exemption level on the income-compression measure including a set of state dummies, and a dummy for Minnesota post 1993 (which limited the housing exemption in that year). We find that the coefficient of the tax measure is negative and significant at the 1% level when we use either the income compression measure or the mean marginal tax rate. The coefficient in column (1) implies a rather small effect: the difference in tax rates between the most and least generous states would change the exemption level by roughly $100 in 1984 prices.

We also tried instrumenting the tax measures with their lags, and using the set of political variables which we described earlier. This gives similar results, see columns (2), (3), (4), (6), (7) and (8). The coefficient is significant at the 1 percent level in all these regression. The estimated coefficient is 5 times as large when we use the political variables in column (3), but changes little for the mean marginal tax rates. The regression has been estimated both with a restricted set of political instruments (including a measure on whether the state legislature was republican or democrat, and the tax efficiency measure) and with the full set of instruments discussed above. The restricted set of instruments is a natural subset since state legislatures must explicitly pass the state budget and the tax efficiency measure captures the cost of raising a particular amount of taxes. The rank test for the significance of the instruments in the first-stage regression is passed for both the restricted and full instrument set. However, the Sargan test rejects the overidentifying restrictions for the full instrument set and this for both tax measures. For the restricted set of instruments the Sargan test is passed for our preferred income compression measure of taxes. The implied elasticity of the exemption with respect to taxes (calculated at the mean) is up to -0.09 when the income compression measure is used in column (2). This number is of the same order of magnitude as for the simulation exercise in section 2.3 above.

6 Conclusion

We have shown in a simple modelling framework that bankruptcy regulation and redistributive taxation interact through the intratemporal insurance and intertemporal smoothing motive. We have provided sufficient conditions under which both policies are substitutes and search for empirical support using data on US states in the period 1980-2003. Consistent with our theoretical perspective, we have found (i) that both redistributive taxation and bankruptcy exemptions are negatively correlated with the inequality of consumption and consumption growth; (ii) that the extent of redistributive taxes and the size of the bankruptcy exemption level are negatively correlated; and (iii) at least for homeowners, the exemptions are associated with higher unsecured household debt.

In light of our results, the recent bankruptcy reform passed in the spring of 2005 should have minor effects on consumption insurance and unsecured debt. The introduced cap of \$125,000 on homestead exemption only applies to property that has been acquired in the previous 3 years, and the cap is only restrictive in quite generous states like Minnesota which allows housing property to be exempt up to a value of \$200,000. The reform mostly has changed the bankruptcy procedures which are regulated at the federal level. Households with above median income face an additional burden of proving that their 'excess' current monthly income (net of 'required' expenses) is less than \$6,000 or 25 percent of their unsecured debt. Only in these cases can households file for bankruptcy under chapter 7. However, the rather vague definitions of excess income and the possibility of households to donate up to 15% of their income to charity leave substantial room for households to endogenously change their current level of excess income. Thus, the impact of the reform depends on the enforcement of the new law by US courts. The additional administrative cost of bankruptcy filings introduced by the reform might have only mild effects: in our numerical illustration in Table 1, column (5), a change in the deadweight cost C borne by the bank from 1.5 to 5 percent of current income has only a small effect on the equilibrium.

Our results suggest that the variation redistributive taxation and personal bankruptcy regulation in the US states can be rationalized within a simple economic model. Although normative conclusions cannot be drawn with the currently available data, the results of the regressions with instrumental variables suggest that there is an interesting policy trade-off in that bankruptcy exemption is less effective in increasing welfare if redistributive taxation is already pronounced. Such a trade-off is not only relevant for US states but also for many other developed countries. As surveyed by Tabb (2005) many European countries such as France and Germany with substantial public welfare programs have recently introduced legislation which allows consumers to declare bankruptcy. Given the tradeoff we investigate, the additional insurance provided by these reforms is unlikely to be important since welfare spending is already substantial in these European countries.

Appendices

Appendix A: Proofs and extensions

Appendix A.1: Proofs of the Remarks

Proof of Remark 1:

Define $\omega_2^+ \equiv \rho_2^* + C/(1-\tau)$. Then

$$\frac{d\left(\frac{dr_2}{dx}|_{b_1}b_1\right)}{d\tau} = \frac{\frac{\partial\omega_2^*}{\partial\tau}f(\omega_2^*) - \frac{\partial\omega_2^+}{\partial\tau}f(\omega_2^+) + \frac{C}{1-\tau}\frac{\partial\omega_2^*}{\partial\tau}f'(\omega_2^*) + \frac{C}{(1-\tau)^2}f(\omega_2^*)}{(1-F(\omega_2^*)-Cf(\omega_2^*))} - \frac{\left(F(\omega_2^*)-F(\omega_2^+)+\frac{C}{1-\tau}f(\omega_2^*)\right)\left(-\frac{\partial\omega_2^*}{\partial\tau}f(\omega_2^*) - C\frac{\partial\omega_2^*}{\partial\tau}f'(\omega_2^*)\right)}{(1-F(\omega_2^*)-Cf(\omega_2^*))^2}.$$

The sign of this derivative depends on the numerators which can be rearranged to

$$\begin{aligned}&\frac{\partial\omega_2^*}{\partial\tau}f(\omega_2^*)\left(1-F(\rho_2^*+C)\right)\\ &-\frac{\partial\rho_2^*}{\partial\tau}f(\rho_2^*+C)\left(1-F(\omega_2^*)\right)\\ &+\xi(C)\ ,\end{aligned}$$

where $\xi(C)$ contains all the other terms and $\xi(0)=0$. Thus

$$\frac{d\left(\frac{dr_2}{dx}|_{b_1}b_1\right)}{d\tau} > 0$$

if

$$\frac{\partial\omega_2^*}{\partial\tau}\frac{f(\omega_2^*)}{1-F(\omega_2^*)} > \frac{\partial\rho_2^*}{\partial\tau}\frac{f(\rho_2^*)}{1-F(\rho_2^*)}$$

and $C=0$. If $x<\rho^+$ implies $\partial r_2/\partial\tau<0$, then $\partial\omega_2^*/\partial\tau<\partial\rho_2^*/\partial\tau<0$ (conditional on b_1). Then a necessary condition for the inequality above to hold is

$$\frac{f(\rho_2^*)}{1-F(\rho_2^*)} > \frac{f(\omega_2^*)}{1-F(\omega_2^*)}.$$

For $\partial r_2/\partial\tau>0$ this inequality is even a sufficient condition. ■

Proof of Remark 2:

Totally differentiating (8) for given b_1,

$$
\begin{aligned}
\frac{d\left(\frac{du_2^b}{dx}|_{b_1}\right)}{d\tau} \quad = \quad & -\frac{d\left(\frac{dr_2}{dx}|_{b_1}b_1\right)}{d\tau}(1-\tau)\int_{\omega_2^*}^{\infty} u'(\widetilde{\rho}_2(\omega_2))f(\omega_2)d\omega_2 \\
& +b_1\frac{dr_2}{dx}|_{b_1}\int_{\omega_2^*}^{\infty} u'(\widetilde{\rho}_2(\omega_2))f(\omega_2)d\omega_2 \\
& +\frac{dr_2}{dx}|_{b_1}b_1\int_{\omega_2^*}^{\infty}(\rho_2(\omega_2)-\rho^+)\ u''(\widetilde{\rho}_2(\omega_2))f(\omega_2)d\omega_2 \\
& +\frac{dr_2}{dx}|_{b_1}b_1\ \frac{\partial\omega_2^*}{\partial\tau}u'(x)f(\omega_2^*) \\
& +\left(\frac{\partial\omega_2^*}{\partial\tau}f(\omega_2^*)-\frac{\partial\rho_2^*}{\partial\tau}f(\rho_2^*)\right)u'(x)\ .
\end{aligned}
$$

where

$$
\frac{\partial\omega_2^*}{\partial\tau} < \frac{\partial\rho_2^*}{\partial\tau} \leq 0\ ,
$$

if the agent receives transfers at the bankruptcy threshold. We assume that redistribution is such that agents pay taxes if they are able to repay their debt in full: $\rho_2(\omega_2)-\rho^+ > 0$, for $\omega_2 > \omega_2^*$.

Now recall that the sufficient condition of Remark 1 implies for negligible bankruptcy cost ($C = 0$), that $d\left(\frac{dr_2}{dx}|_{b_1}b_1\right)/d\tau > 0$. If agents cannot tax deduct their debt then the second line of the derivative vanishes (which otherwise would be positive). Furthermore, given that $dr_2/dx|_{b_1} > 0$ and utility is strictly concave, $u''(\bullet) < 0$, we then know that the third and fourth line of the derivative are negative. If the density is increasing, $f(\omega_2^*) > f(\rho_2^*)$, then also the fifth line is negative so that the derivative can be unambiguously signed to be negative. ■

Proof of Remark 3:

Define net resources in the first period as $\widetilde{\rho}_1 = \rho_1 - \tau(\rho_1-\rho^+)$. Totally differentiating the Euler equation (10) we find

$$
\frac{db_1}{dx}|_{r_2} = -\frac{\frac{\beta(1+r_2)}{1-\tau}u'(x)f(x)}{u''(\widetilde{\rho}_1+b_1)+\beta(1+r_2)^2(1-\tau)\left\{\int_{\varepsilon_2^*}^{\infty}u''(\widetilde{\rho}_2)dF(\varepsilon_2)+u'(x)f(x)\right\}} > 0
$$

$$
\frac{db_1}{d\tau}|_{r_2} = -\frac{(\rho^+-\rho_1)u''(\widetilde{\rho}_1+b_1)+\beta(1+r_2)(\rho_2-\rho^+)\left(\int_{\varepsilon_2^*}^{\infty}u''(\widetilde{\rho}_2)dF(\varepsilon_2)+\overbrace{\frac{\partial\varepsilon_2^*}{\partial\tau}}^{\leq 0\ if\ x\leq\rho^+}u'(x)f(x)\right)}{u''(\widetilde{\rho}_1+b_1)+\beta(1+r_2)^2(1-\tau)\left\{\int_{\varepsilon_2^*}^{\infty}u''(\widetilde{\rho}_2)dF(\varepsilon_2)+u'(x)f(x)\right\}}.
$$

The Euler equation implies that b_1 is optimally chosen. Thus, the derivative of the Euler equation with respect to b_1 is negative for strictly concave utility functions. Therefore the denominator of all total derivatives is negative so that $db_1/dx|_{r_2} > 0$.

A larger τ is more likely to decrease b_1 if it compresses the resources in period 1 and period 2: $\rho^+ > \rho_1$ and $\rho_2 > \rho^+$; and certainly so if $\rho^+ \geq x$. ■

Appendix A.2: Algebra for savers

Utility of savers

For agents who decide in period 1 to hold assets a_1, expected utility in period 2 is

$$u_2^s = \int_{-\infty}^{\infty} u([\omega_2 + (1 + r_f)a_1]\,(1 - \tau) + \tau\rho^+)f(\omega_2)d\omega_2$$

where a_1 are the assets the agent carries from period 1 to period 2 and r_f is the exogenous risk-free world interest rate. Note that the utility of savers only depends on taxes but is unaffected by the exemption x for given a_1.

Lending and redistributive taxation and transfers:

How does τ affect agents who hold positive assets a_1? In this case the Euler equation is

$$u'(\widetilde{\rho}_1 - a_1) = \beta(1 + r_f)\int_{-\infty}^{\infty} u'(\underbrace{\mu + \alpha\varepsilon_1 + \varepsilon_2 + (1 + r_f)a_1}_{=\rho_2} - \tau(\rho_2 - \rho^+))dF(\varepsilon_2)$$

It is easy to show that $da_1/d\tau|_r < 0$ if a larger τ compresses intertemporal resources. For this to be the case, agents have to receive transfers in period 2 and pay taxes in period 1 ($\rho^+ > \rho_2$, $\rho_1 > \rho^+$; the effect on the bankruptcy threshold obviously is absent here). To derive this we totally differentiating the Euler equation above to find

$$\frac{da_1}{d\tau}|_{r_2} = -\frac{(\rho_1 - \rho^+)\,u''(\widetilde{\rho}_1 - a_1) - \beta(1 + r_f)(\rho_2 - \rho^+)\int_{-\infty}^{\infty} u''(\widetilde{\rho}_2)dF(\varepsilon_2)}{u''(\widetilde{\rho}_1 + b_1) + \beta(1 + r_f)^2(1 - \tau)\int_{-\infty}^{\infty} u''(\widetilde{\rho}_2)dF(\varepsilon_2)}\,.$$

Appendix A.3: Further derivations of equations

Derivation of $dr_2/dx|_{b_1}$

Total differentiating equation (5), plugging in ω_2^* and rearranging, we get

$$\begin{aligned}
&\left((1 - F(\omega_2^*))\left(b_1 + (1 + r_2)\frac{\partial b_1}{\partial r_2}\right) - C\frac{\partial \omega_2^*}{\partial r_2}f(\omega_2^*) - \frac{\partial b_1}{\partial r_2}(1 + r_f)\right)dr_2 \\
&+\left((1 - F(\omega_2^*))\left(\frac{\partial b_1}{\partial x}\right) - \left(F(\omega_2^*) - F(\rho_2^* + \frac{C}{1 - \tau})\right) - C\frac{\partial \omega_2^*}{\partial x}f(\omega_2^*) - \frac{\partial b_1}{\partial x}(1 + r_f)\right)dx \\
= \;& 0.
\end{aligned}$$

Noting that

$$\frac{\partial \omega_2^*}{\partial x} = 1/(1-\tau) + (1+r_2)\frac{\partial b_1}{\partial x}$$

and

$$\frac{\partial \omega_2^*}{\partial r_2} = b_1 + (1+r_2)\frac{\partial b_1}{\partial r_2},$$

we find the expression $dr_2/dx|_{b_1}$ displayed in the text.

Derivation of $du_2^b/dx|_{b_1}$**:**

$$\begin{aligned}
\frac{du_2^b}{dx}|_{b_1} &= -b_1\frac{dr_2}{dx}|_{b_1}\int_{\omega_2^*}^{\infty} u'((1-\tau)\rho_2(\omega_2)+\tau\rho^+)f(\omega_2)d\omega_2 \\
&\quad + \left(\frac{\partial \omega_2^*}{\partial x} + \frac{\partial \rho_2^*}{\partial x}\right)(u(x)-u(x))\,f(\omega_2^*) \\
&\quad + (F(\omega_2^*) - F(\rho_2^*))\,u'(x)
\end{aligned}$$

which simplifies to the expression in the text.

Derivation of $d\left(du_2^b/dx|_{b_1}\right)/d\rho^+$**:**

$$\begin{aligned}
\frac{d\left(\frac{du_2^b}{dx}|_{b_1}\right)}{d\rho^+} &= -\frac{d\left(\frac{dr_2}{dx}|_{b_1}b_1\right)}{d\rho^+}(1-\tau)\int_{\omega_2^*}^{\infty} u'(\widetilde{\rho}_2(\omega_2))f(\omega_2)d\omega_2 \\
&\quad -\tau\frac{dr_2}{dx}|_{b_1}b_1\int_{\omega_2^*}^{\infty} u''(\widetilde{\rho}_2(\omega_2))f(\omega_2)d\omega_2 \\
&\quad -\frac{\tau}{1-\tau}\frac{dr_2}{dx}|_{b_1}b_1\; u'(x)f(\omega_2^*) \\
&\quad -\frac{\tau}{1-\tau}\left(f(\omega_2^*) - f(\rho_2^*)\right)u'(x)
\end{aligned}$$

It is easy to see that

$$\frac{d\left(\frac{dr_2}{dx}|_{b_1}b_1\right)}{d\rho^+} > 0$$

under analogous conditions as for $d\tau$. Thus everything is much the same qualitatively but for the effect in the second line: a larger ρ^+ implies less taxation in the good states, thus the marginal-utility cost of exemption in terms of interest payments decreases. Of course, the effect of tax-deductible debt is not present here.

Appendix B: Data Appendix

The Consumer Expenditure Survey (CEX) 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 this 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. As the survey records detailed information on individual 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. Since 1988, households have also been asked detailed questions about their financial position, and in particular about all their outstanding *unsecured debt* (which includes specific and separate questions on credit-card debt, debt on store cards, bank debt, debt at savings and loans companies, credit unions, finance companies and other sources, and medical debt). While each household is interviewed 5 times, questions about unsecured debt are only asked in the second and fifth interview. We only use information of one of these interviews (to avoid issues concerned with correlation across observations) and deflate the debt data by average incomes in the state that year (measured from the CPS). Consumption, on the other hand, was deflated using a household specific Stone-Geary price index for non-durable expenditure so that it is in 1984 dollars. Given the detail of the questionnaire, the information on debt in the CEX is of comparable quality as in the more widely used Survey of Consumer Finances (SCF). Moreover, the CEX contains state information while the Survey of Consumer Finances only provides state information in a single year, 1983. In the CEX, the median debt in the whole sample is $736 for the period 1988-93, and 68% of households hold at least some debt. Conditional on holding debt, the average debt is $3,984, similar to estimates in Cox and Jappelli (1993) based on the SCF.

We explained in the main text that only the 18 largest states were included in the analysis because for the other states the CEX survey has too few observations to sensibly construct cell averages for consumption or consumption growth. Our sample is limited to states which average at least 60 observations in each cell. The states thus included are: California, Colorado, Florida, Georgia, Illinois, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New York, New Jersey, Ohio, Pennsylvania, Texas, Virginia, Washington and Wisconsin.

Information on household level income and transfers is obtained from the March supplement of the Current Population Survey (CPS). This survey is also managed by the BLS, and 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. The CPS has the advantage of being a much larger survey than the CEX. The CPS also contains information on transfers such as 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. Some summary statistics of the annual amount that households receive are reported in Table 2. It 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 (in current dollars). The average wage among wage-earners was slightly higher at $36,800. On average the households in the sample received just under $1,000 of public transfers. Among the 23 percent of households that received at least some income, this transfer income was much larger, at $4,250. The table also shows some of the most important components of this transfer income. For example, if agents receive 'social security', average transfers amount to $6,600, although less than four percent of households receive this category of transfer. The most common transfer are unemployment benefits or worker compensation, where an average amount of about $2,700 is received by more than 13% of households. Among all households in the sample, the average level of unemployment benefit was around $350 and this amounts to more than one third of all the received public transfers.

Measuring redistribution of the tax-transfer system

Constructing a measure of the tax system in each state is not trivial and we need to address a number of problems. US households are subject to taxes levied at the federal and state level, by county administrations, and by schoolboards. These taxes include income taxes, sales taxes, property taxes and duty. We concentrate on income taxes which are raised at both the federal and state level, but we do not include property and sales taxes in our measures of the tax system since they are largely levied at the county, schoolboard and city level which we cannot 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 each household within a state if cross-border shopping takes place. However, we do not believe that excluding sales taxes is problematic since the expenditures recorded in the CEX exclude sales taxes, making the consumption measure comparable across states.

Table 3 shows the *federal tax schedule* in 1998. The marginal tax rate varies from 15% for single filers whose income is below $26,250 to 39.6% for incomes over $288,350. The income at which these rates apply are slightly lower for couples filing separately, while if the couple files jointly the brackets start 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% of the low-income households paid no federal income tax. Furthermore, in 1987, the number of brackets was considerably reduced.

Taxes also vary considerably across states and over time. As an example, columns two, three and four of Table 5 display the 1998 tax rates applicable in some of the largest US states. Over the entire US, eight states, including Texas and Florida in the table, do not levy any state income tax. The other states have a variety of income tax brackets that differ in their progressivity. 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). For example, in California, the lowest tax bracket is at one percent, and the highest is at 9.3 percent. In contrast, other states like Pennsylvania levy a flat-rate income tax of 2.8 percent and there is no tax-exempt income. Other states allow some income to be exempt from tax and these tax exemptions can sometimes be quite large. For example, Minnesota allows the first $2,900 to be exempt for single filers. A few states, such as California, have a tax credit rather than a level of exempt income.

To construct the level of income taxes paid by each household, we exploit the TAXSIM 4.0 program. This program uses a variety of household variables, taken from the CPS, which includes the husband's and wife's earnings, interest, dividends and other income, and information about the household's characteristics (such as the number of dependent children) and other deductibles (like property costs) as well as the year and state of residence as inputs. It uses these variables to calculate 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 these tax liabilities, the problem is to summarize the tax system in each state and in each year. One commonly used measure is the mean marginal tax rate (accounting for both federal and state income taxes). Table 5 shows how mean marginal tax rates vary across some of the largest states. Texas and Florida have the lowest tax rates of 19 percent since these states have no state income tax and only pay federal income tax. Tax rates are higher in Maryland and Minnesota, at around 25 percent, reflecting the higher level of the state-income tax.

However, the mean marginal tax rate is a rather unattractive measure since it does not allow us to capture the substantial heterogeneity in marginal tax rates across agents each year even in the same state. For example, a mean marginal tax rate of 20 percent could be due to a uniform marginal tax rate of 20 per cent, or to the top 20 percent of the population having a rate of 100 percent and the rest of the population having a rate of zero, or the bottom 20 percent having a 100 percent tax rate and the top 80 percent paying nothing. These three tax schedules have substantially different implications for redistribution. Moreover, the mean marginal tax rate ignores the level of transfers that households receive. Thus, we construct an alternative and more direct measure of how much the tax system redistributes income, the 'income-compression measure':

$$1 - \frac{sd_{st}\left(\text{income}_{ist} - \text{tax liability}_{ist} + \text{transfers}_{ist}\right)}{sd_{st}(\text{income}_{ist})}$$

where i denotes the household. This 'income-compression measure' compares inequality in net and gross income for each state s and year t. If inequality in net and gross income are the same (for example if all households paid the same lump-sum tax), the measure takes the value of zero. If instead there is no inequality in net income but some inequality in gross income, the measure takes the value of one. Thus, increasing the amount of redistribution through taxes and transfers decreases inequality in net income compared with gross income, and increases the 'income-compression measure' of the tax system. Moreover, if all households faced the same marginal tax rate and there were no allowances, the 'income-compression measure' would be equal to the marginal tax rate (and also the average tax rate). However, given the substantial heterogeneity in marginal tax rates and transfers across households, we prefer this 'income-compression measure' to the mean marginal tax rate (nonetheless we will report results for both measures below, as well as for the poverty measure we described earlier). Table 5 shows that Texas and Florida again have the lowest level of redistribution using the new measure while the index is now highest in New York, Minnesota and California. However, the ordering of states is similar across the two measures (the correlation coefficient is 0.78).

Bankruptcy regulation

Bankruptcy in the US is regulated by the Federal Bankruptcy Act of 1978, which contains two chapters specific to non-farming households. Individuals could choose to file for personal bankruptcy under either Chapter 7 or under Chapter 13. The act allowed individuals to discharge their unsecured debts (except alimony, child support, taxes, and student debts) and make a 'fresh start'.[17]

Under chapter 7 of the act, the debtor has all his debts expunged but must surrender all his assets except those (deemed by the court) necessary for him to make his 'fresh start'. These necessary assets are the 'exemption', with assets exceeding this value being sold and the excess amount used 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 reinvested in an exempt asset within a certain time period. Under Chapter 13, the debtor agrees to a repayment schedule for part or all of the debt, but retains his assets. Crucially, the debtor could choose between chapter 7 or chapter 13, and thus could never be made to pay more than could be enforced under chapter 7 bankruptcy. Thus the exemptions under chapter 7 placed an upper limit on the amount of unsecured debt that could be recovered through the courts by creditors. Our empirical analysis exploits this fact. Around 70 percent of personal bankruptcy cases resulted in a filing for Chapter 7. However, several courts preferred the debtor to file under chapter 13 but enforced purely nominal repayment schedules.

The federal exemption levels have been revised several times since 1978 and from April 1998 the bankruptcy act was emended to allow the nominal amounts to be adjusted in line with the retail price index every three years. The relevant federal exemption levels are shown in Table 4.[18] 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 up to $200 for each item, jewelry up to $500, other property up to $400 (and any unused homestead exemption), and 'tools of trade' up 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 applies mostly to self-employed households which are excluded from our sample (although including it in our analysis does not substantively change

[17]While there was a 'substantially abuse' clause in the regulations, households were able to exploit the provisions of the bankruptcy act without regard to whether the household was genuinely unable to pay or to whether repayment would result in substantial hardship.

[18]The latest legislation, passed in 2003, lies outside our sample period and hence is not discussed.

the results).

Table 4 shows that the 1984 reform introduced an upper limit on the total value of exempt household goods and reduced the amount of unused homestead exemption that could be claimed for other goods. The revision in 1994 doubled the dollar amounts in each category, while from 1998 the dollar amounts have been adjusted for inflation every three years. Finally, married households who jointly filed for bankruptcy were allowed to claim the exempt amount in each category for each person.

Bankruptcy had traditionally been regulated by the individual states and the 1978 Act continued to let states set their own level of exemptions and even to disallow the federal exemption levels. However, other aspects of the enforcement of bankruptcy law were uniform across states. Similarly to the federal exemptions, most states have specified a variety of goods that are exempt from seizure or forced sale and, unless state law prohibited this, the debtor could choose between the federal and state exemptions (and naturally would choose the larger of the two exemptions).[19]

Table 5 displays some of the differences in exemption levels across states for single filers in 1984 and in 1998. Many states allowed larger exemptions for couples, for older households, and for households with dependents. The table shows that the homestead was fully exempt from seizure in Florida and Texas (subject to an acreage limit). Moreover, in Texas in 1998, $30,000 worth of other assets were exempt, with the amount being doubled for couples filing jointly. In Florida in contrast, the corresponding exemption was up to $1,000 worth of personal property and a car worth up to $1,000, and households in Florida were not allowed to claim the federal exemptions. Minnesota allowed the homestead to be fully exempt in 1984 but later changed this to a maximum value of $200,000. The other exemptions increased from $6,500 to $11,050 during the same period where the exemption level was adjusted in line with the retail price index every two years. Other states, such as Pennsylvania, set the exemption level much lower. In Pennsylvania, only $300 of property was exempt from seizure although clothing was also exempt. However, Pennsylvania allowed households to claim the federal exemptions and obviously households would prefer to do so in this state. Maryland, however, both set a low bankruptcy exemption (the housing exemption was $2,500 and the other exemptions were $3,500) and did not allow the federal exemption to be claimed. Indeed, Maryland had actually reduced the housing exemption in 1983 from $3,500.

The courts have also allowed debtors substantial room for manoeuvre in fully exploiting

[19]Information on the state bankruptcy exemptions was constructed from the Annotated State codes and from primary legislation.

all the exemptions available. In many cases courts have allowed the debtor to rearrange his portfolio of assets prior to default and substitute exempt assets for non-exempt assets (some limit is placed on the ability to rearrange assets by 'abuse/fraud' provisions). Since there is considerable scope for substituting between assets when filing for bankruptcy, we have added the exemptions to construct a total nominal value of the exemption for each household in each state and year. Since households were only allowed to claim the housing exemption if they owned their own house (either outright or through a mortgage), we have added the homestead exemption to the exemption on all other assets only if households owned their home. A more detailed assessment of the household's asset position is not possible because of limited information in the CEX. If no specific upper limit of exemption was defined for a category of goods (for instance Pennsylvania allowed "all necessary wearing apparel"), we assigned the maximum exemption level for that good category in those jurisdictions that had a limit (see Grant, 2001 for further details). For the homestead exemption instead, we include a dummy in the regression if no upper limit for this item was specified. In calculating the exemption level for each household, we considered the household's age, the number of dependents and whether the household was headed by a couple. In states in which households are allowed to claim the federal exemption and this exemption is higher than the state exemption, we use the federal exemption to construct our measure. Finally, we normalize the exemptions by dividing the exemption by average income in each state-year cell. This normalization will better measure how generous the exemptions are as a proportion of income.

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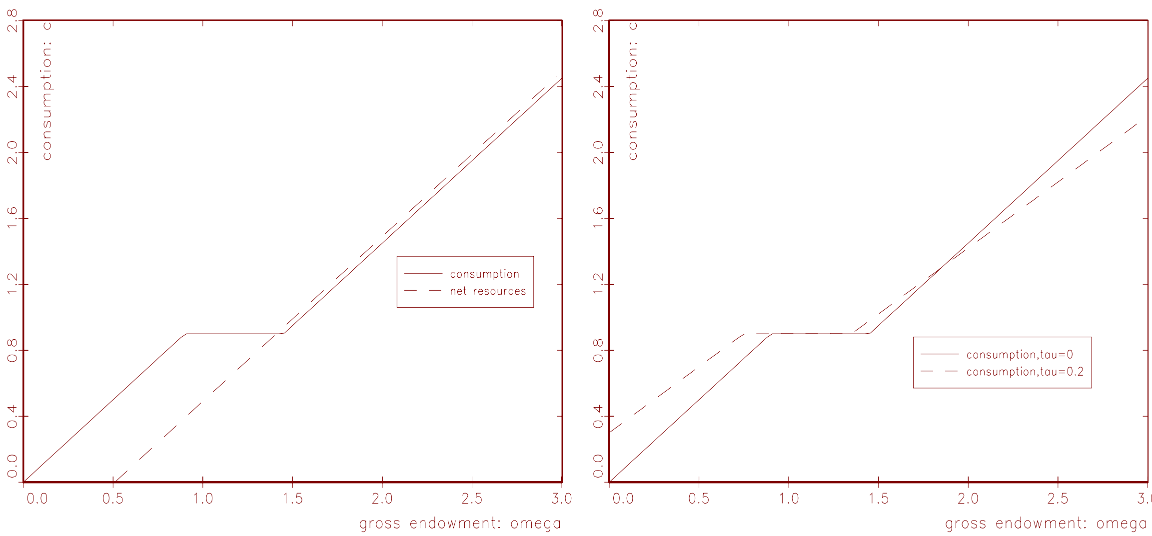

Figure 1: Consumption as a function of gross endowment for positive exemption x and different transfers τ

Table 1: Equilibrium values of borrowing b_1, interest rate r_2, and default probability

Variables	*Benchmark*	$\tau = 0.25$	$x = 0.85$	$\mu = 1.3$	$C = 0.05$	$\sigma = 1$
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
borrowing b_1	0.1854	0.179	0.186	0.139	0.1846	0.21
interest rate r_2	0.0321	0.0325	0.025	0.045	0.034	0.037
default prob.	0.0137	0.012	0.005	0.025	0.0136	0.021

In the benchmark case, the risk-free interest rate $r_f = 0.02$, $\omega_1 = 1$, the bankruptcy cost $C = 0.015$, the bankruptcy exemption $x = 0.9$, the coefficient of risk-aversion $\sigma = 2$, the discount rate $\beta = (1 + 0.1)^{-1}$, $\mu = 1.4$, the marginal tax rate $\tau = 0.2$ while the temporary income shock $\varepsilon \sim N(0, 0.1 * \omega_2)$

Table 2: 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 are constructed from reported responses in the March supplement of the CPS for the years 1980-2003. 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 3: 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 were 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 4: 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 5: Tax redistribution 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	debtors
California	1.0	9.3	72	22.8	34.3	30,000	5,200	50,000	10,900	1984	59.7
Florida	no state income tax			19.2	27.0	no limit	1,000	no limit	2,000	1979	55.5
Maryland	2.0	4.75	1,850	25.1	32.6	2,500	3,500	2,500	3,500	1982	62.9
Minnesota	5.35	7.85	2,900	24.6	34.3	no limit	6,500	200,000	11,050		69.4
New York	4.0	6.85	-	22.1	35.5	10,000	7,400	10,000	7,400	1982	51.9
Pennsylvania	2.8	2.8	-	21.0	29.8		300		300		62.2
Texas	no state income tax			19.0	26.9	no limit	15,000	no limit	30,000		61.6

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 to single filers on 1 January in 1984 and 1998, while 'other' refers to the money amount on all assets excluding housing and 'tools of trade'. California refers to system I exemptions. The column 'fed' refers to the year in which the federal exemption was not allowed, while 'debtors' refers to the proportion of households in the state with at least some unsecured debt.

Table 6: The effect of taxes and bankruptcy exemptions on unsecured debt

	Income compression	Mean marginal tax rate
tax	0.381	0.442
	(0.903)	(2.523)
exemption $\times$ (1-house)	-0.028	-0.048
	(0.284)	(0.305)
exemption $\times$ house	0.213	0.214
	(0.054)	(0.061)
house fully exempt	0.576	0.559
	(0.190)	(0.178)
age/10	-6.404	-6.565
	(3.231)	(3.002)
age/10-squared	1.616	1.651
	(0.753)	(0.709)
age/10-cubed	-0.136	-0.139
	(0.057)	(0.054)
finished school	0.956	0.943
	(0.153)	(0.149)
some college	1.259	1.244
	(0.153)	(0.154)
full college degree	0.761	0.739
	(0.158)	(0.154)
black	-0.574	-0.577
	(0.126)	(0.116)
female	-0.208	-0.210
	(0.068)	(0.062)
couple	-0.228	-0.219
	(0.222)	(0.236)
ln(family-size)	1.092	1.076
	(0.379)	(0.400)
ln(family-size)-squared	-0.404	-0.396
	(0.168)	(0.173)
ln(income)	27.153	27.033
	(2.943)	(3.266)
ln(income)-squared	-1.287	-1.281
	(0.141)	(0.157)
interest rate	-0.062	-0.055
	(0.323)	(0.296)

Estimated by Censored Least Absolute Deviation (CLAD), with bootstrapped standard errors, in parentheses, using 100 repetitions. Regression included all households in the 18 largest states whose head was between 30 and 60 years old. Month, year and state dummies are included. Unsecured debts and the bankruptcy exemptions are measured in logs. 'House fully exempt' is a dummy with the value one if there is no upper limit to the value of the housing exemption. The interest rate is the real municipal bond rate. The sample size is 34,085.

Table 7: The effect of taxes and bankruptcy exemptions on consumption insurance

	income compression				mean marginal tax rate			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$sd(c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$	$sd(c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$
tax	-0.076	-0.254	-0.961	-0.743	-0.188	-0.485	-0.558	-0.541
	(0.050)	(0.083)	(0.495)	(0.229)	(0.070)	(0.117)	(0.138)	(0.135)
exemption	-0.047	-0.066	-0.093	-0.055	-0.042	-0.052	-0.050	-0.049
	(0.014)	(0.024)	(0.033)	(0.034)	(0.014)	(0.023)	(0.023)	(0.034)
house fully exempt	-0.148	-0.108	-0.118	-0.014	-0.122	-0.046	-0.012	-0.027
	(0.051)	(0.084)	(0.096)	(0.127)	(0.051)	(0.085)	(0.081)	(0.130)
constant	0.856	0.719	0.945	0.729	0.839	0.665	0.649	0.634
	(0.067)	(0.113)	(0.218)	(0.179)	(0.066)	(0.054)	(0.055)	(0.039)
IV			lag	pol			lag	pol
$Rank-test$			5.45	6.94			79.7	55.7
$(prob)$			(0.000)	(0.000)			(0.000)	(0.000)
$Sargan$				10.77				8.91
$(prob)$				(0.056)				(0.112)
N	420	412	384	358	420	412	384	358
R^2	0.143	0.091			0.153	0.108		

Standard errors in parentheses. *IV* refers to whether the tax system is instrumented by itself lagged twice (denoted 'lag') or by a set of political instruments (denoted 'pol'). All regressions included a full set of state dummies. The columns are overlabeled with the measure of the tax system that was used in the regression.

Table 8: The relationship between taxes and bankruptcy exemptions

	income compression				mean marginal tax rate			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	IV	IV	IV	OLS	IV	IV	IV
tax	-0.049	-0.316	-0.269	-0.234	-0.171	-0.236	-0.201	-0.174
	(0.016)	(0.119)	(0.071)	(0.034)	(0.020)	(0.028)	(0.029)	(0.013)
constant	0.069	0.161	0.139	0.128	0.093	0.109	0.099	0.092
	(0.007)	(0.040)	(0.024)	(0.012)	(0.006)	(0.007)	(0.007)	(0.004)
IV		lag	pol1	pol2		lag	pol1	pol2
$Rank - test$			4.98	6.94			7.16	55.7
$(prob)$			(0.000)	(0.000)			(0.000)	(0.000)
$Sargan$			2.965	42.78			4.290	27.99
$(prob)$			(0.085)	(0.000)			(0.038)	(0.000)
N	420	384	358	358	420	384	358	358
R^2	0.746				0.777			

Standard errors in parentheses. IV refers to whether the tax system is instrumented by itself lagged twice (denoted 'lag') or by a set of political instruments: 'pol1' denotes the regression in which we use only the political affiliation of the state legislature and the tax efficiency index as instruments, while 'pol2' denotes the regression in which the full set of instruments is used. All regressions included a set of state dummies, and a dummy for Minnesota post 1993. The columns are overlabeled with the measure of the tax system that was used in the regression.