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U.S. consumer bankruptcy choice: The importance of general equilibrium effects ☆

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Abstract

We study the implications of U.S. personal bankruptcy rules for resource allocation and welfare. Our analysis shows that general equilibrium considerations along with bankruptcy chapter choice and production matter crucially for the effects of policy reform. Contrary to previous work, we find that completely eliminating bankruptcy provisions causes significant declines in output and welfare by reducing capital formation and labor input. Furthermore, subjecting Chapter 7 filers to means testing, as suggested by recent legislative proposals, would not improve upon current bankruptcy provisions and, at best, leave aggregate filings, output, and welfare unchanged. However, we do find that an alternative tightening of Chapter 7, in the form of lower asset exemptions, can increase economic efficiency.

JEL classification: D52; G18

Keywords: Consumer bankruptcy; Chapter 7; Chapter 13

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1. Introduction

The economics of personal bankruptcy is a subject of increasing interest for economists in general and macroeconomists in particular. By allowing households to stop or delay the repayment of debts, the option to file for bankruptcy helps complete markets and promotes risk sharing. Thus, recent research has focused on the implications of bankruptcy rules for resource allocation and welfare. This literature, however, has confined itself to both partial equilibrium settings and only one of the options available to debtors under current U.S. bankruptcy law.[1]

In contrast, we show that the analysis of consumer bankruptcy requires (i) a general equilibrium framework with endogenous factor supply, risk premia, and wages, and (ii) both bankruptcy chapters currently available to debtors, Chapters 7 and 13, each of which has its own incentive effects on labor supply and capital formation. Any study of U.S. consumer bankruptcy that ignores these features is potentially misleading for two reasons. First, defaulting under Chapter 13, while letting debtors keep their assets, requires them to enter a partial repayment plan that acts as a powerful wage tax (Posner, 1999; Wang and White, 2000). Hence, by discouraging labor effort, Chapter 13 directly affects production and welfare. Second, by allowing for the discharge of all unsecured debt net of exemptions, Chapter 7 defaults affect risk premia which then induce further changes in the overall volume of debt and, ultimately, capital accumulation.

Contrary to previous work, our analysis indicates that eliminating bankruptcy options entirely carries significant social costs. It is true that getting rid of bankruptcy provisions remove important ex post bankruptcy costs such as exclusion from credit markets. Absent production, and without any feedback effects from prices, this elimination of bankruptcy costs is a driving force that leads to the significant welfare gains found in the existing literature. However, with production explicitly considered, changes in risk premia lead to declines in output. Specifically, because the risk premium falls sharply as consumers can no longer default, households find it cheaper to borrow. While this effect is immaterial for efficiency concerns in exchange economies, it directly reduces the stock of capital available for production in our framework. In addition, the fall in capital reduces labor demand. With both lower capital formation and labor input, our model yields a decline in output that more than offsets the welfare gains associated with the elimination of bankruptcy costs.

Our analysis also indicates that tightening Chapter 7 provisions through "means testing", as suggested by recent congressional reform proposals aimed at restricting Chapter 7 to only the neediest households, leads not to just greater debt repayment but also more Chapter 13 bankruptcies. Contrary to the stated objectives of the proposals, these effects can induce a *fall* rather than an increase in output and welfare. Because Chapter 13 repayment plans reduce expected earnings, a higher rate of Chapter 13 bankruptcies discourages labor effort. Furthermore, the fact that creditors collect more effectively on their loans under tighter Chapter 7 provisions lowers the lending rate which

[1]See Adler et al. (2000), Zha (2001), Chatterjee et al. (2002), Lehnert and Maki (2002), as well as Livshits et al. (2003). Athreya (2002) does allow for an endogenous interest rate, but the environment is that of an exchange economy with no production and a single bankruptcy chapter. Wang and White (2000) explore both bankruptcy chapters allowed under U.S. law but do so in a partial equilibrium framework.

then leads to greater consumer debt. This greater volume of debt in turn reduces the available supply of capital and, given the reduction in labor input, output and welfare fall.[2]

Finally, we show that an alternative tightening of Chapter 7 provisions, in the form of lower asset exemptions, can increase economic efficiency. This proposal helps increase output and welfare because lower Chapter 7 asset exemptions paradoxically lead to more Chapter 7 and fewer Chapter 13 bankruptcies. With lower exemption levels under Chapter 7, the greater confiscation of assets in the event of default reduces the incentive to save and, consequently, increases the likelihood of default. With default more likely, the risk premium rises which induces a lower level of debt. This effect helps raise the supply of available capital. At the same time, a higher lending rate increases the burden of loan repayment under Chapter 13 which leads to a fall in Chapter 13 bankruptcies. Given that Chapter 13 acts as a wage tax, labor input then correspondingly rises. The end result is an increase in both capital and labor that directly contribute to raising output and welfare.

Our modeling strategy follows most closely that of Athreya (2002) and Li (2001). While Athreya (2002) studies bankruptcy filings under Chapter 7 only, Li (2001) investigates both Chapters 7 and 13 filings but does so in a two-period framework. As in Athreya (2002), Chatterjee et al. (2002) analyze unsecured consumer loans but allow for default only under Chapter 7. Their innovation lies in the explicit modeling of a menu of credit levels and interest rates offered by credit suppliers. Livshits et al. (2001) focus on income garnishment in a partial equilibrium life-cycle framework. None of the above papers allows for economy-wide production. Wang and White (2000) study optimal bankruptcy proceedings. Here, in contrast, existing provisions are taken as given.

This paper is organized as follows. Section 2 provides an overview of U.S. bankruptcy law. In Section 3, we present our theoretical framework. Section 4 discusses the trade-offs between bankruptcy Chapters. In Section 5, we carry out quantitative evaluations of several policy experiments. Section 6 offers some concluding remarks.

2. Overview of U.S. personal bankruptcy law

Current U.S. law allows for two personal bankruptcy procedures—Chapters 7 and 13—with debtors having the right to choose between them. These Chapters represent virtual opposites in their treatment of current assets versus future income.

2.1. Chapter 7: an asset tax

Under Chapter 7, a debtor must turn over all of his assets exceeding some exemption level to a bankruptcy trustee. In return, many types of unsecured debt including credit card debt, installment loans, and medical bills are discharged. The trustee then liquidates all of the debtor's non-exempt assets and uses the proceeds to partially repay his debts.

In addition to losing his current assets, a Chapter 7 debtor cannot file again under that chapter for a period of six years following his initial filing. He must also bear the cost of exclusion from credit during that period, as well as a potential non-pecuniary cost for having failed to meet his debt obligations. Many authors refer to this cost as "stigma" and

[2]In the partial equilibrium frameworks of Athreya (2002) and Chatterjee et al. (2002), increases in debt repayment associated with tighter Chapter 7 provisions do not feedback into capital formation through prices. In their analyses, therefore, means testing under Chapter 7 leads to welfare gains.

argue that it is an important factor in households' bankruptcy decisions.[3] Records of a Chapter 7 bankruptcy can stay on one's credit history for a period of up to ten years. It is this chapter which has received the attention of the recent quantitative bankruptcy literature.

2.2. Chapter 13: a wage tax

Under Chapter 13, a debtor can keep all of his assets but must propose a plan to repay a portion of his debts from future earnings, typically over a period of three to five years. The amount of debt to be repaid must be no less than the value of non-exempt assets the debtor would have lost under Chapter 7. Before a debt adjustment plan can be confirmed by a bankruptcy judge, it must satisfy "full payment" or "disposable income" tests. That is, unless a debtor proposes to pay his debts in full, he is required to pay all of his disposable income—income that is not reasonably necessary for the maintenance or support of the debtor and his dependents—to the Chapter 13 plan for up to five years. Moreover, the law is explicit about including income from a secondary job and spousal income, as well as accounting for changes in current and future income.[4] At the end of the repayment period, any remaining unpaid debt is discharged.

In principal, a debtor can file as often as every six months under Chapter 13. However, he cannot incur additional debt without approval from a bankruptcy trustee while a Chapter 13 plan is in effect. Furthermore, since lenders do not distinguish between Chapters 7 and 13 bankruptcy filings, a Chapter 13 filer also faces exclusion from credit during the repayment period, and possibly societal disapproval or "stigma."

Although full debt repayment is possible under Chapter 13, very few repayment plans end up paying unsecured creditors in full in practice, especially given high trustee's fees that range from 3% to 10% of each payment. According to the U.S. Department of Justice, in 2001, only 17.4% of debtors ended up paying more than 70% of their unsecured debt, and only a fraction of those still would have ended up paying their debts in full.[5] An earlier GAO study carried out in 1983 found that the amount repaid under Chapter 13 averaged just around 57% of the associated unsecured debt.[6]

Given these observations, it is not surprising that Chapter 13 repayment plans are typically interpreted as a tax on disposable income both in law and economics. Posner (1999) is especially explicit regarding the incentive effects associated with the tax aspects of Chapter 13:

> Under Chapter 13, all of a debtor's disposable income must be used to repay debts unless the creditors consent to a more generous plan. Thus, every dollar that the debtor might earn by working harder will be taken by creditors, so the debtor has little incentive to work hard. Indeed, many debtors might stop working and instead live off their families and collect welfare benefits, because by doing so they do no worse than they do by working and losing their entire disposable income. People who

[3]See White (1998), Fay et al. (2002), Gross and Souleles (2002), as well as Buckley and Brinig (1998).

[4]See United States Code Annotated (U.S.C.) Akin, Bkrtpcy. D. Nb. 1985, 54 B.R. 700, and Bottorff, Bkrtcy. W. D. Mo. 1999, 232 B. R. 171.

[5]U.S. Department of Justice, Chapter 13 Standing Trustee Annual Reports, 1998–2002.

[6]U.S. GAO, p. 43.

refuse to work will neither pay off their debts, nor receive a discharge; but creditors will not be paid either.

These statements make clear that because Chapter 13 works as a significant wage tax, it reduces workers' willingness to work, or leads them to stop working altogether.

3. The model

There is a continuum of ex ante identical households. Each household maximizes its expected sum of discounted utility $E\sum_{t=0}^{\infty}\beta^t U(c_t, l_t)$, where $0<\beta<1$ is the discount factor, c_t represents consumption at date t, and l_t is labor supply at date t. Household preferences take the form

$$U(c_t, l_t) = \frac{[c_t^{1-\sigma}(1-l_t)^{\sigma}]^{1-\rho}-1}{1-\rho}. \tag{1}$$

In each time period, households are endowed with one unit of time that can be allocated either to work or leisure. Following Hansen (1985), and Hansen and Imrohoroglu (1992), we assume that households can choose to work a given number of hours or not at all, $l \in \{0, \widehat{h}\}$. Household income fluctuates over time as a result of stochastic labor productivity shocks denoted by ε. The labor productivity shock takes values in $\mathscr{R}_+$ and follows a first-order Markov process whose cumulative distribution function is $G(\varepsilon'|\varepsilon)$, with associated density function $g(\varepsilon'|\varepsilon)$.

Aggregate production is given by

$$y_t = k_t^{\alpha} n_t^{1-\alpha}, \quad 0<\alpha<1, \tag{2}$$

where y_t is total output, k_t capital input, and n_t effective labor input. Capital depreciates at rate δ, $0\leqslant\delta\leqslant 1$, when used in production.

There also exists an intermediation sector that takes all deposits and makes loans. This sector invests any deposits net of lending as capital input in the production process. We denote the gross deposit rate by R_t, and consider credit contracts with fixed interest rates that ensure zero-profits given average repayment rates within a pool of borrowers. Thus, all borrowers are charged the same rate $R_t+\tau+\gamma_t$.[7] Here, τ represents an exogenous transaction cost per unit of loan that captures the cost of servicing accounts. The endogenous risk premium required to cover potential default is denoted by γ_t. When the intermediation sector is competitive, the deposit rate equals the marginal product of capital and intermediaries make zero profits in equilibrium.

3.1. The household's problem

In the environment we describe below, households find themselves in one of two main situations. They either have access to credit or are borrowing constrained as a result of having filed for bankruptcy.

[7]This simplifying assumption, which follows Athreya (2002, 2003) and Lehnert and Maki (2002), allows us to study general equilibrium price effects on consumer borrowing, default, and welfare. In partial equilibrium settings, lending rates can be made contingent on loan amounts, income, and other household characteristics while keeping the model tractable. See Chatterjee et al. (2002) and Livshits et al. (2001).

3.1.1. Unconstrained households

Let $V^u(a,d,\varepsilon)$ denote the value function of an unconstrained household. The relevant states for this household include its asset level, $a \in A = \mathscr{R}_+$, its debt level, $d \in D = [0, \overline{d}]$, and its labor productivity draw, $\varepsilon \in \mathscr{E} = \mathscr{R}_+$. This household has three options: it can either pay off its debt, file for bankruptcy under Chapter 7, or file for bankruptcy under Chapter 13. We use $V^p(a,d,\varepsilon)$, $V^7(a,\varepsilon)$, and $V^{13}(a,d,\varepsilon)$ to represent the value functions associated with each of these three options, respectively.

The value of paying off one's debt in the current period is defined recursively as follows:

$$V^p(a,d,\varepsilon) = \max_{\{c,a' \geqslant 0, l \in \{0,\widehat{h}\}, 0 \leqslant d' \leqslant \overline{d}\}} \left\{ U(c,l) + \beta \int_{\mathscr{E}} V^u(a',d',\varepsilon')\, \mathrm{d}G(\varepsilon'|\varepsilon) \right\} \tag{P1}$$

subject to

$$c + a' \leqslant Ra + \varepsilon w l + d' - (R + \tau + \gamma)d, \tag{3}$$

where a' denotes the amount of assets carried into next period, d' represents next period's debt, and w is the household's wage. Note that the household's budget constraint (3) explicitly allows for simultaneous borrowing and saving at different rates. Indeed, in our framework, the presence of exemptions under Chapter 7 will lead households to use debt before drawing down their assets completely (see Li, 2001). Thus, the simultaneous modeling of assets and debt enables us to directly explore the economic effect of asset exemption levels under Chapter 7, an exercise that is typically lacking in previous work.[8] That said, there exists an upper bound on how much debt a household can carry into the next period, $\overline{d}$. Eq. (3) also shows that a household that pays off its debt in full in the current period necessarily gains unconstrained access to credit markets in the following period.

Let $V^{c7}(a,\varepsilon)$ denote the value function of a household that has filed under Chapter 7 and that is now borrowing constrained. Similarly, let $V^{c13}(a,d,\varepsilon)$ represent the value function of a household that is borrowing-constrained as a result of filing under Chapter 13. The value of filing for Chapter 7 can then be recursively defined as

$$V^7(a,\varepsilon) = \max_{\{c,a' \geqslant 0, l \in \{0,\widehat{h}\}\}} \left\{ U(c,l) - s + \beta \int_{\mathscr{E}} V^{c7}(a',\varepsilon')\, \mathrm{d}G(\varepsilon'|\varepsilon) \right\} \tag{P2}$$

subject to

$$c + a' \leqslant \min(Ra, x) + \varepsilon w l. \tag{4}$$

Once a household chooses to file for bankruptcy under Chapter 7, all of its debts are discharged and d no longer serves as a state variable. Moreover, as depicted in its budget constraint (4), it can keep assets up to the exemption level $x > 0$. To capture the social stigma associated with bankruptcy, we assume that defaulters bear a utility cost denoted $s > 0$. These households are necessarily borrowing constrained in the following period and have continuation utility $V^{c7}(a',\varepsilon')$.

Similarly, an unconstrained household filing for Chapter 13 solves the following problem:

$$V^{13}(a,d,\varepsilon) = \max_{\{c,a' \geqslant 0, l \in \{0,\widehat{h}\}\}} \left\{ U(c,l) - s + \beta \int_{\mathscr{E}} V^{c13}(a',d',\varepsilon')\, \mathrm{d}G(\varepsilon'|\varepsilon) \right\} \tag{P3}$$

[8] See Pavan (2003) for a recent exception.

subject to

$$c + a' \leqslant Ra + [1 - \eta(d)]\varepsilon w l. \tag{5}$$

A household filing under Chapter 13 is allowed to keep all of its assets but must enter a partial debt repayment plan financed from current and future wages. Following Adler et al. (2000) and Wang and White (2000), we model the repayment rate, $0 < \eta(d) < 1$, as a debt-contingent linear wage tax.[9] It follows that having filed under Chapter 13, a household retains only a portion $1 - \eta(d)$ of its current wage, where

$$\eta(d) = \frac{(R + \tau + \gamma)d}{\omega}. \tag{6}$$

In Eq. (6), ω denotes the debtor's unconditional five-year mean labor income. In other words, we impose a five-year debt repayment period. Observe that Chapter 13 calls for the repayment of principal plus interest as of the time of filing. In keeping with the law, any interest accrued beyond that date does not have to be repaid. As in practice, our framework implies that Chapter 13 will rarely pay off creditors in full ex post, either because the debtor cuts back his work hours or because his realized income stream turns out lower than expected. Finally, as with Chapter 7 filers, a Chapter 13 filer pays the bankruptcy cost s and becomes borrowing constrained in the following period.

Since a household with access to credit can choose to repay its debts or file for bankruptcy under either Chapter 7 or 13, we have that

$$V^u(a, d, \varepsilon) = \max\{V^p(a, d, \varepsilon), V^7(a, \varepsilon), V^{13}(a, d, \varepsilon)\}. \tag{7}$$

3.1.2. Borrowing-constrained households

Exclusion from credit markets is a key cost for households that have defaulted under either Chapter 7 or 13. As in Athreya (2002) and Chatterjee et al. (2002), we model this exclusion using a lottery. Specifically, in each period following bankruptcy, a household remains in the borrowing-constrained state with probability λ_i, $i = 7, 13$, where λ_7 and λ_{13} correspond to a Chapter 7 and a Chapter 13 filing, respectively. Under this lottery, $1/(1 - \lambda_i)$ captures the mean waiting time needed to regain full access to credit markets following bankruptcy. This device, therefore, allows us to approximate the fixed duration for which a household's poor credit history is maintained by the bankruptcy code without having to keep track of how many periods have elapsed since an individual household last declared bankruptcy.

A Chapter 7 defaulter who is restricted from credit markets solves the following problem:

$$V^{c7}(a, \varepsilon) = \max_{\{c, a' \geqslant 0, l \in \{0, \widehat{h}\}\}} \left\{ U(c, l) - s + \beta \int_{\mathscr{E}} [\lambda_7 V^{c7}(a', \varepsilon') + (1 - \lambda_7) V^u(a', 0, \varepsilon')] \, \mathrm{d}G(\varepsilon' | \varepsilon) \right\} \tag{P4}$$

[9] We have already seen that Chapter 13 requires that all of a debtor's income, net of expenses reasonably necessary for his maintenance, be applied to the plan. Thus, this assumption amounts to modeling court-determined maintenance expenses, which are subjective in practice, as proportional to income.

subject to

$$c + a' \leqslant Ra + \varepsilon wl. \tag{8}$$

Thus, a constrained Chapter 7 debtor continues to suffer a utility loss from having filed for bankruptcy. In the following period, it will carry on unable to borrow with probability λ_7 or regain access to credit with probability $1 - \lambda_7$.

Likewise, a constrained household that has defaulted under Chapter 13 solves

$$V^{c13}(a, d, \varepsilon) = \max_{\{c,a' \geqslant 0, l \in \{0,\widehat{h}\}\}} \left\{ U(c, l) - s + \beta \int_{\mathscr{E}} [\lambda_{13} V^{c13}(a', d, \varepsilon') + (1 - \lambda_{13}) V^{u}(a', 0, \varepsilon')] \, \mathrm{d}G(\varepsilon' | \varepsilon) \right\} \tag{P5}$$

subject to

$$c + a' \leqslant Ra + [1 - \eta(d)]\varepsilon wl. \tag{9}$$

A household in default under Chapter 13 continues to pay off its debt out of wages and cannot borrow as long as it remains in the constrained state. It will continue to be barred from credit markets in the following period with probability λ_{13} or regain entry into the unconstrained pool with probability $1 - \lambda_{13}$.

3.2. The firm's problem

A representative firm takes as given the wage, w, as well as the interest rate, R, and solves the following optimization problem

$$\max_{\{k,n\}} k^{\alpha} n^{1-\alpha} - (R - 1)k - wn - \delta k. \tag{10}$$

3.3. Stationary equilibrium

A stochastic stationary equilibrium for this economy is a set of prices (the deposit rate, the borrowing rate, and the wage), household consumption, labor, and credit allocations, as well as firms' decision rules, such that (i) households' decisions maximize their lifetime utility, (ii) firms' decision rules maximize profits, (iii) all markets clear, and (iv) individual and aggregate behavior are consistent.[10]

4. Choosing between Chapters 7 and 13

To gain insight into the model we have just presented, this section describes key properties of households' value functions that govern how defaulting debtors choose between Chapters 7 and 13. Fig. 1 shows that V^7, the utility of a Chapter 7 filer, increases in the filer's assets up to some threshold, x/R, and flattens out thereafter. At the same time, the utility of a Chapter 13 filer, V^{13}, increases continuously with the filer's assets.[11]

[10] See Li and Sarte (2002) for a formal description of these equilibrium conditions.

[11] These properties of debtors' value functions are established formally in Li and Sarte (2002). It is also shown that the utility of a Chapter 13 filer decreases in his debt level, unlike that of a Chapter 7 filer which is invariant to debt.

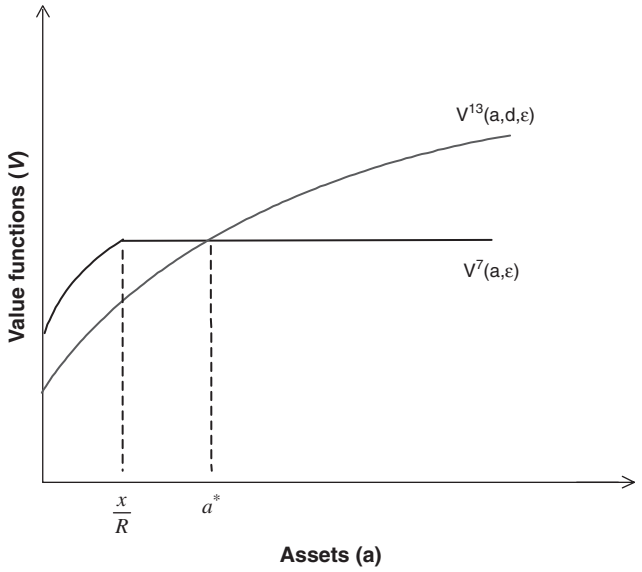

Fig. 1. The value of filing for bankruptcy.

To explain the shape of Chapter 7 filers' utility in Fig. 1, recall in (4) that all wealth above the exemption level must be surrendered in the event of a Chapter 7 default. Therefore, any assets accumulated beyond that level do not influence the value of declaring Chapter 7 bankruptcy. Furthermore, because Chapter 7 provides for the discharge of all debts, the level of debt at the time of filing will not affect a Chapter 7 filer's value function. This explains why V^7 does not contain d as an argument in Fig. 1. In contrast, since a Chapter 13 filer retains his assets, but faces a repayment rate, $\eta(d)$, that is contingent on debt, his utility increases in assets (which expand his budget set), but decreases in debt.

Fig. 1 also shows that when household wealth is relatively low, $a \leqslant a^*$, the value of defaulting under Chapter 7 dominates that of defaulting under Chapter 13. The reverse is true for households whose assets are relatively high, $a \geqslant a^*$. Hence, if both Chapters 7 and 13 bankruptcies are observed in equilibrium, our model implies that Chapter 13 defaulters have higher assets than households that default under Chapter 7. In a sense, it is only natural that Chapter 13, which allows households to retain their assets, would be more attractive to wealthier households.[12] Indeed, using a random sample of Chapters 7 and 13 cases from a population of 17,565 bankruptcies, Domowitz and Sartain (1999) find that equity levels are important factors in debtors' bankruptcy choice decisions. Higher levels of equity relative to debt push debtors into Chapter 13 with a probability double that predicted for households with low equity holdings (see also Nelson, 1999). At this point, we find it helpful to calibrate our economy in order to make matters more concrete.

[12]In principle, it is possible for V^7 to lie everywhere below V^{13} in Fig. 1. However, no Chapter 7 defaults would ever be observed in this case.

4.1. Benchmark calibration

We choose our benchmark model parameters so as to reproduce key U.S. economic statistics. A time period is taken to be one year and we choose the discount factor β to match the annualized post WWII real return available on T-bills, approximately 2.7%. We set the risk-aversion parameter as in Aiyagari and McGrattan (1998), $\rho = 1.5$. Following Hansen and Imrohoroglu (1992), we let $\sigma = 0.67$, and set $\widehat{h}$ to 0.45. As with many other quantitative studies on business cycles, the labor share of income is set to 0.70, which implies that $\alpha = 0.3$. Consistent with the postwar average depreciation of fixed private capital and consumer durables, we choose an annual depreciation rate δ of 0.10.

The transaction cost parameter τ is set to 5%, close to the 5.3% cost of servicing credit card accounts found by Evans and Schmalensee (1999). We choose the risk spread γ to match the real interest rate on unsecured loans. According to an annual report by the Federal Reserve Board, over the five years since the last major change in bankruptcy law in 1994, the real rate on unsecured loans has averaged 13.5%. The parameters λ_7 and λ_{13} are set so that on average, Chapters 7 and 13 filers are excluded from credit markets for six and five years, respectively.

To simplify calibration, we assume that labor productivity follows a two-state Markov chain with values in $[y, 2-y]$. We further assume that the transition matrix is symmetric, with the likelihood of remaining in the same productivity state as in the previous period given by $0<\pi<1$. Along with y and π, there remain three parameters to be calibrated, the borrowing ceiling, $\overline{d}$, the bankruptcy stigma, s, and the Chapter 7 asset exemption level, x. We choose these parameters so as to match the following five U.S. statistics: the private capital-output ratio, approximately 2.5% in the U.S., the debt to income ratio, 9% as calculated by the Federal Reserve Board, the Gini index of income, 0.44 based on Quadrini's (2000) analysis of the Panel Study of Income Dynamics, and the percentage of households that file for bankruptcy under Chapters 7 and 13, 0.83 and 0.35, respectively, as reported by the American Bankruptcy Institute.

The parameter values that achieve our calibration targets are summarized in Table 1. We report the main properties of the benchmark model economy and their data counterparts in Table 2. As shown in Table 2, the model does well in reproducing the statistics our calibration set out to match. In addition, our framework also performs relatively well in reproducing debt-related facts we had not specifically set out to match. Personal bankruptcy in our model results in the discharge of nearly 6% of total consumer debt. This matches closely 1998 WEFA estimates which indicate that bankruptcy filings led to the discharge of $42 billion in consumer debt in 1997, roughly 7% of the $568 billion held in consumer revolving debt in that year (WEFA Group, 1998). Approximately 70% of the debt that is released, both in the model and in the data, is due to Chapter 7 filings. Our framework also implies that Chapter 13 defaulters repay on aggregate about 65% of their debts, somewhat higher than the 57% repayment rate for Chapter 13 filings reported by the GAO.

4.2. Simulated asset decision rules

Fig. 2, panel (A) plots filers' utility as a function of assets and bankruptcy chapter choice obtained under our benchmark calibration.[13] As discussed above, given similar debt levels,

[13]This figure assumes a low realization of household productivity.

Table 1
Calibrated parameters

Parameter		Value
Preference		
β	Time discount rate	0.93
ρ	Coefficient of relative risk aversion	1.5
σ		0.67
$\widehat{h}$	Indivisible labor supply	0.45
Technology		
α	Capital income share	0.3
δ	Capital depreciation rate	0.1
ε	Labor productivity shock	[0.25, 1.75]
$g(\varepsilon'\|\varepsilon)$	Transition matrix for labor productivity	$\left[\begin{smallmatrix}0.9 & 0.1\\ 0.1 & 0.9\end{smallmatrix}\right]$
τ	Cost of servicing loans	0.05
$\overline{d}$	Upper bound on borrowing	0.98
Bankruptcy provisions		
s	Non-pecuniary filing cost	0.89
x	Chapter 7 asset exemption level	0.39
$1/(1-\lambda_7)$	Average length of exclusion from credit markets after Chapter 7	6
$1/(1-\lambda_{13})$	Average length of exclusion from credit markets after Chapter 13	5

Table 2
The Benchmark model economy

Statistics	U.S. data	Model
Risk premium (%)	10.8	10.5
Capital/output	2.5	2.4
Debt/income	0.09	0.10
Gini index of income	0.44	0.45
Percentage of defaults (%)		
Total	1.18	1.25
Chapter 7	0.83	0.86
Chapter 13	0.35	0.39

defaulting households with lower assets choose to file under Chapter 7 while those with higher wealth choose Chapter 13.

Fig. 2, panels (C) and (D), presents simulated asset decision rules as functions of assets and debt. Observe that Chapter 13 filers always save more than those who repay their debts. This finding arises from two forces. First, since these households see their debt partially discharged once they file for bankruptcy, depleting their assets is no longer necessary in order to service their debt. Second, in anticipation of being credit constrained, bankruptcy filers recognize that savings will be the only means with which they can smooth consumption in the future.

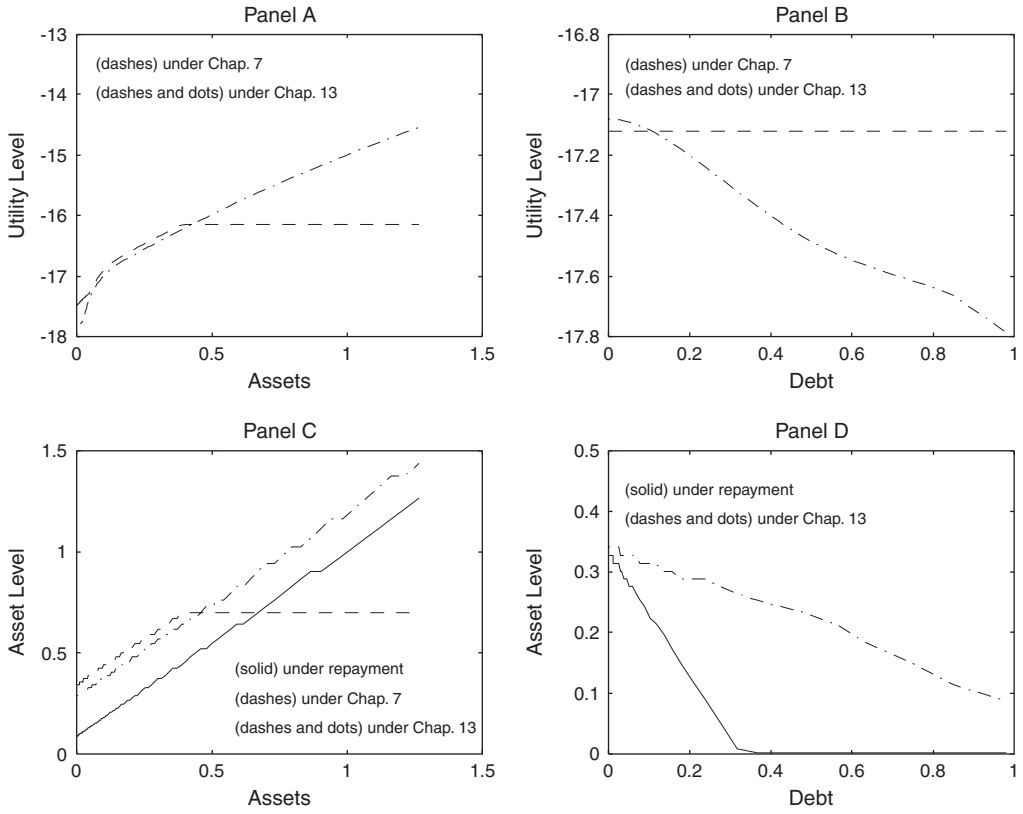

Fig. 2. Numerical value functions and asset decision rules.

Finally, Fig. 2, panel (C), shows that above the Chapter 7 exemption level, approximately 0.39, Chapter 7 filers' savings are constant. As with their utility, this result stems from the fact that all assets above the Chapter 7 exemption are seized by creditors. Thus, assets above the exemption level no longer affect Chapter 7 filers' decision rules. Furthermore, since all debt is discharged under Chapter 7, savings for Chapter 7 filers (not shown) are also independent of their current debt level.

5. Bankruptcy reforms in general equilibrium

Using our calibrated model economy, we now conduct three simulations designed to underscore the importance of general equilibrium considerations in evaluating the effects of policy reform. First, we study the case where no bankruptcy is allowed and contrast our findings with previous work. Second, we analyze a bankruptcy reform proposal based on "means testing" similar to the many such proposals introduced before Congress since 1997. The goal of means testing is to restrict the option of a Chapter 7 filing to only the neediest households. Finally, we experiment with lowering asset exemption levels as an alternative way to tighten Chapter 7 provisions.

5.1. Eliminating bankruptcy provisions

This section examines the effects of eliminating bankruptcy provisions entirely. In a setting very similar to ours, but without production and bankruptcy chapter choice, Athreya (2002) shows that such a proposal can generate significant welfare gains. A question then arises as to why bankruptcy options exist in the first place. We now show that a possible answer to this question lies in the explicit modeling of production and chapter choice.

5.1.1. Effects on prices and quantities

Table 3 presents our main findings, providing the responses of key variables to the complete elimination of bankruptcy options. Since households must now pay off their debts, lenders no longer need to charge a default premium (i.e. $\gamma = 0$). In equilibrium, therefore, the lending rate falls sharply from 13% to just 8.14%. Given this lower lending rate, the debt to income ratio rises by 34%. Furthermore, since the aggregate stock of private capital must add up to total assets net of loans,

$$k = \int_{A,D,\mathscr{E}} (a^u - d^u)\,\mathrm{d}\mu^u + \int_{A,\mathscr{E}} a^{c7}\,\mathrm{d}\mu^{c7} + \int_{A,D,\mathscr{E}} a^{c13}\,\mathrm{d}\mu^{c13}, \tag{11}$$

where μ^i is the measure of households in situation i, the rise in consumer debt in turn reduces the supply of available capital. Note in Table 3 that consistent with this lower equilibrium capital stock, the deposit rate rises by roughly 60 basis points.

5.1.2. Implications for welfare

We define social welfare as

$$\mathscr{W} = \int_{A,D,\mathscr{E}} V^u\,\mathrm{d}\mu^u + \int_{A,\mathscr{E}} V^{c7}\,\mathrm{d}\mu^{c7} + \int_{A,D,\mathscr{E}} V^{c13}\,\mathrm{d}\mu^{c13}, \tag{12}$$

where the integrals above are evaluated using the steady-state distribution of assets, debt, labor productivity shocks, and credit status. Since all households are weighted equally, our notion of social welfare is utilitarian in nature. We measure a given welfare change as the percent change in benchmark consumption at every date and state that equates welfare under the economy defined by the proposed bankruptcy policy to welfare under the benchmark economy (see Aiyagari and McGrattan, 1998). Our results, therefore, only capture steady state differences resulting from policy changes and ignore potentially important transition costs.[14]

In a setting without production, the welfare consequences of removing bankruptcy provisions may be understood in terms of three main effects. First, recall that bankruptcy is typically justified as a means of insurance for households that suffer adverse income shocks. Specifically, since households face uninsurable idiosyncratic risk in our environment, there will be states of the world in which a household's income is low. Requiring the full repayment of debts in this case, through the elimination of bankruptcy, would directly result in welfare losses from temporarily low consumption. Second, because

[14]Because of the difficulties involved in tracking the distribution of wealth as an endogenous state variable in this model, we leave this issue to future research.

Table 3
Eliminating bankruptcy provisions and tightening asset exemptions under Chapter 7

Statistics	Benchmark ($x = 0.39$)	Eliminating bankruptcy provisions entirely (% change from benchmark)	Tightening asset exemptions under Chapter 7 ($\overline{x} = 0.375$)[a] (% change from benchmark)
Deposit rate (%)[b]	2.516	+0.596	−0.023
Lending rate (%)	13.008	−4.867	+0.027
Debt/income	0.104	+34.146	−6.013
Assets			
Total	1.412	+1.873	−0.046
Ave. Chapter 7 filer	0.003	N/A	−33.33
Ave. Chapter 13 filer	0.160	N/A	−0.125
Consumer debt			
Ave. Chapter 7 filer	0.167	N/A	+0.119
Ave. Chapter 13 filer	0.196	N/A	−0.101
Capital	1.366	−8.989	+0.326
Labor	0.392	−2.430	+0.053
Output	0.570	−4.447	+0.133
Welfare	−0.761	−3.330	+0.421
Chapter 7 filings (%)	0.860	N/A	+0.109
Chapter 13 filings (%)	0.386	N/A	−0.375
Total filings (%)	1.246	N/A	−0.265

[a]The case $\overline{x} = 0.375$ maximizes steady state welfare.
[b]For the deposit rate, as well as all variables already expressed in percent, changes from the benchmark are in levels.

lenders are always repaid when default options are eliminated, the absence of bankruptcy procedures also implies a lower lending rate and, in equilibrium, a higher volume of loans. Since each loan carries a service cost, τ, the elimination of bankruptcy is associated with larger deadweight losses linked to credit transactions. The third effect acts in an opposite direction and can yield substantial welfare gains. In fact, without bankruptcy, the ensuing reduction in bankruptcy costs associated with exclusion from credit markets and other non-pecuniary penalties can significantly outweigh the welfare losses stemming from decreased consumption smoothing. More specifically, absent production, Athreya (2002) shows that eliminating bankruptcy can yield welfare gains ranging up to 0.7%.

In contrast, in our framework, the welfare gains associated with the elimination of bankruptcy costs are more than offset by general equilibrium feedback effects into production. We have already seen in Table 3 that removing bankruptcy lowers the risk premium, as households can no longer default, which induces a rise in loans and a corresponding fall in the supply of capital. In addition, the fall in aggregate capital leads to an inward shift in labor demand and, in equilibrium, both wages and labor input fall. Consequently, and contrary to Athreya (2002), the sharp decline in capital and labor input reduces production of the final good, total consumption, and welfare. In particular, we find that getting rid of bankruptcy leads to a 4.4% reduction in total output, and as much as a 3.3% decrease in welfare, relative to the benchmark case.

5.2. Means testing under Chapter 7

There have been many attempts by Congress to pass bankruptcy reform legislation over recent years, and almost all of these reforms require a tightening of Chapter 7 provisions.[15] More precisely, under these proposals, a means test would be applied to determine which debtors are forced into Chapter 13, and thus debt repayment out of current and future income. Ultimately, the objective of these proposals is to improve the efficiency of credit allocation. In contrast, our analysis suggest that means testing under Chapter 7 at best leaves output and welfare unchanged.

According to the 2001 House and Senate bills, a household that "passes" either of the following two tests would be barred from filing under Chapter 7:

- The debtor's income meets or exceeds the regional median income of households with the same number of members.
- The debtor's estimated five-year earnings less expenses represent at least 25% of his general non-priority unsecured debts.

Alternatively, note that to "fail" the means test implies that a household *would* be allowed to file for Chapter 7.[16] Given that court-determined expenses are subjective in nature, we experiment with different levels of expenses measured as a proportion of estimated five-year earnings and denoted by $1-\phi$, $\phi \in [0,1]$. When $\phi = 0$, all of a defaulter's estimated five-year income is used as expenses so that he would automatically qualify for Chapter 7. As ϕ rises from zero, it becomes increasingly difficult to "fail" the means test because fewer expenses are allowed which makes it more likely that a household's income will represent 25% of its debts. Thus, as ϕ rises, households are less likely to be eligible for Chapter 7 bankruptcy.

Recall from Eq. (7) in Section 3 that, in the benchmark case without means-testing, a household with access to credit can choose to repay its debt or file for bankruptcy under either chapter. With means-testing, however, Eq. (7) must now be altered to

$$V^u(a,d,\varepsilon) = \begin{cases} \max\{V^p(a,d,\varepsilon), V^7(a,\varepsilon), V^{13}(a,d,\varepsilon)\} & \text{when the household} \\ & \text{fails the means-test,} \\ \max\{V^p(a,d,\varepsilon), V^{13}(a,d,\varepsilon)\} & \text{otherwise.} \end{cases} \tag{13}$$

Table 4 reports our main findings. Observe first that relative to the benchmark case, the means test does not bind for values of ϕ that are less than or equal to 0.37. In this case, Chapter 7 defaults, as a percentage of the population, remains as in the benchmark scenario at approximately 0.8%, and all other allocations as well as prices are unchanged. Of course, as ϕ rises, the means test becomes more stringent and Chapter 7 defaults can eventually be driven out. A value of $\phi = 0.40$ is enough to eliminate the benchmark percentage of Chapter 7 defaults.

[15]In March 2001, the House and Senate passed their own versions of bankruptcy reform legislation (HR 333 and S 420). Similar bills were passed in the previous year by the 106th Congress, and hearings were held in 1997 by the 105th Congress.

[16]This (somewhat odd) way of defining what it means to "pass" or "fail" the means test is taken from the actual bills.

Table 4
Means-testing for Chapter 7 filers

Statistics	Benchmark	Efficient means testing ($\phi \leqslant 0.37$)	Driving out Chapter 7 defaults ($\phi \geqslant 0.40$) (% change from benchmark)
Deposit rate (%)[a]	2.516	2.516	+0.011
Lending rate (%)	13.008	13.008	−0.175
Debt/income	0.104	0.104	+4.047
Savings	1.412	1.412	+0.008
Capital	1.366	1.366	−0.264
Labor	0.392	0.392	−0.114
Output	0.570	0.570	−0.171
Welfare	−0.761	−0.761	−1.010
Chapter 7 filings (%)	0.860	0.860	−0.860
Chapter 13 filings (%)	0.386	0.386	+0.708
Total filings	1.246	1.246	−0.151

[a]For the deposit rate, as well as all variables already expressed in percent, changes from the benchmark are in levels.

As the severity of the means test increases, households that borrow are effectively left with only two options: paying off their debts or filing under Chapter 13. It is not surprising, therefore, that the incidence of Chapter 13 defaults rises significantly once Chapter 7 defaults have been eradicated. This switch in chapter choice implies that creditors are able to collect more effectively on their loans so that, in equilibrium, the default premium, γ, and the lending rate, $R+\tau+\gamma$, both fall. In the case where $\phi > 0.40$, observe in Table 4 that the lending rate falls by 17.5 basis points. Given this lower lending rate, the volume of consumer debt rises, which helps reduce the supply of available capital.

The increase in Chapter 13 bankruptcies that prevails once Chapter 7 defaults have been eliminated also implies a lower level of labor input. Recall that the required debt repayment plan under Chapter 13 acts as a wage tax and, therefore, reduces the incentive to work. With both labor input and capital input falling as the means test becomes more stringent, output necessarily decreases.

Three main factors determine the effects of stricter Chapter 7 provisions on total welfare. First, we have just seen that a means test severe enough to eradicate Chapter 7 bankruptcies causes a fall in output. This leads to a corresponding decrease in aggregate consumption, which has a direct negative impact on welfare. Second, each loan in our model carries a transaction cost, τ. The lower lending rate that emerges when ϕ is high enough is associated with a higher volume of loans and, consequently, an increase in aggregate transaction costs. (Given the fall in output and the noticeable rise in the debt to income ratio in Table 4, the level of debt increases significantly.) These costs represent a pure deadweight loss which also reduce both total consumption and welfare. Finally, as the difficulty of filing for Chapter 7 increases, marginal households with estimated five-year earnings at the threshold now only have the option to file for Chapter 13 or pay off their debts. With fewer options available, these households are unambiguously worse off.

It should be observed that because the lending rate, $R+\tau+\gamma$, falls by 17.5 basis points in the third column of Table 4, some households are now better able to smooth

consumption intertemporally. However, Table 4 also suggests that in equilibrium, the gain in welfare implied by these households' increased consumption smoothing falls far short of the welfare losses implied by the other forces we just discussed. When the means test is made stringent enough to eliminate Chapter 7 defaults, welfare falls a full 1% point. In the end, therefore, we find that means testing cannot improve upon current bankruptcy provisions and, at best, leaves output and welfare unchanged. These results contrast sharply with the intended objectives of means test based legislation recently introduced by the House and Senate.

5.3. Tightening Chapter 7 via lower asset exemptions

While means testing under Chapter 7 proved ineffective in improving resource allocation, it does not follow that stricter Chapter 7 provisions cannot increase welfare. To illustrate this point, we show that lower asset exemption levels, which was a key feature of earlier bankruptcy reforms such as the Bankruptcy Reform Act of 1994, can improve economic efficiency.[17] This result arises because, in general equilibrium, lower asset exemptions paradoxically induce more Chapter 7 but fewer Chapter 13 bankruptcies.

Lower asset exemptions involve two forces that act in opposite directions regarding credit allocation. On the one hand, a lower exemption level implies a greater confiscation of assets and, at the margin, less financial benefits from filing under Chapter 7. This effect tends to decrease Chapter 7 defaults. On the other hand, precisely because more assets are confiscated in the event of default, a lower exemption level also reduces the incentive to save and increases the incentive to borrow. Furthermore, in saving less and/or borrowing more, households find themselves at greater risk of default under Chapter 7. In equilibrium, we find that the reduced incentive to save dominates and perversely leads to *greater* Chapter 7 bankruptcies. In the example shown in Table 3, where the level of exemption x is set so as to maximize welfare, savings for Chapter 7 defaulters decrease by $\frac{1}{3}$ relative to the benchmark case. At the same time, consumer debt for these households rises slightly. Thus, with a lower exemption level, the measure of additional households that file for bankruptcy under Chapter 7 increases by 0.109% points relative to the benchmark case of 0.86%.

A key implication of the larger incidence of Chapter 7 bankruptcies is a deterioration in borrower repayment rates. Consequently, in order that the financial intermediation sector break even, the default premium, γ, and thus the lending rate, $R+\tau+\gamma$, must increase. Recall from Eq. (6) that the percentage of wage income that may be collected by creditors under Chapter 13, $\eta(d)$, is proportional to defaulters' debt burden, $(R+\tau+\gamma)d$. Since the debt burden increases with a higher lending rate, the prospect of filing under Chapter 13 now worsens. Therefore, in equilibrium, lower exemption levels under Chapter 7 actually lead to *fewer* Chapter 13 filings and, in fact, *fewer* total defaults.

Because lower Chapter 7 asset exemptions help reduce the incidence of Chapter 13 filings, aggregate labor supply increases as households on average have greater incentive to work. Furthermore, the decrease in aggregate filings driven by the fall in Chapter 13 bankruptcies reduces the losses associated with non-pecuniary bankruptcy costs. Finally, the reduction in total debt associated with the rise in the lending rate also translates into

[17]Because previous studies did not explicitly allow for simultaneous saving and borrowing as a consequence of bankruptcy exemptions, such an analysis has remained lacking in the recent quantitative bankruptcy literature.

smaller deadweight losses arising from transaction costs. The latter forces, of course, all tend to increase total consumption and welfare.

We should note, however, that reductions in Chapter 7 asset exemptions cannot lead to ever-increasing welfare. Because Chapter 7 defaults continue to rise with lower asset exemptions, total filings eventually also increase as the incidence of Chapter 13 bankruptcies can only be driven down to zero. With aggregate bankruptcy filings rising, so do the deadweight losses associated with *ex-post* bankruptcy penalties such as stigma and credit market restrictions. In the example depicted in Table 3, the level of asset exemption that maximizes steady state-welfare leads to a non-negligible 0.4% improvement in welfare relative to the benchmark case. At that point, Chapter 13 defaults are virtually eliminated.

6. Concluding remarks

This paper extends the existing literature on consumer bankruptcy by simultaneously incorporating three new key features in a general equilibrium framework. First, households are given the option to file for bankruptcy under Chapter 13. Second, production is explicitly taken into account. Third, households may simultaneously borrow and save at different rates. These new elements give rise to substantive findings regarding bankruptcy reform.

First, we find that eliminating bankruptcy options entirely carries significant social costs. In particular, the change in prices associated with the elimination of bankruptcy provisions is directly linked to a reduction in capital formation and a corresponding inward shift in labor demand. The resulting decline in output more than offsets the welfare gains associated with the elimination of *ex post* bankruptcy costs such as exclusion from credit. Second, our analysis shows that a tightening of Chapter 7 provisions through means testing, as suggested by the many reform proposals introduced before Congress since 1997, leads not to just greater debt repayment but also more Chapter 13 bankruptcies. Contrary to the goal of the proposals, these effects can induce a fall rather than an increase in output and welfare. Finally, we also demonstrate that an alternative tightening of Chapter 7 provisions, in the form lower asset exemptions, can increase economic efficiency. In all three of these experiments, general equilibrium effects matter crucially for the outcomes. Therefore, bankruptcy policy recommendations that ignore these effects can potentially be very misleading.

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Further Reading

United States Code Annotated, Title 11, Bankruptcy §1141 to End, 1993.