Redistributive Taxation and Personal Bankruptcy in US States*

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Abstract

Personal bankruptcy regulation and redistributive taxes and transfers vary considerably across US states and over time. Our hypothesis is that both policies are imperfect substitutes in insuring consumption of risk-averse agents in incomplete markets. Exploiting data variation over time for 18 US states 1980-2003, we find considerable support for this hypothesis: (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

The volume of consumer credit, in part unsecured, has increased substantially in the last decades in the US and some borrowers of unsecured debt end up defaulting on their debts. Roughly 1.5% of US households have filed for personal bankruptcy in each recent year and defaulted on approximately \$120 billion in 2003 or \$1,100 per household in each recent year (see White, 2006).[1] At the same time, the average US household received \$1,000 in direct transfers per year (see the authors' calculation based on the CPS in Table 1). Hence, bankruptcy regulation and redistributive taxes and transfers are both important policies that affect US households.

Besides the aggregate importance of both policies, there is substantial variation in the regulation of bankruptcy and redistributive taxes and transfers 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 regardless of value (although subject to an acreage limit) 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 there is a simple economic explanation for this negative correlation between the two policies. If markets are incomplete (for empirical evidence see, for example, Attanasio and Davis, 1996, or Blundell *et al.*, 2006), 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 the net benefits of each policy are reduced in the presence of the other. This is far from obvious since the bankruptcy exemption is crucially associated with intertemporal consumption-smoothing (it is only important if agents save and borrow across time) whereas this is not the case for redistributive tax and transfer schemes. While, in principle, a tax system could be devised that replicates the redistribution implied by a bankruptcy law, this is not practically possible since it would require conditioning taxes and transfers on who would

[1] Empirical data on household portfolios show that bankruptcy is financially attractive for many US households. Based on the Survey of Consumer Finances 1995, White (1998) computes that 15% of households could have increased their net worth in 1995 if they had filed for bankruptcy.

otherwise default. For this the government would need to know not only the household's current asset position but also information on consumption and saving requiring knowledge of 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 Rhea, 1984, Jackson, 2001, or Hynes, 2002). Bankruptcy provides insurance at a cost since households receiving bad shocks can default, while households without bad shocks repay at higher interest rates. We argue 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 mechanisms, even a very simple model points to more subtle interactions as both policies affect the bankruptcy decision and thus how banks price lending to households. In the Appendix we show in a stylized model under what conditions both policies are substitutes in providing partial insurance to consumers.

The important contribution of this paper is that we provide empirical evidence on our hypothesis using data for 18 US states over a long time period, 1980-2003. We construct new data on bankruptcy exemptions in these US states for our sample period. We combine these data with measures for redistributive taxes and transfers and consumption data using the Consumer Expenditure Survey (CEX) and the Current Population Survey (CPS).[2] Since all our data have time variation, we can control for state specific unobserved heterogeneity.

The empirical evidence, based on time variation in US states, supports our hypothesis. We find that the generosity of the bankruptcy exemption and the extent of redistributive taxes and transfers are negatively correlated, suggesting that both policies are substitutes in providing some consumption insurance. Indeed, we find that both the bankruptcy exemption and redistributive taxation are associated with less inequality in consumption growth which directly measures consumption insurance and is purged from cross-sectional heterogeneity. The empirical evidence for the effect of both policies on unsecured household debt, however,

[2]We use income information in the CPS rather than the CEX (which is used for consumption) because of the larger survey size, 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.

is less clear-cut.

Of course, we are not the first to analyze bankruptcy or redistributive taxation in the US.[3] For example, Gropp *et al.* (1997) and Pavan (2005) investigate the effect of personal bankruptcy procedures on households' assets, Fay *et al.* (2002) provide empirical evidence on the importance of exemptions for bankruptcy decisions, while Zame (1993) shows theoretically how bankruptcy can provide partial insurance against income fluctuations. In the context of the recent bankruptcy reforms, Athreya (1999, 2006) and Chatterjee *et al.* (2007) calibrate numerical models to gauge how the benefits of bankruptcy compare with the costs, such as higher interest rates.[4] 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).

To the best of our knowledge, however, this paper is the first to jointly analyze redistributive taxation and bankruptcy exemptions empirically. The evidence of Fisher (2005), for instance, focuses only on one interesting part of the policy interaction to show that more generous unemployment insurance is negatively associated with the probability of declaring bankruptcy, using the rather few observations on bankrupt households in the PSID in the 1990s. The most important difference to our empirical work is that we are interested in directly quantifying the association of bankruptcy exemptions and redistributive taxes and transfers with consumption insurance. In order to have a sufficient sample size for US states, we use CEX and CPS data which are repeated cross-sectional but for the one-year panel component in the CEX. Furthermore we construct a new measure for bankruptcy exemption and a comprehensive measure for redistribution in terms of taxes and transfers which vary both across time and US states.

The rest of the paper is structured as follows. In Section 2 we discuss the theoretical background which is presented more formally in the Appendix. We describe the data and the consumer bankruptcy law in Section 3. We discuss the econometric specification in Section

[3]Whereas the bankruptcy and credit of firms, or taxes and entrepreneurial risk taking, have received attention (for example, Berkowitz and White, 2004, and Cullen and Gordon, 2007, and their references), there has been less research into the effects of these policies on the risk sharing of households.

[4]See also the analyses of Hansen and Imhoroglu (1992) and Bertola and Koeniger (2007) on interactions between government redistribution and financial market imperfections.

4, present our empirical results in Section 5 before we conclude in Section 6.

2 Theoretical background

In this section we discuss the theoretical background which is useful to understand the empirical analysis. A more formal analysis is given in the Appendix.

Consumption insurance in a given period. Suppose that an agent receives an uncertain endowment in a period and cannot fully insure that risk in markets. Instead there are two policies which can partially insure the agent: bankruptcy with a level of exempt resources that cannot be touched by banks in case of bankruptcy (the exemption level); or redistributive taxes and transfers.

While it is obvious how taxes and transfers, which redistribute resources from good to bad states, can provide consumption insurance, this deserves some explanation for personal bankruptcy. The possibility of bankruptcy with a positive exemption level implies that agents find it optimal to declare bankruptcy if their endowment is below a critical threshold. This critical threshold increases together with the exemption level so that higher exemption levels provide insurance for a larger range of endowments below that threshold. The consumer can then afford more consumption as he keeps his exempt resources and does not repay his debt. This insurance comes at a cost if the consumer's endowment is above the critical threshold. In equilibrium, the consumer pays higher interest on debt as banks must be compensated for the higher default risk *ex ante*.

This is illustrated in the left panel of Figure 1. We plot consumption for a positive bankruptcy exemption level (the solid line) and consumption if agents fully repay their debt (the dashed line) as a function of the gross endowment. So far we consider no redistributive taxes and transfers. Consumption differs in the two cases only because households always repay their debt in one case but not in the other. The figure shows that a positive bankruptcy exemption reduces consumption in good states below the consumption level attained under full repayment. This is due to the higher interest rate implied by the bankruptcy risk. The figure also shows that a positive bankruptcy exemption provides insurance in bad states: the bankruptcy exemption provides full insurance in an interval of the gross endowment in which the consumption function is flat and consumption independent of the level of gross endowment. Agents consume the amount of exempt resources and default partially on their debt. If the gross endowment is low enough, agents fully default on their debt. Then, the consumption increase afforded by the bankruptcy exemption is largest, as measured by the distance between the solid and dashed line at a given endowment level. Instead 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.

With concave utility, one would expect that redistributive taxes or transfers and bankruptcy exemptions are imperfect substitutes in generating insurance in a given period. More consumption in bad states of the world (either due to transfers or bankruptcy exemptions) raises expected utility but with strictly concave utility the marginal utility gain is lower if more is already redistributed towards these states. The interaction between the two policies, however, is a bit more subtle since redistributive transfers or taxes do not only lower the marginal direct *benefit* of bankruptcy exemptions but also change the threshold at which agents declare bankruptcy and thus the *cost* of the bankruptcy exemption in terms of higher interest rates.

We derive these interactions formally in the Appendix and illustrate them here with Figure 1. Recall that the left panel of the figure plots consumption with a positive exemption level (the solid line) and consumption if the consumer always fully repays his debt (the dashed lined). The right panel of the figure shows how redistributive transfers and taxes affect consumption for a given positive exemption level. In drawing the right panel we assume 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 a positive bankruptcy exemption is less desirable cannot be deduced from the graph as the consumption under full repayment (which is not drawn) also tilts clockwise and the interest rate changes. Furthermore, 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 the endowment.

Beyond one period. Bankruptcy exemptions and redistributive taxation do not only interact in terms of providing insurance in a given period. Redistributive taxation can eliminate part of the intertemporal inequality of resources and thus the borrowing motive. Less borrowing obviously makes bankruptcy less important for insurance purposes. Ultimately, it is an empirical question whether redistributive taxes or transfers and bankruptcy exemptions are imperfect substitutes in providing consumption insurance in incomplete markets.[5] We now provide empirical evidence on the following hypotheses:

(i) Redistributive taxes and transfers as well as bankruptcy exemptions both provide some consumption insurance. We test this prediction by estimating the effect of changes in both policies on the standard deviation of consumption growth, which is a measure for consumption insurance.

(ii) Consumption insurance provided by exemptions is less valuable if redistribution through taxes and transfers is more pronounced. We test this empirically by investigating whether changes in both policies in US states are negatively correlated.

(iii) Redistributive taxes and transfers that reduce intertemporal inequality make households borrow less. Moreover, for a given interest rate, insurance provided by bankruptcy exemption induces more household debt if precautionary motives matter (see Remark 2 in the Appendix, for a formal derivation). We check whether this is the case empirically, estimating the effect of changes in both policies on household debt.

It is important to note that in our empirical analysis we condition on the initial policies in all US states since we include state fixed effects. Thus, we exploit the time variation of these policies in US states to estimate the coefficients of interest.

[5] Clear qualitative predictions are even harder to make if one considers different persistence of shocks. On the one hand, more persistent shocks increase the benefit from declaring bankruptcy ex post but on the other hand the costs of debt ex ante will also increase as banks price this risk. Our data do not allow us to explore the interaction of shock persistence and the insurance provided by both policies.

3 Data

We have described the interaction between redistributive taxation and the level of bankruptcy exemptions in providing consumption insurance in incomplete markets. We now search for empirical evidence exploiting variation in the two policies in different US states between 1980 and 2003. We construct a panel of state-year cells[6] using household data from the Consumer Expenditure Survey (CEX) and from the Current Population Survey (CPS).[7] As relatively few households are sampled in some states in the CEX, our sample only contains households resident in the 18 largest US states which nevertheless cover the full range of US states in terms of geography, taxes and transfers, and bankruptcy exemptions.[8] 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.

For our analysis, we will need to summarize taxes and transfers, bankruptcy exemptions and consumption in each state and year. When constructing these measures we apply the same sample selection criteria. We restrict the sample to those households with complete state information and whose head is aged between 30 to 60. 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 consumers' risk and not entrepreneurial risk and self-employed households have motivations for borrowing other than to smooth consumption.

Consumption. We use the CEX to construct a measure of non-durable consumption and debt for each household. The survey is constructed as a rotating panel in which households are interviewed 5 times at quarterly intervals (although no information is reported for the first interview). Each quarter, households that reached their fifth interview are replaced. The

[6]Data limitations only allow estimations with household-level data in the specifications with unsecured debt.

[7]Available household panel data from the Panel Study of Income Dynamics (PSID) have a too small sample size to investigate differences across states and time.

[8]This consideration also precludes analyzing finer subgroups of the population.

CEX contains extremely detailed information on the individual items of consumer spending and as well as the demographic and other characteristics, including the state of residence. Consumption growth for the households is calculated as the difference in log non-durable consumption in the second and fifth interview.

We use the standard deviation of consumption and consumption growth within a state-year cell as measures 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 fixed-membership group. A useful corollary is that if markets are incomplete then this cross-sectional measure should increase as Deaton and Paxson found for the US. Moreover, if 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: in complete markets consumption should change for all households by the same amount. Hence, if consumption is growing by different amounts for different households so that the variance of consumption growth is positive, then we can again reject full insurance. Moreover, we know that markets provide less insurance if the variance of consumption growth is larger.

Debt. From 1988, households in their second and fifth interview of the CEX were asked separate questions 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. We sum these different items (adding negative balances held in checking and brokerage accounts) to construct gross unsecured debt for each household.[9] Excluded from the total are mortgage, and other secured debts. Thus, the debts analyzed differ from those in Gropp *et al.* (1997) which is important since the impact of bankruptcy exemptions on

[9] We concentrate on gross rather than net unsecured debt because this is the amount that is not repaid in bankruptcy. Moreover, we only include each household in the regressions.

secured and unsecured debt is very different (Berkowitz and Hynes, 1999). The creditor has an additional claim to mortgage (and other secured) debt and can always recover the house (or other security) if the debtor defaults. The housing, or other exemptions will not affect the creditors rights in this case and hence we exclude such debts in the analysis.

Consumption and debt have been deflated by the 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 (similar numbers are reported by Cox and Jappelli, 1993, for the Survey of Consumer Finances). Around 60% of consumers, and thus the median consumer, hold at least some unsecured debt, and this proportion is similar across all states (see the last column in Table 3).

Income. We use the March supplement of the CPS to obtain information on the household-level (total labor) income and transfers (which include 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). This survey, managed by the Bureau of Labor Statistics (BLS), reports extremely detailed information on income as well as the households' other characteristics. Table 1 shows that nearly 95% of households receive some wage income which averages almost $35,000. On average, households also receive nearly $1,000 in transfers (over $4,000 among the quarter of households who receive at least some transfer).

Using the CPS income data rather than the CEX data to construct measures for redistribution through taxes and transfers has several advantages. The CPS is a larger survey, hence cell averages are measured more precisely and the small sample bias is reduced. Moreover, if both consumption and income are taken from the same sample, measurement error would affect both the dependent variable as well as the regressor in some of the specifications estimated below. This would not only bias the estimates but the sign of the bias would be ambiguous. Constructing the cell averages using different data sets circumvents this problem.

3.1 Redistribution through Taxes and Transfers

To measure the level of income taxes and transfers that each household pays or receives, we use the data from the CPS and exploit the TAXSIM 4.0 program developed by Feenberg (see Feenberg and Coutts, 1993, for details) that is available from the NBER.[10] The program TAXSIM uses a variety of household variables, including the husband's and wife's earnings, interest, dividend and other income, and information about the household's characteristics (such as the number of dependent children) and other deductibles (like property costs) as inputs to calculate both the state and the federal tax bracket, tax liability, and marginal tax rate for each household in the sample. It explicitly controls for a variety of allowances to which the household is entitled.

Both federal and state taxes vary considerably across time and between households, and states set very different marginal tax rates and allowances. Columns (2), (3) and (4) of Table 2 display the federal tax rates for one year in our sample, 1998. For example, the federal income tax rate in 1998 was 15% for single filers whose income is below $26,250 (the lowest tax bracket and the rate paid by nearly 60% of households) but increased in steps to 39.6% for those whose income was over $288,350. These brackets were nearly doubled for couples filing jointly (each partner halved this allowance if filing separately). These federal tax brackets 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.

There is also considerable variation in state income taxes. Eight US states, including Texas and Florida, levy no state income tax. The other states have a variety of income tax brackets of differing progressivity. In most states the marginal tax rate increases with income. This is shown for a subset of states in columns (2), (3) and (4) in Table 3. In California, for example, the lowest tax bracket is 1% and the highest is 9.3%. Many states have tax

[10]We concentrate on income taxes which are raised at both the federal and state level, but we exclude 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. However, we do not believe that excluding sales taxes is problematic in our analysis since the expenditures recorded in the CEX exclude sales taxes, too.

allowances (which depend on whether the taxpayer has a spouse or other dependents), which can sometimes be quite large: Minnesota allows the first \$2,900 to be exempt for single filers. However, some states set a flat rate tax without allowances: in Pennsylvania this rate is 2.8%.

We construct two alternative measures of the tax and transfer system which account for both federal and state income taxes and (with respect to the second measure) also for transfers. The first measure is the mean marginal tax rate, which is often used to compare different tax systems (for instance, this measure is extensively summarized by Feenberg on the TAXSIM website at the NBER). Table 3 shows how that tax rate varies across some of the largest US states for our sample (which restricts attention to households between the ages of 30 and 60). Texas and Florida have the lowest tax rates of 19% since these states levy no state income tax and households only pay federal income tax. The mean marginal tax rates are higher in Maryland and Minnesota, at around 25%, reflecting the higher level of the state-income tax.

However, the commonly used mean marginal tax rate is rather unattractive since it does not capture the substantial heterogeneity in marginal tax rates across agents in each year even in the same state. For example, a mean marginal tax rate of 20% could be due to a uniform marginal tax rate of 20%, or to the top 20% of the population having a rate of 100% and the rest of the population having a rate of zero, or the bottom 20% having a 100% tax rate and the top 80% 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 a 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 sd denotes the standard deviation, the subscript i denotes the household, s the state and t the year. 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 were the same (for example if all households paid the same lump-sum tax), the measure would take the value of zero. If instead there were no inequality in net income but some inequality in gross income, the measure would take 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.[11] Table 3 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 for the income compression measure and for the mean marginal tax rate (the correlation between the two measures is 0.78). Given the substantial heterogeneity in marginal tax rates and in transfers across households, we prefer the 'income-compression measure' (but nonetheless report results for both measures).[12]

3.2 Bankruptcy exemptions

Using legislative data, we construct the bankruptcy exemption level for each household in the CEX sample. To understand the variation in the data, we now give a brief overview of consumer bankruptcy law and the changes of the exemptions over time. Bankruptcy in the US is regulated by the Federal Bankruptcy Act of 1978, which allows individuals from non-farming households to file for personal bankruptcy under either chapter 7 or under chapter 13. Under chapter 7 of the act, the debtor has all his unsecured debts expunged (except alimony, child support, taxes, and student debts) 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

[11] 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.

[12] We checked whether our results are robust if we use several other measures. We constructed a measure of income compression using the Gini coefficient rather than the standard deviation. This measure is constructed as:

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

Moreover, we have 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. Finally, we also experimented with an income-compression measure based on standard deviations of the *logarithm* of net or gross income. The results (available from the authors) are similar when using these measures of the tax-transfer system.

used to satisfy the debt. 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. This means that the chapter-7 exemptions place an upper limit on the amount of unsecured debt that creditors can recover through the courts.[13]

Table 4 shows that the 1978 Act allowed the house or homestead to be exempt up to the value of $7,500 while other exempt assets included a car of $1,200, household goods 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.[14] If filing jointly for bankruptcy, federal law allowed both the husband and the wife to each claim every exemption. The level of these exemptions has been revised periodically since 1978.[15] 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 while the 1994 revision doubled the dollar amounts in each category.

Because bankruptcy had traditionally been regulated by individual states, the 1978 Act allowed states to replace the federal exemption levels with their own. All other aspects of the bankruptcy law, however, 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 some have explicitly disallowed the federal exemptions. Table 5 lists the state laws that define which assets are exempt, where these laws and the changes are taken from each state's *Annotated State Code* and from primary legislation.[16] The table shows that bankruptcy exemption levels do change over time, albeit less frequently than taxes and transfers.

[13]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, often enforcing purely nominal repayment schedules.

[14]This last item refers to work material or assets needed in order to practise professionally (some jurisdictions allowed this category to include transport to and from work). 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 (including it in our analysis does not substantively change the results).

[15]The most recent legislation, passed in 2003, lies outside our sample period and hence is not discussed.

[16]Hynes *et al.* (2004) showed that the different levels of bankruptcy exemptions across US states in the 1970s-1990s are highly correlated with their historic levels in 1920. These permanent differences across states are controlled for by the state-fixed effects in our regressions below.

Table 3 displays some of the differences in exemption levels in the largest 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 (Minnesotan exemptions are 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, 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. Maryland had reduced the housing exemption in 1983 from the higher value of $3,500.

Unless explicitly prohibited by state law, the debtor could choose between the federal and state exemptions, naturally choosing the larger exemption. Table 5 shows, for example, that Massachusetts changed the level of the exemptions in 1983, 1985 and 2000, while the exemptions did not change in Michigan. However, Michigan allowed the more generous federal exemptions to apply to Michigan residents, and these federal exemptions changed in 1984, 1994, 1998 and 2001. Thus, the exemptions which any household could claim changed at some point in almost all states in the sample, and in some states it did many times (eight changes occurred in California and nine in Minnesota).

The courts, in most cases, have allowed each debtor to rearrange his portfolio of assets prior to default and substitute exempt for non-exempt assets.[17] Since there is considerable

[17] While there is 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

scope for substituting between assets when filing for bankruptcy, we have added the exemptions together ('but excluding the tools' of trade exemption) to construct a total nominal value of the exemption for each household. This value takes account of all the households characteristics such as the marital status, and whether the household would be better off claiming the federal exemption, should state law allow this. Since households were only allowed to claim the housing exemption if they owned their 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.[18] Finally, we normalize the exemptions, dividing by the average income in each state-year cell, to measure the generosity of the exemptions in terms of mean income.

The bankruptcy exemptions have been shown to be important for the behavior of US households. The portfolio of many US households includes unsecured debt and positive asset holdings in more or less liquid form. Based on the Survey of Consumer Finances 1995, for example, White (1998) computes that 15% of households could have increased their net worth in 1995 if they had filed for bankruptcy. In this paper we are interested in quantifying the amount of consumption insurance provided by these exemptions.

Following this discussion of bankruptcy law and of taxes and transfers, we now use the constructed data set which contains unsecured debt, consumption, consumption growth, the bankruptcy exemption levels and redistribution through taxes and transfers for households in 18 US states during the period 1980-2003. We will first investigate how the bankruptcy exemptions, and taxes and transfers, affect the level of household debt. These regressions use household level data for 1988-2003. We will then investigate how taxes and transfers and the bankruptcy exemptions affect consumption smoothing. For these regressions we compute both the standard deviation of log consumption and of consumption growth in order to measure consumption insurance for each of the 420 state-year cells in our sample.

to whether repayment would result in substantial hardship.

[18] A more detailed assessment of the household's asset position is not possible because of limited information in the CEX. If no specific upper exemption limit was defined for a category of non-housing goods (for instance Pennsylvania allowed "all necessary wearing apparel"), we assigned the maximum exemption level for that good in those jurisdictions that had a limit (see Grant, 2001 for further details). In contrast, we add a dummy to the regression if the housing exemption had no limit.

We now turn to the econometric specification.

4 Econometric specification

We estimate three different sets of equations with different dependent variables but otherwise similar controls. Firstly, we use repeated cross-sectional data to regress unsecured household debt on household characteristics, the bankruptcy exemptions and, in separate regressions, the two different measures of the tax and transfer system. These regressions show how the two policies are associated with household borrowing. We then use our panel of state-year cells to regress our measures for consumption insurance on the policy variables.[19] 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.

Due to the limited number of observations in our sample –with at least 60 observations in each cell we only have 420 state-year cells– these specifications do not test for other details of the possibly rather rich policy interactions (mentioned in Section 2 and shown in the simple model presented in the Appendix). However, the reduced-form regressions allow us to investigate whether the data are broadly consistent with our hypothesis.

The regressions for consumption insurance use data of the state-year cells and take the form:

$$y_{st} = \beta_0 + \beta_1 \tau_{st} + \beta_2 x_{1st} + \beta_3 x_{2st} + f_s + \varepsilon_{st} \tag{1}$$

where as before s is the state, t is the time period, τ_{st} measures redistribution through the tax and transfer system, x_{1st} is the bankruptcy exemption while x_{2st} is a dummy for the unlimited homestead exemption, and y_{st} denotes the dependent variable. The error is composed of a state fixed effect f_s and an idiosyncratic component ε_{st}.[20] The state fixed effects capture fixed differences over time in within state consumption inequality: they control for all remaining unobserved heterogeneity across states that is not accounted for by the policy variables.

[19]As mentioned above, limited data availability does not allow an analysis at the household level.

[20]Note that the between state variation affects the mean level of consumption and hence is removed when constructing the standard deviation of consumption (or consumption growth) in each cell.

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. Thus, the coefficients of interest are estimated using changes in the states over time rather than differences across states. The state fixed effects are estimated by including state dummies in the regression so that consistent estimation of β_0, β_1, β_2, and β_3 requires a large number of time periods.

Including state fixed effects in the regression implies that β_3, the coefficient of the dummy for an unlimited homestead exemption, is only identified from states where this variable changed. In the data this only happened once, when Minnesota abolished the unlimited homestead exemption in 1993 and replaced it with a homestead exemption of $200,000. Hence including this variable in the regressions is equivalent to having a dummy for pre-1993 Minnesota, meaning the coefficient on the unlimited homestead exemption dummy is not well identified. Thus, we do not place much emphasis on interpreting the estimate of β_3.

4.1 Instrumental Variables

An issue well known in the literature (see, for example, Besley and Case, 2000), is that the estimated association between the policy variables and the dependent variable in equation (1) may be spurious due to changes in other unobserved variables. For example, a state productivity shock is likely to affect the state's budget (and hence tax requirements) but also gross income and consumption of households in the state. Thus, we need instruments that predict the policy variables but do not affect the dependent variable.

While we instrument the measures for taxes and transfers we treat the bankruptcy exemptions as predetermined. This is plausible for two reasons: changing the exemptions does not directly affect the state budget constraint; and changes in the exemptions take longer to implement than changing taxes or transfers when deciding on the state budget which is done every year.[21]

We experiment with two possible instrument sets that predict the extent of redistribution through taxes and transfers but do not affect current consumption insurance directly. Firstly,

[21] An exception is the automatic update of exemptions due to inflation that the federal government and some states implement at regular intervals.

we use lagged values of the redistribution measures. Secondly, we use a set of six instruments containing political variables (like the political affiliation of the state governor and the state legislature, and the proportion of voters in a state voting democratic rather than republican in presidential elections), per-capita GDP in each state and two measures of how effective the state is at raising tax revenue (the tax fiscal capacity and the tax intensity or effort in each period). For the years up to 1991, data on these last two variables are available 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 and redistribution rather than economic fundamentals. The ACIR measures are an even more natural instrument as they measure how efficient the state is at raising tax revenue. The ACIR index is higher if a given marginal tax rate raises more income from households (accounting for the cost of raising the revenue and the amount of revenue that is raised). Alternatively, it takes less effort to raise a fixed proportion of income. A state which is less efficient at raising tax revenue may resort to a generous bankruptcy exemption rather than attempting to increase redistribution through the tax and benefit system.

5 Results

Table 6 contains regression results on the relationship between both policies and the level of unsecured household debt. This regression is similar to previous research by Gropp *et al.* who use the 1983 wave of the Survey of Consumer Finances (SCF). This allows us to check the effect of our new measures of bankruptcy exemptions and of redistributive taxes and transfers, and the robustness of the previous findings for our different data in the sample period 1988-2003.

In Table 7 and Table 8 we display the main results of interest in this paper. Table 7 shows how both redistribution through taxes and transfers and the exemptions are associated with the standard deviation of consumption and consumption growth while Table 8 investigates the correlation between the bankruptcy exemptions and the tax and benefit system. These results shed light on whether both policies are imperfect substitutes (in providing some consumption insurance).

5.1 Unsecured household debt

Table 6 shows the estimates for the association of government redistribution through taxes and transfers and of the bankruptcy exemptions with unsecured debt. Debts and the exemption are measured in logs, or rather as $\log(1+b)$ and $\log(1+x)$, where b denotes the debt level and x the bankruptcy exemption level. Column (1) uses the income compression measure while column (2) uses the mean marginal tax rates as a regressor. 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.[22]

Since households cannot report negative debts - such households would report zero debts - the 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).[23] 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.[24]

The main focus of the analysis are the coefficient estimates of the bankruptcy exemption and of the tax and transfer system. Since we have household level data, we can estimate different coefficients of the exemption for homeowners and renters. This allows us to at least partially condition on the assets that the household owns. Hence each regression includes the

[22]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.

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

[24]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.

exemption level, included separately for homeowners and non-homeowners, and a dummy for the unlimited homestead exemption for homeowners.[25] This is in the spirit of Gropp *et al.* (1997) who have shown that the effect of the bankruptcy exemptions are different for high-asset and for low-asset households.

The coefficient estimate for redistribution through taxes and transfers is positive but not significant for either measure of the tax and transfer system in columns (1) and (2). Although insignificant, the positive sign is surprising: 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.

The coefficient estimate for the bankruptcy exemption is negative for renters. However, this effect is small (the coefficient implies that a 10% increase in the exemption reduces debts by 0.3% using the income compression measure, and 0.5% using the mean marginal tax rate) and is neither statistically nor economically significant. The estimated effect on those households who own their house is positive, much larger in size and significant at the 5% level. The coefficient suggests that unsecured debts increase by over 2% when the bankruptcy exemption increases by 10%. These results are qualitatively similar to those obtained by Gropp *et al.* (1997) who found that the bankruptcy exemptions had a negative effect on borrowing of 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 results in our regressions show that the homestead exemptions have a significant positive effect on the level of debt that households hold which suggests that more generous bankruptcy exemptions can help households to smooth consumption.

The estimated coefficient of the dummy for the unlimited homestead exemption is also positive and significant in the regression at the 5% level. The estimate implies that households have over 50% 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 done in the regression, means that the coefficient of the unlimited

[25] 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.

homestead exemption dummy is identified only due to Minnesota replacing its unlimited homestead exemption by a maximum homestead exemption of $200,000 in 1993 (see the discussion above). Hence, the coefficient of the dummy is not well identified.

The coefficients of the household characteristics are very similar for both measures of the tax and transfer 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 is positively associated with the level of debt, but family size squared has a negative coefficient. 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 and transfer system, where including state dummies means that the effects are estimated using changes within states. Columns (1) and (6) use the standard deviation of log consumption as the dependent variable. Recall that market completeness would imply that neither the measures of the tax-transfer system nor the bankruptcy exemptions will be significant in these regressions.

Column (1) uses our preferred measure of the tax and transfer system, the income compression measure. In this regression both the tax and transfer measure and the bankruptcy exemptions enter negatively (as predicted if both policies provide consumption insurance in incomplete markets), but while the bankruptcy exemption is significant at the 1% level, the tax and transfer measure is not significant. Column (6) uses the mean marginal tax rate and both the tax system and the bankruptcy exemption are significant at the 1% 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, see the discussion above).

The estimates in column (1) suggest that if a state changed from having the least to having most income compression in our sample, this would explain 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, a change from the smallest to the largest exemption level could explain about one quarter of the differences in within state consumption inequality.

The coefficient estimate is sizeable, but not implausible, even though currently only 1.5% 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% 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% 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 precautionary motives matter, 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. In particular, differences in consumption growth are not affected by *ex ante* consumption inequality. The rest of Table 7 reports results for regressions using consumption growth. In the OLS regression the tax and transfer system is always significant at the 1% level regardless of which measure of redistribution through taxes and transfers is used. Moreover, the bankruptcy exemption is significant at the 1% level in column (2) and at 5% in column (7). The coefficient of unlimited homestead exemption, while no longer significant, remains negative. Results reported in column (5) show that the coefficient estimates of the income-compression measure and the exemptions are robust and remain economically significant if we add time dummies. Not surprisingly, the significance of the estimates decreases in this case due to the smaller remaining data variation.[26]

One concern with the OLS regressions is that taxes or transfers 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-and-transfer redistribution measures using their lags or using a set of what we call political variables which have been discussed above (in a regression specification without time dummies). In all cases the rank test for the significance of the instruments in the first regression stage is passed at conventional significance levels.[27] Again both the tax-and-transfer system and the bankruptcy exemption are significant, and both are negatively associated with the variance of consumption changes, as predicted by our hypothesis. Lastly, we instrument the tax-and-transfer measures using the political variables (see columns (4) and (9)). We find that taxes and transfers 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 where the relevant critical values are obtained from the $\chi^2(5)$-distribution). In column (4), the point estimates imply that both policies have an effect of similar size (i.e., exemptions no longer have a larger effect as in the regressions with the standard deviation of consumption levels in column (1)), with changes from the least to most generous US state, in terms of sample averages, implying

[26]Results, available from the authors on request, show that the estimates for the specification in column (1) are also robust to the inclusion of time dummies.

[27]Instrumenting the tax-and-transfer measures with their second-order lags gives very similar results.

around a quarter of a standard deviation reduction in the inequality of consumption growth rates in each case. This effect is sizeable but plausible for the reasons mentioned above. The estimates imply that a 1% increase in the income-compression measure has the same effect as an increase of exemptions of about $6,500 in 1984 prices.

5.3 Redistributive taxes or transfers and bankruptcy exemption

We have found mixed evidence on how redistribution through taxes or transfers and bankruptcy exemptions are associated with unsecured debt but both policies seem to provide similar amounts of consumption insurance. This suggests that both redistributive tax-transfer schemes and bankruptcy exemption might be imperfect substitutes in providing consumption insurance. 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 unlimited homestead exemptions.[28] 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 that if a state changed income compression from the least to the most generous level, this would be associated with a lower exemption level of roughly $10,000 in 1984 prices.

We also tried to instrument the tax-and-transfer measures with their lags or the set of political variables which we described earlier. This gives qualitatively similar results, see columns (2), (3), (4), (6), (7) and (8). In each case the coefficient is significant at the 1% level. 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

[28] As we state above, in our regressions with state fixed effects this is equivalent to including a dummy for Minnesota pre 1993 (which limited the housing exemption in that year).

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 over-identifying 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 -0.09 when the income compression measure is used in column (2).

6 Conclusion

We have argued that bankruptcy exemptions and redistributive taxes and transfers both provide some consumption insurance in incomplete markets. We have searched for empirical support using data on US states in the period 1980-2003. Consistent with our hypothesis we have found (i) that both redistributive taxation and bankruptcy exemptions are negatively associated with the inequality of consumption and of consumption growth; (ii) that the extent of redistributive taxes or transfers and the size of the bankruptcy exemption level are negatively correlated.

These results relate to Fisher (2005) who finds that the generosity of unemployment insurance is negatively correlated with the incidence of bankruptcy, and argues that this may occur since both policies provide insurance to households. We have provided evidence which supports this hypothesis, where we relate a more general measure for redistribution through taxes and transfers, and bankruptcy exemptions to the extent of consumption smoothing in US states.

Our results suggest that the negative correlation of redistributive taxation and personal bankruptcy regulation in the US states can be explained by a simple economic mechanism. Clearly, redistributive taxation also depends on other determinants which are not related to consumption smoothing and insurance. In this respect it is surprising and interesting to find that the negative correlation is borne out in the data. Although normative conclusions cannot be drawn with the currently available data, the results of the regressions with instrumental variables suggest that there might be an interesting policy trade-off in that bankruptcy exemption is less effective in increasing consumer 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, like France and Germany, with substantial public welfare programs have recently introduced legislation which allows consumers to declare bankruptcy. Given the trade-off we investigate, the additional insurance provided by these reforms is unlikely to be important since welfare spending is already substantial in these European countries.

Appendix: Background material for Section 2

A.1. A stylized model

In this appendix we construct a simple model with two periods labeled 1 and 2 in which the bankruptcy decision is modeled in a standard way (see, for example, White, 2006). The model motivates our empirical analysis. It shows that even in such a simple model the effect of bankruptcy exemptions and redistributive taxes and transfers on consumer welfare is not as obvious as one might think, as both policies affect the bankruptcy decision and thus how banks price lending to households. We show under what conditions both policies are substitutes in providing partial insurance to consumers and illustrate the interactions between a linear redistributive tax/transfer scheme and a bankruptcy exemption. We choose a simple structure that allows us to derive some analytic results for a relatively general class of utility functions and probability distributions.

Basic setup. 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 like his amount of debt (we drop the agent-specific index for convenience). In contrast, the world interest rate r_f is exogenous and constant. This assumption is common in the literature. For example, Athreya (2006) defends 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. 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 current resources and of expected future endowment draws in period 2. This focus is justified since each US state's median household owes some unsecured debt.

Timing. Given the endowment ω_1 (normalized 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, before bankruptcy in period 2 resources are defined as

$$\rho_2 = \begin{cases} \omega_2 - (1 + r_2)b_1 & \text{if borrow} \\ \omega_2 + (1 + r_f)a_1 & \text{if save.} \end{cases}$$

Depending on whether the agent saved a_1 or borrowed b_1 in the previous period, total resources are larger or smaller than the current endowment ω_2. In period 1, total resources, 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 their level of 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 time-invariant linear tax/transfer schedule

$$\tau(\rho_t - \rho^+) \tag{2}$$

so that 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. We focus on τ but it can be shown that shown that changing ρ^+ has similar effects. Moreover, we abstract from a more complicated reallocation of resources by taxes and transfer *across time* (think of a pension scheme) and focus entirely on the role of taxes and transfers for providing insurance in incomplete markets by compressing after-tax income distribution (Varian, 1980).

It is this effect of taxes and transfers which is most related to insurance provided by consumer bankruptcy.

A larger τ not only implies higher marginal tax rates in good states of the world (for high draws of ε_t) but also larger transfers in bad states in which, as we will see below, the agent may decide to declare bankruptcy. 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). For simplicity we assume that the same tax rate applies to the endowment and assets/debt. Moreover, we do not explicitly model the deadweight loss resulting from this policy. A deadweight loss could be added without adding further insight unless we let this loss depend on bankruptcy exemptions. Athreya and Simpson (2003) have looked at such interactions numerically. In their model, the moral hazard problem of unemployment insurance schemes is exacerbated by bankruptcy exemptions which shelter the consumption of agents especially from long-term shocks. Less unemployment insurance then increases search effort, reduces the unemployment rate, and thus also lowers default rates. Such possible interactions between the welfare system and consumer bankruptcy have already been recognized by Posner (1995). Although problems of hidden action are certainly important in the real world, we abstract from them in this paper. Whether bankruptcy exemption and redistributive taxation are substitutes depends on certain conditions already in our simpler framework so that additional complications would not add additional insights for our empirical application.

The second policy in the model is the bankruptcy exemption x, the level of resources that can be kept when the household defaults. Fay *et al.* (2002) have shown empirically that exemptions are important for consumers' bankruptcy decision in the US. We focus on this important policy variable since, while bankruptcy is regulated at the federal level, states are allowed to set their own level of exemptions. This is important since our empirical application exploits the variation in the exemptions over time within each state.

We make the simplifying assumption that exemptions apply to resources and not to positive assets, as in reality. This simplification is not important, however, since we assume, as is realistic, that the households can rearrange their portfolio and convert endowments into assets before declaring bankruptcy.

Bankruptcy decision. Agents declare bankruptcy in period 2 if they have borrowed and their total *after-tax* resources if they repaid their debt would fall below the exemption level x,

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

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

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

Unsurprisingly, richer agents declare bankruptcy if the exemption level x is higher. In contrast, the effect of more redistribution (increasing τ) on the bankruptcy decision 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

$$\omega_2^* = \frac{x - \tau\rho^+}{1-\tau} + (1+r_2)b_1. \quad (3)$$

Agents declare bankruptcy at higher endowment levels if they have to service more debt.

In the remaining part of the appendix, 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. 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. We then parameterize both the utility and probability function in order to characterize the equilibrium and optimal exemption level in period 1 (for endogenous b_1 *and* r_2).

Expected utility in the second period. 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. (Note that endowments in the second period that are below ω_2^* do not enter the Euler equation because consumption is not affected by the borrowing decision for these endowments.) That is:

$$u'(\widetilde{\omega}_1) > \beta(1 + r_2) \int_{\omega_2^*}^{\infty} u'(\widetilde{\omega}_2) f(\omega_2) d\omega_2, \tag{4}$$

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).

The expected utility of a borrower in period 2 is

$$\begin{aligned} u_2^b \;=\; & \int_{\omega_2^*}^{\infty} u((\underbrace{\omega_2 - (1 + r_2)b_1}_{=\rho_2})(1 - \tau) + \tau\rho^+) f(\omega_2) d\omega_2 \\ & + \int_{\rho_2^*}^{\omega_2^*} u(x) f(\omega_2) d\omega_2 \\ & + \int_0^{\rho_2^*} u(\omega_2(1 - \tau) + \tau\rho^+) f(\omega_2) d\omega_2. \end{aligned} \tag{5}$$

The first line of expression (5) 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 now briefly mention how the interest rate is determined before we show how the insurance provided by bankruptcy is affected by the redistributive tax and transfer scheme.

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. Clearly, the interest rate r_2 depends on the amount of debt outstanding since this influences the repayment probability (the bankruptcy threshold

ω_2^* depends on the amount of debt b_1, see equation (3)). The arbitrage condition, which implicitly defines the interest rate r_2, is

$$\int_{\rho_2^*+\frac{C}{1-\tau}}^{\omega_2^*}(\omega_2 - x - C - \tau(\omega_2 - \rho^+))f(\omega_2)d\omega_2 + \int_{\omega_2^*}^{\infty}(1+r_2)b_1 f(\omega_2)d\omega_2 = b_1(1+r_f) \quad (6)$$

where C is the deadweight bankruptcy cost which prevents full insurance of risk-averse consumers by risk-neutral banks. This cost is borne by the bank, and reflects deadweight administrative and judicial costs. 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 those states where the agent fully repays. 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 would start costly procedures if it knows that it does not receive any net payment.

Policy substitutes? We provide analytic results on how bankruptcy exemptions and redistributive taxes and transfers interact in this stylized model.

Analytical results. We show under what conditions bankruptcy exemptions and redistributive taxes and transfers are substitutes in terms of the expected utility in the second period.

Remark 1: *For given borrowing b_1, 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 receive transfers at the bankruptcy threshold, consumers cannot tax-deduct their debt and some restrictions on the probability distribution are satisfied.

Proof: provided in the section of proofs below.

The intuition is given in Section 2 in the main text. Next, we briefly 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

$$u'(\widetilde{\omega}_1 + b_1) = \beta(1+r_2)\int_{\varepsilon_2^*}^{\infty} u'(\underbrace{\mu + \varepsilon_2 - (1+r_2)b_1}_{=\rho_2} - \tau(\rho_2 - \rho^+))dF(\varepsilon_2) \tag{7}$$

is satisfied (assuming that the parameters are such that the agent finds it optimal to borrow). Recall that $\omega_2 = \mu + \varepsilon_2$ and that the amount borrowed is only repaid above the bankruptcy threshold ε_2^*. The bankruptcy threshold is defined as

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

We show:

Remark 2: *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: provided in the section of proofs below.

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, 2006).

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. 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 the 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.

Numerical example. We have shown under what conditions redistributive taxation and bankruptcy exemptions are substitutes. However, for the derivations on insurance in period 2 we have conditioned on the amount borrowed b_1 whereas for the derivations on borrowing 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 unless strong assumptions are imposed on the utility function (such as constant absolute risk aversion). This section illustrates numerically the period 1 equilibrium for constant relative risk aversion utility:

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}. \tag{8}$$

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 (7) to iterate for the optimal b_1. We then update the bankruptcy threshold ε_2^* and use the bank's arbitrage condition (6) to solve for r_2. For the new values of b_1 and r_2, we restart the algorithm until convergence.

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 3 and 4 and their discussion below). This exemption level implies reasonable default rates and is substantially lower than the mean of second period endowment which is 1.4. We assume that $\rho^+ = 0.9 = x$ so that the comparative statics for taxes τ in Remark 2 apply and set the marginal tax rate $\tau = 0.2$ which equals the mean (federal plus state) marginal tax rate in Texas (see Table 3). We assume a rather small bankruptcy cost C of 1.5% in terms of first-period resources. Finally, the coefficient of relative risk aversion, $\sigma = 2$, 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. With the chosen parameters, borrowing is optimal (the agent is impatient and expects his income to rise 40% in the second period).

Table A1 summarizes the equilibrium values for the benchmark parametrization in column (1). Columns (2) and (3) display the results when we change taxes or the exemption level. 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 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 borrowing is 0.032, 60% higher than the risk-free rate r_f.

In column (2) of Table A1, we increase marginal taxes/transfers to $\tau = 0.25$, approximately the mean marginal tax rate in US states like Maryland or Minnesota (see Table 3). In our numerical example there are two effects. More redistribution through transfers/taxes decreases the amount borrowed (as pointed out in Remark 2) and thus the default probability, but agents are taxed for some endowments where they partially default. Thus the bank recovers less in the case of default and overall the interest rate increases slightly in this example, despite the lower frequency of default.

Column (3) shows that reducing 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 2. This happens because the lower exemption 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.

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 $\tau = 0.25$. We find 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 1 and 2 which showed qualitatively how redistribution through the tax system can lower the welfare gains derived from bankruptcy exemption by decreasing borrowing and insurance provided in the second period.

A.2. Proofs of the Remarks

We first provide some further results on how the interest rate depends on the exemption level and taxes and transfers. These results will be useful for the proof of Remark 1.

I. Further derivations on the interest rate

Total differentiating equation (6), 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 that for a given level of borrowing:

$$\left.\frac{dr_2}{dx}\right|_{b_1}=\frac{F(\omega_2^*)-F(\rho_2^*+\frac{C}{1-\tau})+\frac{C}{1-\tau}f(\omega_2^*)}{(1-F(\omega_2^*))\,b_1-Cf(\omega_2^*)b_1}>0\ , \tag{9}$$

where $F(.)$ is the cumulative distribution function. The intuition is that a higher exemption level x makes the agent default in more states of the world (recall equation (3)). 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, of 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 A.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:*

$$\frac{d\left(\frac{dr_2}{dx}|_{b_1}b_1\right)}{d\tau} > 0 \tag{10}$$

iff

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

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

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

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

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

iff

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

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. ■

The intuition for Remark A.1 is that, with increasing density and decreasing hazard, more redistribution increases the expected cost of bankruptcy 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 A.1 can no longer be interpreted in a straightforward way. As inspection of equation (9) 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".

II. Proof of Remark 1

II.A. Preliminaries We first provide further derivations which are useful. Totally differentiating (5) with respect to the exemption x we find for given b_1 that

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

which simplifies to

$$\begin{aligned}\frac{du_2^b}{dx}|_{b_1} &= -(1-\tau)b_1\frac{dr_2}{dx}|_{b_1}\int_{\omega_2^*}^{\infty} u'((1-\tau)\rho_2(\omega_2)+\tau\rho^+)f(\omega_2)d\omega_2 \\ &\quad+(F(\omega_2^*)-F(\rho_2^*))\,u'(x).\end{aligned} \tag{11}$$

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 (9) 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 (2006), 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.

II.B. Proof

Totally differentiating (11) for given b_1,

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

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 A.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. ■

II.C. Some explanation

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. 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 A.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 1 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.

III. Proof of Remark 2

Define net resources in the first period as $\widetilde{\rho}_1 = \rho_1 - \tau(\rho_1 - \rho^+)$. Totally differentiating the Euler equation (7) 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 $\rho^+ \geq x$. ■

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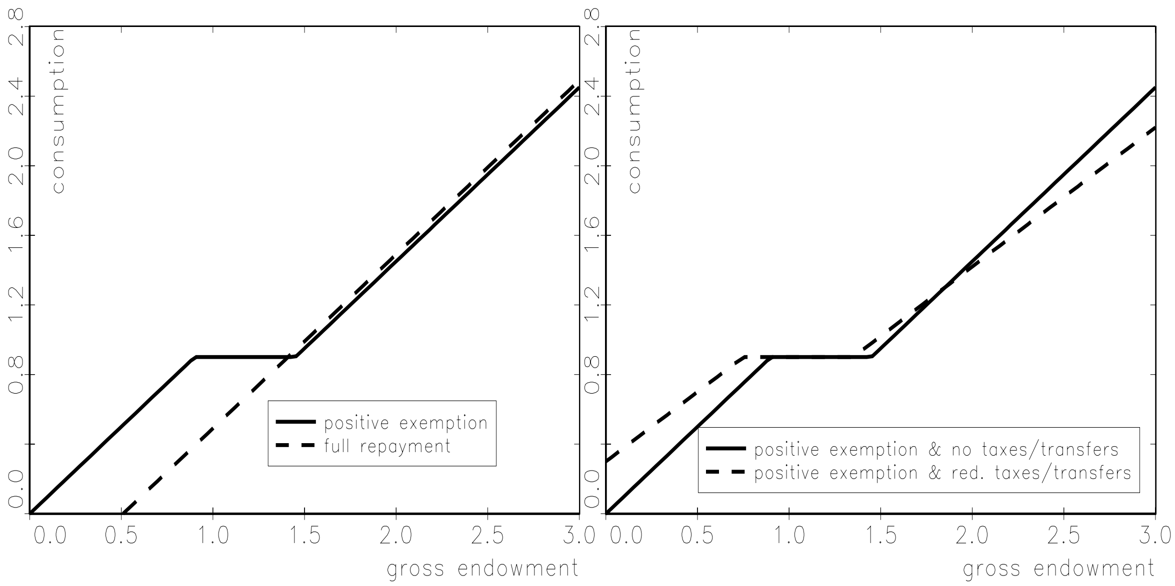

Figure 1: Consumption as a function of gross endowment for different bankruptcy exemption levels and taxes/transfers

Table 1: 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 2: 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 3: 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 1980-2003, and households aged between 30 and 60, 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 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: Summary of Laws and Changes in State Bankruptcy Exemptions

State	Annotated State Code	Changes	Fed*
Federal	11-522(d)	1984, 1994, 1998, 2001	-
Alabama	6-10-2, 6-10-6, 6-10-11	1988	no
Arizona	33-1101, 33-1121, 33-1123, 33-1124, 33-1125, 33-1126, 33-1130	1982, 1983, 1989, 1992, 2001	no
California*	704.010, 704.020, 704.030, 704.040, 704.060, 704.080, 704.730	1982, 1983, 1986, 1988, 1990, 1995, 1997, 2003	no
Colorado	13-54-102, 13-54-107, 38-41-201	1981, 1985, 1991, 2000	no
Florida	222.05, 222.25, Constitution 10-4		no
Georgia	44-13-1, 44-13-100	1981, 2001	no
Hawaii	651-92, 651-121	1984, 1999	yes
Illinois	735-5/12-901, 735-5/12-1001 735-5/12-1201	1982	no
Indiana	34-55-10-1, 34-55-10-2		no
Iowa	561.16, 627.6, 627.10	1981, 1986, 1988, 1996	no
Maryland	11-504	1982, 1983, 1989	no
Mass.	188-1, 235-35	1983, 1985, 2000	yes
Michigan	600.6023		yes
Minnesota	510.01, 510.02, 550.37	1983, 1986, 1988, 1990, 1992, 1993, 1994, 1996, 1998	yes
Missouri	513.427, 513.430, 513.440, 513.475	1982, 1993, 2003	no
OK Nevada	21.090, 115.010	1981, 1983, 1989, 1995, 1997, 2003	no
New Jersey	2A:17-19, 2A:26-4		yes
New York	CVP-52-5205, CVP-52-5206, DCD-10a-282 DCD-10a-283, DCD-10a-284	1982	no
?? Oregon	23.160, 23.164, 23.240, 23.305	1981, 1993	no
Penn.	8123, 8124		yes
Texas	41.001-41.005, 42.001-42.005	1991	yes
Virginia	34-3.1, 34.3.4, 34-26	1990	no
Washington	6-13-030, 6-13-020, 6-15-010	1983, 1987, 1991, 1999, 2003	yes
Wisconsin	815.18, 815.20	1986, 1990	yes

*Alternative system available in California which substitutes for Federal exemptions. The table reports the local state code which discusses the level of exempt assets in bankruptcy, and reports each of the years in which the code was changed. 'Fed' refers to whether the Federal bankruptcy code was allowed.

Table 6: Taxes/transfers, bankruptcy exemptions and unsecured debt

Dependent variable: Unsecured debt	(1)	(2)
income compression	0.381	-
	(0.903)	
mean marginal tax rate	-	0.442
		(2.523)
exemption × renter	-0.028	-0.048
	(0.284)	(0.305)
exemption × homeowner	0.213	0.214
	(0.054)	(0.061)
unlimited homestead exemption	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. ‘Unlimited homestead exemption’ 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: Taxes/transfers, bankruptcy exemptions and consumption insurance

Dependent variable:	$sd(c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$	$sd(c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$	$sd(\Delta c_{it})$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
income compression	-0.123	-0.353	-0.625	-0.746	-0.211	-	-	-	-
	(0.107)	(0.172)	(0.222)	(0.258)	(0.247)				
mean marginal tax rate	-	-	-	-	-	-0.177	-0.536	-0.664	-0.765
						(0.141)	(0.215)	(0.243)	(0.241)
exemption	-0.045	-0.059	-0.057	-0.028	-0.039	-0.045	-0.059	-0.058	-0.030
	(0.013)	(0.016)	(0.019)	(0.029)	(0.033)	(0.012)	(0.017)	(0.020)	(0.030)
unlimited homestead exemption	-0.141	-0.086	-0.048	0.042	0.006	-0.139	-0.085	-0.056	0.024
	(0.036)	(0.045)	(0.056)	(0.095)	(0.083)	(0.034)	(0.049)	(0.058)	(0.100)
constant	0.860	0.719	0.758	0.644	0.448	0.859	0.725	0.725	0.608
	(0.058)	(0.078)	(0.089)	(0.148)	(0.122)	(0.056)	(0.078)	(0.076)	(0.142)
time effects	-	-	-	-	yes	-	-	-	-
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	412	420	412	384	358
R^2	0.143	0.091	-	-	0.247	0.153	0.108	-	-

Standard errors in parentheses allow for clustering by state. In columns (3), (4), (8) and (9) the tax/transfer 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. Column (5) includes time dummies.

Table 8: The relationship between taxes/transfers and bankruptcy exemptions

Dependent variable: Bankruptcy exemptions	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
income compression	-0.049	-0.316	-0.269	-0.234	-	-	-	-
	(0.016)	(0.119)	(0.071)	(0.034)				
mean marginal tax rate	-	-	-	-	-0.171	-0.236	-0.201	-0.174
					(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 allow for clustering by state. *IV* refers to whether the tax/transfer 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 unlimited homestead exemptions.

Table for appendix:

Table A1: Equilibrium values of borrowing b_1, interest rate r_2, and default probability

Variables	*Benchmark*	$\tau = 0.25$	$x = 0.85$
	(1)	**(2)**	**(3)**
borrowing b_1	0.1854	0.179	0.186
interest rate r_2	0.0321	0.0325	0.025
default prob.	0.0137	0.012	0.005

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 $\varepsilon \sim N(0, 0.1 * \omega_2)$.