Consumer Durables and Risky Borrowing: the Effects of Bankruptcy Protection*

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Abstract

I estimate a dynamic model of durable and non-durable consumption choice and default behavior in an economy where risky borrowing is allowed and bankruptcy protection is regulated by law. I exploit the substantial difference in the generosity of bankruptcy exemptions across the U.S. states to assess the role of durable goods as both informal collateral for unsecured debt and self-insurance against bad shocks to earnings. The model accounts for the equilibrium effects of bankruptcy protection on both consumer saving behavior and the credit market.The individual-specific borrowing limits are endogenously derived from the equilibrium condition of the banking sector. The default risk premium charged on unsecured loans is decreasing in durable wealth and increasing in the exemption level. The generosity of bankruptcy protection does change both the incentives and the ability of households to accumulate durable wealth.The proposed Bankruptcy Reform H.R. 333 (2002) would increase default and interest rates, and would not improve welfare.

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1 Introduction

In this paper, I analyze the effects of personal bankruptcy protection on household saving behavior, focusing attention on the accumulation of net durable wealth. In particular, I exploit variation in the level of bankruptcy protection across U.S. states to assess the role of durable wealth as both informal collateral and self-insurance against future bad shocks to earnings.

In the U.S., a person that files for bankruptcy under Chapter 7 is repossessed of all assets in excess of an exempted value, which depends on the state of residence. All unsecured debt is discharged and the person keeps all exempted assets (mostly durables) and future income, thus enabling a "fresh start". There are substantial differences in the generosity of these exemption levels across the U.S. states. The homestead exemption (the amount of one's home equity that can be kept in bankruptcy) ranges from a few hundred dollars to $100,000, and can be unlimited in some states. Cross-state variation in exemption levels provides the appropriate environment to exploit in order to assess the impact of bankruptcy protection on consumer behavior.

The major component (above 80%) of exempted assets are durable goods, namely home equity and cars.[1] The minimum consumption floor guaranteed by the exemption is conditional on the individual holding some assets. We thus expect exemption levels to influence the incentives to hold durable wealth, at least for households that are willing to borrow.

Moreover, bankruptcy protection affects both the demand and supply of credit. On the one hand, it provides insurance that permits an agent to better smooth consumption over time and states. The greater the exemption level, the smaller the risk of impoverishment upon default, and, thus, the higher the demand for borrowed funds. On the other hand, the higher the exemption level, the higher the probability and magnitude of losses on loans, and, thus, the smaller the supply of credit. This effect on supply leads to higher interest rates on loans and tighter credit constraints. The theoretical model in this work, and the empirical work based on it, account for both of these effects.

I develop a dynamic life cycle model of durable and non-durable consumption choice in an economy with incomplete markets where bankruptcy is regulated by law. The household, facing idiosyncratic shocks to earnings, can borrow or save in a competitive credit market. Risk-neutral banks provide a risk-free return on deposits, but issue loans at interest rates that depend, in equilibrium, on observable components of the agents' histories. Given uncertainty about future earnings, households cannot commit to repaying debt. Borrowing constraints are derived endogenously from the equilibrium condition of the banking sector.

The fact that households can borrow at the risk of default and that a minimum consumption is always guaranteed by the exemption level can explain why households are observed to accumulate debt and durable goods at the same

[1] Home equity is defined as the market value of the occupied house net of the remaining mortgage payments. Bankruptcy protection affects only house equity. Debts which are collateralized - mortgages, home equity loans and automobile loans - cannot be discharged unless debtors give up the collateral.

time. In the model, the optimal choice of durable and non-durable consumption depends not only on lifetime resources (as would be the case in a standard certainty-equivalence life cycle model), but also on the expected growth of income and on the borrowing constraints faced by the individual at different ages.

Bankruptcy regulation affects the household's credit conditions and incentives to accumulate durable goods in the following way. Given any level of debt, durables in excess of the exempted value serve as informal collateral that is used to lower the cost of borrowing, since it increases the expected returns to the banks. Instead, durable assets below the level of exemption provide insurance against future bad shocks to earnings as they can be saved in bankruptcy. Through these effects, a higher exemption level should increase the incentive to hold durables. On the other hand, a household with a high probability of default is not willing to hold durables above the exempted amount. Moreover, the higher are the borrowing constraints and the higher is the probability of default, the more households will save in financial assets rather than durable wealth. The overall impact of bankruptcy protection on the accumulation of durables depends on which of these two effects prevails.

The empirical work combines information on exemption levels with longitudinal data on married couples from Panel Study of Income Dynamics (PSID) on bankruptcies and on the life cycle pattern of accumulation of durables. The data reveal significant differences in the accumulation of durable and non-durable wealth of households who reside in low vs. high exemption states. Although net durable and non-durable wealth increase throughout the life cycle in both (at least up to age 60), they are greater in high exemption states, even after conditioning on age and other household characteristics. Bankruptcies, as reported in the PSID, are relatively rare; only 2.11% of the married couples used in the analysis had ever filed for bankruptcy.

Estimation is by maximum likelihood and involves iterating between the likelihood function and the solution of the optimization problem. A novel feature of the estimation procedure is that it allows for biased reporting in bankruptcy filings, which have been noted to be severely underreported in the PSID.

The paper makes the following contributions. First, it provides an evaluation of the impact of bankruptcy protection on the accumulation of durable goods without using data on interest rates which are difficult to observe. In this context, a reduced form analysis that failed to account for the endogeneity of the borrowing interest rate would be misspecified, and would lead to biased estimates of the effect of the exemption level.[2] Structural estimation allows me to derive both the equilibrium interest rate function and the (also unobserved) credit restrictions faced by individuals in a coherent theoretical framework.

Second, there have been few attempts to estimate the preference parameters of a life cycle model of consumer behavior that incorporates endogenous borrowing constraints and savings in both durable and financial assets.[3] The

[2] Given the opposing effects of the exemption level on the demand of durables described above, it is not possible to determine the direction of the bias a-priori.

[3] Gourinchas and Parker (1999), for instance, structurally estimate a model of optimal life cycle consumption expenditures. In their model, individuals never choose to borrow because

fitted model matches the durable and non-durable net wealth life cycle profiles, and default behavior, observed in the data. I find reasonable estimates of the preference parameters. The average household has a discount rate of 9.9% and a coefficient of relative risk aversion of about 1.4.

Third, the cross-state variation in bankruptcy exemption levels allows me to measure how important consumer durables are as informal collateral, by explicitly including these goods in the borrowing constraint. Fernandez-Villaverde and Krueger (2000) suggest that it is necessary to model durable goods to understand life cycle consumption and portfolio allocation. The existence of borrowing constraints induces households to accumulate mostly durable wealth early in life, with the shift to financial wealth only later in the life cycle. The endogenous borrowing constraints they use, however, do not allow for any default. By introducing the possibility of bankruptcy, my model is more general and allows otherwise constrained agents to borrow more, at the risk of defaulting. Moreover, the credit constraints considered here take into account the institutional and legal features of the U.S. unsecured credit market. Using the micro data and the variations in bankruptcy law across states, I quantitatively evaluate the impact of holding durable wealth on the cost of borrowing over the life cycle. A simple exercise shows that the default risk premium applied on borrowing interest rates is weakly decreasing in the amount of durable wealth held by the agent, and increasing in the exemption level.

Lastly, the estimates permit an analysis of the effects of potential policy instruments. Bankruptcy reform has been under consideration in Congress at least since 1997. The credit card industry is pushing for a bill that would make it more difficult for debtors to file for bankruptcy. A proposal to limit the exemption level set by each state to $125,000, and to force debtors with enough income to repay $10,000 or 25% of their debt within five years was recently rejected.[4] I use the estimated model to evaluate the impact of the proposed bankruptcy reform not only on household default decisions, but also on saving behavior and credit market conditions. The default rate is found to rise by 0.75 percentage points, with an increase in the equilibrium borrowing interest rate of 1.24 percentage points. However, the average loss per defaulter underwent by the unsecured credit industry would diminish by about 11%. The reform would not improve welfare.

The paper is organized as follows. The next section describes bankruptcy law in the U.S.. Section 3 reviews the literature on default. The theoretical model is presented in section 4, while section 5 contains an illustration of the micro data used in estimation. Results are presented in section 6, and section 7 contains possible extensions and concluding remarks. Some technical details and all tables and figures are relegated to the Appendix.

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there is a strictly positive probability that income will be close to zero and Inada conditions hold. Under the same assumptions, this is not true when it is possible both to default and to hold savings in durable wealth.

[4] H.R. 333, rejected on November 14th, 2002.

2 Personal Bankruptcy in the U.S.

Personal Bankruptcy law is intended to help people who cannot pay their debts. Individuals that file for bankrutpcy in the U.S. can choose to do so either under Chapter 7, "Straight Bankruptcy", or under Chapter 13, "Wage Earners Plan".

Under Chapter 7, the individual is required to give up all his non-exempted assets to a trustee for the benefit of his creditors, in exchange for which he will be discharged from all his unsecured debt.[5] The bankrupt person does not have to sacrifice any of his future income to debt repayment (which is why this type of bankruptcy is also called "Fresh Start").

Under Chapter 13, the debtor presents a plan in which he surrenders all of his disposable income to creditors over several years (typically three to five).[6] In the case of a Chapter 13 filing, the creditors receive an amount that is at least as much as they would have received in a Chapter 7 filing.[7]

Around 70% of all personal bankruptcy filings occur under Chapter 7.[8] Given the close relationship between Chapter 7 and Chapter 13 bankruptcy filings, I ignore the distinction between them and model just Chapter 7 bankruptcy, following Gropp, Scholz and White (1997) and many others in the literature.

Personal bankruptcy law became more favorable to debtors with the Bankruptcy Reform Act of 1978 (BRA78). Before 1978, the exemptions were specified by the states and were in general very low.[9] The BRA78 was written to protect those already poor households who would suffer the most from financial setbacks caused by adverse consequences such as ill health, job loss or family strain. A generous exemption would provide them with adequate assets for a "fresh start". The BRA78 specified a uniform (Federal) bankruptcy exemption of $7,500 for equity in "homesteads" (owner-occupied principal residences) and $4,000 for non-homestead property, with the exemption values doubled when married couples filed for bankruptcy. However, the act permitted states to opt out of the Federal exemption by adopting their own bankruptcy exemptions. By 1983 all states had done so, although 12 states allowed debtors to choose between the state and the Federal bankruptcy exemptions. The result is quite a heterogenous set of exemption levels, ranging from a few hundred dollars to an unlimited amount for the homestead exemption (Gropp, Scholz and White (1997)).

With the Bankruptcy Reform Act of 1994 the Congress doubled the Federal

[5] Some debt survives the bankruptcy, such as alimony and child support, taxes and educational loans. Secured debt must also be paid in full, or the debtor will lose the collateral that secured the loan (Sullivan, Warren and Westbrook (2000)).

[6] Disposable income is defined as all the income in excess of necessary living expenses (determined by the court - Hynes (1997)).

[7] Most (around 65%) Chapter 13 cases fail before all the promised payments have been made. When that happens, either the case is dismissed (and debtors will have to file again or to struggle on without bankruptcy relief) or the case may be converted into a Chapter 7 liquidation (Sullivan, Warren and Westbrook (2000)).

[8] Kowalewski (2000).

[9] The first exemption in the U.S. was created in Texas in 1839 (Hynes (1997)).

Bankruptcy exemption, which had not been adjusted for inflation since 1978. In fact, between 1978 and 1994, exemptions changed infrequently, which justifies treating the cross-state variation in exemptions as exogenous to the credit market behavior.

Exemptions are of several kinds. The most significant exemption (at least for home owner debtors) is certainly the homestead exemption, which entitles the debtor to exempt his home equity up to a certain amount.[10] States can give an additional detailed list of other kinds of exemptions, including clothing, jewelry, home furnishings, sports equipment, vehicles, food and books. The list of personal property exemptions can be very specific, and does not always contain a dollar value, but instead lists quantities, or limitations based on "necessity", so that the exemption is quite difficult to quantify. There is also a "wild card" exemption, which allows the debtor to choose the object of the exemption up to a certain dollar amount (usually not very high).

Often exemptions depend on the characteristics of the debtors: some states allow married couples who file for bankruptcy to each claim a homestead exemption (so that the effective exemption level is doubled). Other states offer increased exemptions to senior citizens or make the exemptions dependent on the number of dependents the debtor has, or on whether the debtor lives in a rural or urban area.

Exemption levels also have significance outside of bankruptcy. A general creditor, for instance, may only seize a debtor's property if the debtor has non-exempt equity in that asset.[11] However, a mortgage is senior to the exemption: the exemption does not affect the right of a secured creditor to seize his collateral if he is not repaid in full (Hynes (1997)).

There are also various anti-abuse provisions that limit the possibility that the debtor borrows from unsecured creditors to accumulate more exempt assets. If a court finds behavior of this kind, it can deny the bankruptcy petition on the grounds that it was fraudulent.

A list of states and relative exemptions is given in Table 1 in the Appendix.[12] To calculate exemptions, I use the sum of homestead exemption, motor vehicle and wild card exemptions in two sample years, 1984 and 1992. For the states that give the possibility of opting for the Federal law, I impute the highest of the two homestead exemption levels. I double the homestead exemption in states where it is permitted for married couples filing jointly to do so, since my micro data sample consists of married heads of households. Thus calculated, exemptions range from an average value of $2,700 over the period 1984-1994 (in Delaware) to a maximum average value of $87,000 (in Nevada), to unlimited in eight states.

[10] Some states have an "unlimited" homestead exemption. In reality, this is not actually "unlimited", since it usually contains a limit on the lot size (eg. in Arkansas a debtor can claim an unlimited exemption only if his homestead is under 1/4 of an acre).

[11] If the debtor defaults without filing for bankruptcy (i.e. he simply does not repay), the creditors have the right to garnish his wages (up to a certain limit) and seize any non-exempt property in satisfaction of their debt.

[12] Exemption levels are as reported by Elias, Renauer and Leonard (several years).

Exemption levels did not vary much in nominal terms over the years 1984 to 1994. They actually decreased in real terms because they were not often adjusted for inflation. The average national exemption level was $25,400 in 1984, and $24,000 in 1992. Only three states experienced sizeable changes in their exemption levels between 1984 and 1994. Exemptions in Idaho increased from $6,400 to $75,200 (in real terms), Iowa changed from a mere $4,500 to an unlimited exemption regime, while the opposite happened in South Dakota, where exemptions went from unlimited to $25,200. If a household in the PSID dataset is a resident of any of these three states, it is included in the sample used for estimation only for the period in which exemptions stay stable (e.g. if a household is married over the whole period 1984 to 1994, but resides in Idaho, it enters the sample only for the years 1984 to 1989, with an exemption of $6,400, and is excluded from the sample in 1994).

For estimation, I will need to simulate histories of households' choices at each permanent state (education, age at marriage and exemption level). For computational reasons, I simplify and divide the U.S. states into four different groups of exemptions. The first group comprises all states with an average exemption below $15,000 over the period 1984-1994, and is assigned an exemption level of $9,800 (which is the average value over the period in that group of states). The second group includes all states with an exemption between $15,000 and $40,000, whose average exemption is $22,900. The third group is that of the states with exemptions between $40,000 and $87,000, with average value $64,500, while the fourth group is characterized by an unlimited exemption regime. For exemption levels and groups of states, refer to Table 1 in the Appendix.

3 Literature Review

A very large literature analyzes the interaction between borrower and lender either in a context where the debtor does not commit to the repayment (Hart and Moore [1994], Kocherlakota [1996]) or in a context where the presence of asymmetric information and moral hazard leads to incentive problems (Green [1987], Thomas and Worrall [1989], Atkenson and Lucas [1992], Aiyagari and Williamson [1999]). These contributions aim to characterize the efficient contract with incentive constraints, such that individuals never default on their debt by construction. In reality, however, a positive default rate is observed. Moreover, the papers cited above do not analyze the investment decisions of the agents, which are considered as fixed.[13]

Another branch of the literature examines the macroeconomic consequences of private information or lack of commitment in a dynamic setting. Smith and Wang [2000], Kehoe and Levine [2000], Cooley, Marimon and Quadrini [2000] all present general equilibrium models in a context of enforceability problems.

[13] Only exception is represented by Ayiagari and Williamson [1999], who actually endogenously derive the efficient allocation of resources and the interest rate in an economy with private information and random matching (but with no default in equilibrium).

Again, being derived from an optimization under incentive constraints, the equilibrium is characterized by a zero default rate by construction.

Similar in spirit, but more specifically aimed at the study of the consumption pattern of durable goods, is Fernandez-Villaverde and Krueger [2000]. In their paper, they suggest that it is important to explicitly model durables to understand life-cycle consumption and portfolio allocation. Again, the endogenous borrowing constraints they use do not allow any default.

There exists a small, but growing, literature that uses an equilibrium approach to characterize the quantitative features of an economy in which agents have the option to default. Athreya (2000, 2001) evaluates the welfare consequences of new proposals from the National Bankruptcy Review Commission and the Bankruptcy Reform Act of 1999. Li and Sarte (2002) explore the effects of the proposed Bankruptcy Reform H.R. 333 (2002), explicitly modeling the choice between Chapter 7 and Chapter 13 bankruptcy filing in a general equilibrium model. In all these models, however, all agents borrow at the same interest rate, so banks can increase their profits by reducing the credit limits. Chatterjee, Corbae, Nakajima and Rios-Rull (2002) prove the existence of a competitive equilibrium for an incomplete markets, infinitely lived agents economy with unsecured consumer credit and the possibility of default. Their main goal is to match the main quantitative facts about bankruptcy and unsecured credit in the U.S. (the percentage of defaulters, the fraction of borrowers in the market, the volume of debt). Livshits, MacGee and Tertilt (2001) focus their attention on the comparison between the "Fresh Start" bankruptcy and a Wage Garnishment rule. They are interested above all on the effect these different institutions have on labor supply. This paper differs from this literature in a number of important dimensions. I address a different question and explicitly model the effect of bankruptcy protection on durable wealth. Moreover, I use micro data to estimate the parameters of the model.[14]

Several empirical papers analyze individuals' incentives to file for bankruptcy. Other studies assess the impact of bankruptcy law on the default rate and credit conditions. Gropp, Scholz and White (1997) estimate the effects of different exemption levels on credit supply and demand. Their main finding is that the higher a state's exemption level, the more likely it is that lenders will turn down credit applicants, especially those in the bottom quartile of the wealth distribution.[15] The effects of the exemption levels on the credit market are also addressed in Berkowitz and Hynes (1999) and Lin and White (2000), who study the relationship between mortgage interest rates and bankruptcy law, but get opposite results.[16] It is worth noting here that any analysis of

[14]At a theoretical level, it is worth mentioning the important papers by Dubey, Geanakoplos and Shubik (1994, revised 2000) and Zame (1993). They show how the default option can promote efficiency in an incomplete markets environment, since it replaces the existing contracts with more "desired" or appropriate contracts.

[15]Their results are based on reduced form regressions using the Survey of Consumer Finances dataset of 1983.

[16]Berkowitz and Hynes (1999) find that large exemptions drive down the interest rates, since there is more secured versus unsecured debt (meaning there is a greater supply of mortgages).

the impact of bankruptcy regulation on the credit market necessarily finds an obstacle in the unobservability of the interest rates and credit limits that each individual faces.

Other empirical research focuses on the factors that lead to personal bankruptcy. Not surprisingly, the main reasons seem to be an unexpected loss of income, due to unemployment, large medical bills or divorce, together with poor debt management, i.e. a high debt to income ratio (Sullivan, Warren and Westbrook (1989, 2000)). However, some studies also underline the role of a decrease in the so called "stigma" effect attached to bankruptcy in increasing the propensity to default. According to Fay, Hurst and White (2000), households' bankruptcy decisions are influenced by the average bankruptcy filing rate in the localities where they live, which is a proxy for stigma. Similar conclusions in favor of a "stigma" explanation of the increased bankruptcy rate are in Gross and Souleles (1998), who use a very exclusive dataset, composed of several hundred thousand individual credit card accounts, from different issuers.

To the best of my knowledge, there exists just one attempt to evaluate the effects of bankruptcy exemptions on the accumulation of wealth (Repetto (1998)). From a reduced form analysis, Repetto's main finding is that bankruptcy protection discourages the accumulation of positive financial wealth, while raises the amount of home equity individuals are willing to hold.[17] Although Repetto does include interest rates into the analysis, these are state specific rates on secured loans, while the correct variable to use would be the individual interest rate on unsecured debt, which is unobserved.

A structural estimation of a dynamic behavioral model allows me to perform a more complete analysis of alternative bankruptcy policies and, possibly, credit market regulations.

4 The Model

In this section, I describe a dynamic life cycle model of household consumption, accumulation of durables, and saving/borrowing in an incomplete-market economy where default is allowed. I first present the basic structure of the model. I then formalize the problem of the agent in a recursive fashion, define the equilibrium and describe the computational solution method.

4.1 Basic Structure

The basic unit of analysis is a head of household from the period after he gets married until retirement. Each period t represents a time span of 5 years. Individuals in the sample range in age from 20 to 64 years old; hence, $t = 1$

Lin and White (2000) take the opposite view: a higher exemption level does not increase the supply of mortgages, but actually increases by 2% the probability of being turned down for a mortgage (they use Home Mortgage Disclosure Act data for 1992 through 1997).

[17] The dataset used is the PSID (heads of household).

stands for 20 to 24 years old, $t = 2$ for 25 to 29 years old etc., until period $T = 9$, when all individuals are assumed to retire.

There is just one good produced in the economy, whose price is normalized to one. All transactions are in terms of that good, which can be used as durable or nondurable consumption, or can be saved. A durable good provides utility in the current period and constitutes a source of liquidity for the future. The agent faces idiosyncratic uncertainty and receives a random endowment each period. There exists a competitive credit market, in which risk neutral banks provide a risk-free return on deposits and supply loans at individual-specific interest rates. Markets are assumed to be incomplete, in the sense that it is not possible to make the repayment of the loans contingent on future endowments. A key feature of the model is the lack of commitment of the agent in the contract with the bank.

The household maximizes its lifetime discounted utility from consumption of nondurables and durables.

4.2 Individual Problem

4.2.1 Endowments and Permanent States

The permanent state of an individual is comprised of his age at marriage, a, his education level, s, and the exemption level e of his state of residence. The age at marriage can be between 0 and 8, with 0 denoting an age younger than twenty years old, 1 an age between twenty and twenty-four, and so on until the last age group between fifty-five and fifty-nine years old. The decision process starts at age $a + 1$. Education s is measured in number of years of school, between 0 and 17. The exemption level e is the value of durable assets that can be kept if filing for bankruptcy, in the interval $[0, \overline{e}]$.[18] The decisions about schooling, state of residence and marriage are not modeled, and these variables are not allowed to change over the life cycle.

At marriage, the agent is characterized by his initial endowments of financial assets d_{a+1} (debt or savings) and durable goods h_a. Initial states are a deterministic function of age and education plus a random component, all known at $a + 1$.

Initial durable wealth h_a is a function of age at marriage and education:

$$h_a = \alpha_0 + \alpha_1 a + \alpha_2 s + \varepsilon_h,$$

where ε_h is normally distributed, with mean 0 and variance σ_h^2.

Initial non-durable wealth d_{a+1} is also a function of age at marriage and education:

[18] In estimation, the following four categories of education are considered: no high school ($s = 9$), high school degree ($s = 12$), some college ($s = 14$)and college degree ($s = 16$). Exemption levels are also divided into four groups: \$10,000, \$21,700, \$57,000 and unlimited (see below).

$$d_{a+1} = \beta_0 + \beta_1 a + \beta_2 s + \varepsilon_d,$$

with the random component $\varepsilon_d \sim N\left(0, \sigma_d^2\right)$. The two errors ε_h and ε_d are assumed to be correlated, with a covariance equal to σ_{hd}.

At each age t, the household receives the following earnings endowment:

$$y_t = \exp(\alpha_t + \alpha_s s)\epsilon_t^y,$$

where α_t is a coefficient that depends on age t (each age is characterized by a different labor productivity, or wage rate). Earnings are also a function of the individual's education s (with α_s being the corresponding marginal effect on $\log(y_t)$). The shock to earnings ϵ_t^y is realized at t and lognormally distributed, $\epsilon_t^y \sim LN\left(0, \sigma_y^2\right)$, at any t. Shocks are serially independent over time.

4.2.2 Preferences

The individual derives utility from consumption of the nondurable good, $c \geq 0$, and from the services of the stock of durables owned, $h \geq 0$. The per period utility of the agent is continuous, strictly increasing and strictly concave in both arguments, and obeys the Inada conditions for nondurable consumption.

Following Fernandez-Villaverde and Krueger (2000), the utility takes the following CRRA functional form, with a CES aggregator function of the consumption services from durables and nondurables :

$$u\left(c_t, h_t, \varepsilon_t^c\right) = \frac{\left\{\left[\theta\varepsilon_t^c (c_t)^\tau + (1-\theta)\left(h_t\right)^\tau\right]^{\frac{1}{\tau}}\right\}^{1-\sigma}}{1-\sigma},$$

where the coefficient of relative risk aversion is $\sigma > 1$, the consumption share is $\theta \in (0,1)$, and the constant elasticity of substitution coefficent is $\tau < 1$.

At each period t the household receives a shock to preferences ε_t^c, which is lognormally distributed, $\varepsilon_t^c \sim LN\left(0, \sigma_c^2\right)$, and uncorrelated with the shock to earnings.

4.2.3 Decisions and constraints

At each t, after having observed the realizations of shocks to earnings and preferences, the household chooses the quantity c_t of nondurable goods to consume and the stock h_t of durables which provide consumption services in t and are a possible source of liquidity in the next period. Moreover, the agent can decide whether to save or borrow at a bank an amount $b_t \in \Re$, where b_t is positive if he borrows, and negative if he lends. If $b_t < 0$ (he saves), at $t+1$ he has the right to receive $d_{t+1} = Rb_t$, where $R > 1$ is the risk-free gross interest rate. If instead $b_t > 0$ (he borrows), the agent has to pay an individual-specific amount d_{t+1} at $t+1$, which is determined below. The contract with the bank is therefore characterized by (b_t, d_{t+1}) at any period t (the banking sector is described in detail in the following section).

The household, however, does not commit to repay its debt. At the beginning of each period t, the agent chooses whether to repay the debt d_t (if any) or not. In the latter case, he decides to default and file for bankruptcy. According to the law, the bank will repossess all the defaulter's durables (h_t) in excess of the exempted level, e. The bankrupt person cannot borrow in the period of default (just in that period), but he can buy durables and save. Moreover, he incurs a cost that is proportional to his earnings: he looses a percentage q^y of y_t $(0 < q^y < 1)$.[19] The bankrupt individual's life goes back to normal in the period after he defaulted (he can borrow again, and default again).[20]

Durables depreciate at a rate $\delta \in (0,1)$.

The budget constraint of an individual that does not default is

$$c_t + h_t = y_t + (1-\delta)h_{t-1} - d_t + b_t$$

with the borrowing constraint

$$\begin{aligned} b_t &= \frac{d_{t+1}}{R} \qquad \text{if } d_{t+1} \leq 0 \\ b_t &\leq \overline{b}\,(h_t, d_{t+1}) \quad \text{if } \ d_{t+1} > 0 \end{aligned}$$

where $\overline{b}\,(h_t, d_{t+1})$ is the maximum borrowing allowed by the bank to the individual that chooses to hold durables h_t and have a debt d_{t+1} in $t+1$. This borrowing constraint is derived endogenously from the equilibrium condition of the banking sector (see next section), and will hold with equality.

For a person that defaults the budget constraint is

$$\begin{gathered} c_t + h_t = \min\left\{(1-\delta)h_{t-1}, e\right\} + y_t\,(1-q^y) + \frac{d_{t+1}}{R} \\ \text{with } \ d_{t+1} \leq 0 \end{gathered}$$

as he is able to keep the exempted durables (or all the durables, if the value of these is less than the exemption level), and can only save.

In the last period of life the individual chooses how much to consume and how many durables and savings (negative d_{T+1}) to leave for retirement, and he can default on his debt.

[19] Under Chapter 7 bankruptcy filing, the individual can actually keep all his current (if not paid yet) and future wages (the punishment falls only on assets). However, the whole bankruptcy process usually lasts for about three to eight months (Elias, Renauer and Leonard (1997)). In these months, wages and all other assets are frozen and are not freely available to the individual.

[20] In the U.S., you cannot file for bankruptcy for 6 years after a prior bankruptcy. By construction, in the model an individual will be able to file for bankruptcy no sooner than two periods after having first defaulted.

4.2.4 Timing

Each period, the individual first observes the realization of the shocks to earnings and preferences and decides whether to default (if he is a net debtor). After that, he buys durables, borrows or saves and consumes.

4.2.5 Preferences and Objective function

Let $\beta \in (0,1)$ be the individual discount factor.

Then the overall expected utility of the agent at marriage is given by:

$$U\left(\{c_t, h_t, \varepsilon_t^c\}_{t=a+1}^T\right) = E_{a+1}[\sum_{t=a+1}^{T} \beta^{t-a-1} u\left(c_t, h_t, \varepsilon_t^c\right) + \beta^{T-a-1} g\left(h_T - d_{T+1}\right)]$$

where E_{a+1} denotes the expectation at the period after marriage, taken over the stream of future random shocks. The function $g\left(h_T - d_{T+1}\right)$ is linear in wealth, and represents the retirement motive.

4.3 Credit sector

The agent can opt for one of several savings or loan arrangements with a set of competitive banks. As mentioned above, each contract with a bank specifies the loan $b_t > 0$ from that bank (or the deposit $b_t < 0$ into that bank), and the repayment d_{t+1} (or withdrawal of savings, if negative).[21]

Banks have perfect information about the age and the endowments of individuals (their earnings, stock of durables and debt/credit), and get to observe the shocks at the same time as the agents do. Therefore, banks are able to perfectly discriminate among different types of borrowers. I assume, as in Chatterjee, Corbae, Nakajima and Rios-Rull (2002), that each bank actually contracts with only one type of agent in the economy.[22] Banks maximize their expected profits every period. Perfect competition implies that in equilibrium the expected profits derived from each type-specific contract are zero.

As mentioned above, the assumption that d_{t+1} is not made contingent on the realization of the shock to earnings is embedded in the formulation of the contract (b_t, d_{t+1}). In other words, markets are incomplete, since it is not possible for the agent to perfectly insure himself against future shocks to earnings. The kind of standard debt contracts considered here is quite consistent with the contracts observed in practice.

The uncertainty of future earnings, together with the implicit assumption that the agent does not commit to the contract with the bank, are sufficient

[21] I restrict my attention to just one contract, although this could represent the sum of many loans arrangements, $\left(b_t^k, d_{t+1}^k\right)_{k=1}^K$.

[22] This is an equilibrium result: banks perfectly discriminate among borrowers through the interest rate.

conditions to allow the possibility that the individual defaults.[23] Banks, on the other hand, are supposed to commit to the contracts with the agent, so that saving is always riskless.

For each contract (b_t, d_{t+1}), the actual repayment made to the bank will be equal to d_{t+1} if there is no default, while the maximum of the value of non exempt durables, as long as this is less than the debt d_{t+1}, and zero will be repossessed in case of default. Clearly, the repayment made to the bank in $t+1$ does depend on the quantity of durables and debt chosen by the individual at age t, and on the shocks ε^y_{t+1} and ε^c_{t+1}.

The zero expected profits condition determines the borrowing $\overline{b}_t$ allowed at each level of debt and durable wealth:

$$\overline{b}_t(h_t, d_{t+1}) = \begin{cases} \frac{d_{t+1}}{R} \qquad \text{if } d_{t+1} \leq \max\{(1-\delta)h_t - e, 0\} \\ \frac{1}{R}[1 - \mu_t(h_t, d_{t+1})]d_{t+1} + \mu_t(h_t, d_{t+1}) \max\{(1-\delta)h_t - e, 0\}] \\ \qquad \text{otherwise} \end{cases} \tag{1}$$

If the debt is smaller than the non exempted durable assets, then the bank will be able to recover the borrowed funds in full, so that the borrowing allowed will simply be the discounted value of d_{t+1}. I denote with $\mu_t(h_t, d_{t+1})$ the probability of defaulting for a person with deterministic state (h_t, d_{t+1}) in $t+1$. If the debt is higher than the non exempted assets, the bank will be fully repaid only with probability $[1 - \mu_t(h_t, d_{t+1})]$, while with probability $\mu_t(h_t, d_{t+1})$ the bank will repossess the non exempted assets, $(1-\delta)h_t - e$, if positive. The borrowing allowed is the discounted value of the expected repayment.

The individual specific (gross) interest rate on the loan is simply the ratio between d_{t+1} and $\overline{b}_t(h_t, d_{t+1})$, and therefore depends on the debt and on durable wealth held by the household.

4.4 The problem in recursive formulation

The problem of the agent can be written in recursive form.

The state variables at age t are $(h_{t-1}, d_t, \varepsilon^y_t, \varepsilon^c_t)$.[24]

Let $(h_{t-1}, d_t, \varepsilon^y_t, \varepsilon^c_t) = x_t = (\underline{x}_t, \underline{\varepsilon}_t)$, where $\underline{x}_t = (h_{t-1}, d_t)$ denotes those states that are chosen by the agent in the previous period, while $\underline{\varepsilon}_t$ is simply the vector of the realizations of the shocks at t.

[23] The lack of commitment argument, with the uncertainty on future earnings, is just one possible source of a positive probability of default (Hart and Moore (1994), Kocherlakota (1996)). Asymmetric information and moral hazard could be some of the alternative assumptions to generate default in the economy (Green (1987), Thomas and Worrall (1989)).

[24] Rigorously, states include also age at marriage, education and the exemption level of the state where the agent lives; to simplify notation, I omit these, since they are permanent throughout the decision time span. Trivially, age also is a state.

The control variables at age t are $\left(h_t, d_{t+1}, b_t, c_t, I_t^d\right)$, where b_t and c_t are uniquely determined by the constraints and $\left(h_t, d_{t+1}, I_t^d\right)$.

Given s, a and e, the agent solves the following problem:

$\forall\ (a+1) \leq t < T$

$$V_t\left(\underline{x}_t, \underline{\varepsilon}_t\right) = \begin{cases} \max_{I_t^d \in \{0,1\}} \left\{(1-I_t^d)V_t^0\left(\underline{x}_t, \underline{\varepsilon}_t\right) + I_t^d V_t^1\left(\underline{x}_t, \underline{\varepsilon}_t\right)\right\} & \text{if } d_t > 0 \\ V_t^0\left(\underline{x}_t, \underline{\varepsilon}_t\right) \quad \text{otherwise} \end{cases}$$

where $I_t^d = 1$ is chosen if the individual defaults, $I_t^d = 0$ otherwise.

The value of not defaulting is given by:

$$V_t^0\left(\underline{x}_t, \underline{\varepsilon}_t\right) =$$
$$\max_{c_t, h_t, b_t, d_{t+1}} \left\{u\left(c_t, h_t, \varepsilon_t^c\right) + \beta E_t\left(V_{t+1}\left(\underline{x}_{t+1}, \underline{\varepsilon}_{t+1}\right)\right)\right\}$$
$$s.t. \begin{cases} c_t + h_t = y_t + (1-\delta)h_{t-1} - d_t + b_t \\ b_t \leq \overline{b_t}\left(h_t, d_{t+1}\right) \\ h_t \geq 0, c_t \geq 0, d_{t+1} \in R \end{cases}$$

where $\overline{b}_t\left(h_{t,} d_{t+1}\right)$ is derived from (1). As mentioned above, this constraint holds with equality.

The value of defaulting is

$$V_t^1\left(\underline{x}_t, \underline{\varepsilon}_t\right) =$$

$$\max_{c_t, h_t, d_{t+1}} \left\{u\left(c_t, h_t, \varepsilon_t^c\right) + \beta E_t\left(V_{t+1}\left(\underline{x}_{t+1}, \underline{\varepsilon}_{t+1}\right)\right)\right\} \tag{2}$$

$$\text{s.t.} \begin{cases} c_t + h_t = \min\left\{(1-\delta)h_{t-1}, e\right\} + y_t(1-q^y) + \frac{d_{t+1}}{R} \\ h_t \geq 0, c_t \geq 0, d_{t+1} \leq 0 \end{cases} \tag{3}$$

At each period t expectations are taken over the joint distribution of the stochastic shocks $\underline{\varepsilon}_{t+1}$.

In period T the value $V_T\left(\underline{x}_T, \underline{\varepsilon}_T\right)$ is the greater of:

$$V_T^0\left(\underline{x}_T, \underline{\varepsilon}_T\right) = \max_{c_T, h_T, d_{T+1}} \left\{u\left(c_T, h_T, \varepsilon_T^c\right) + \beta g(h_T - d_{T+1})\right\} \tag{4}$$

$$\text{s.t.} \begin{cases} c_T + h_T = (1-\delta)h_{T-1} + y_T - d_T + \frac{d_{T+1}}{R} \\ h_T \geq 0, c_T \geq 0, d_{T+1} \leq 0 \end{cases} \tag{5}$$

and

$$V_T^1\left(\underline{x}_T, \underline{\varepsilon}_T\right) = \max_{c_T, h_T, d_{T+1}} \left\{u\left(c_T, h_T, \varepsilon_T^c\right) + \beta g(h_T - d_{T+1})\right\} \tag{6}$$

$$\text{s.t.} \quad \begin{cases} c_T + h_T = \min\{(1-\delta)h_{T-1}, E_l\} + y_T(1-q^y) + \frac{d_{T+1}}{R} \\ 0 \leq h_T \leq e, c_T \geq 0, d_{T+1} \leq 0 \end{cases} \tag{7}$$

where $g(h_T - d_{T+1}) = \alpha_h h_T - \alpha_d d_{T+1}$ represents the additional value of carrying over wealth $(h_T - d_{T+1})$ into the retirement period.

A solution to the dynamic optimization problem is given by optimal decision rules for durable goods $h_t\left(\underline{x}_t, \underline{\varepsilon}_t\right) \in \Re_+$, borrowing/saving contracts $\left(b_t\left(\underline{x}_t, \underline{\varepsilon}_t\right), d_{t+1}\left(\underline{x}_t, \underline{\varepsilon}_t\right)\right) \in \Re^2$, consumption $c_t\left(\underline{x}_t, \underline{\varepsilon}_t\right) \in \Re_+$ and default $I_t^d\left(\underline{x}_t, \underline{\varepsilon}_t\right) \in \{0,1\}$, for any state $\left(\underline{x}_t, \underline{\varepsilon}_t\right) \in \Re_+ \times \Re \times \Re_+^2$, for any period $t = a+1, ...T$.

4.5 Equilibrium

Given the risk-free gross interest rate R and the bankruptcy exemption level e, a Recursive Competitive Equilibrium is a set of value functions $V_t\left(\underline{x}_t, \underline{\varepsilon}_t\right)$, policy functions $h_t\left(\underline{x}_t, \underline{\varepsilon}_t\right)$, $d_{t+1}\left(\underline{x}_t, \underline{\varepsilon}_t\right)$, $b_t\left(\underline{x}_t, \underline{\varepsilon}_t\right)$, $c_t\left(\underline{x}_t, \underline{\varepsilon}_t\right)$ and $I_t^d\left(\underline{x}_t, \underline{\varepsilon}_t\right)$, a probability of default function $\mu_t\left(\underline{x}_{t+1}\right)$ and a borrowing constraint function $\overline{b_t}\left(\underline{x}_{t+1}\right)$ such that:

1) at each t, the policy functions solve the agent's optimization problem with corresponding value function V_t;

2) $\overline{b_t}\left(\underline{x}_{t+1}\right)$ is determined by the zero expected profits condition of the banks, at each t and for each $\underline{x}_{t+1}$;

3) at each t, for each $\underline{x}_{t+1}$, the probability of default is given by

$$\mu_t\left(\underline{x}_{t+1}\right) = E_t[I_{t+1}^d\left(\underline{x}_{t+1}, \underline{\varepsilon}_{t+1}\right)].$$

4.6 The solution method

The solution to the model is not analytic, and has to be numerically computed. Having to deal with two continuous deterministic states, two continuous random shocks and three choices (durables, debt and default), the problem is particularly burdensome. The main difficulty is in evaluating two dimensional integrals at each of the many state points, at each period.

Because the policies at each age (solutions of the dynamic problem) are functions of the continuous shocks, they are impossible to store in a computer. However, in order to be able to evaluate the value function and the optimal choice at any state and age, it is sufficient to know the expected values $E_t V_{t+1}\left(\underline{x}_{t+1}, \underline{\varepsilon}_{t+1}\right)$ and $\overline{b_t}\left(\underline{x}_{t+1}\right)$ (as in (1) above, $\overline{b_t}\left(\underline{x}_{t+1}\right)$ also involves an expectation, since it depends on the probability of default). I therefore consider a solution of the model to consist of the set of

$$EMAX(\underline{x}_t, t) = E_{t-1}(V_t(\underline{x}_t, \underline{\varepsilon}_t))$$

and

$$EBOR(\underline{x}_t, t) = \overline{b_t}\,(\underline{x}_t)\,R$$

as functions of each state $\underline{x}_t$ and age t, $t = a+2, ..., T$.

Each of these elements corresponds to a double integral over the distribution of the shocks $\underline{\varepsilon}_t = (\varepsilon_t^y, \varepsilon_t^c)$.

First, in order to decrease the computational burden, instead of discretizing the level values of the control variables, I transform the problem such that the choice is the percentage change in the value of durables and debt. In this way the number of choices is limited, while the feasible state space grows with age.

The solution method I use is due to Keane and Wolpin (1994) and consists of using Monte Carlo integration to evaluate the required integrals at a subset of state points and interpolating the non-simulated values using a regression function. After having evaluated the EMAX and EBOR functions, life-cycle profiles of the decisions of consumption, stock of durables, borrowing/saving and default can be simulated. See the Appendix for a description of the algorithm used for computation.

5 Data

The data are a subsample of the Panel Study of Income Dynamics (PSID), which is a longitudinal study started in 1968 with a sample of 5,000 families, with individuals followed -whether or not in the same family unit - every year until 1997, and every other year since then. Information on wealth in the PSID is collected only at three waves: 1984, 1989 and 1994, with an early release of a fourth, in 1999. For this reason I restrict attention to the period 1984-1994 (another reason being that there has been an important reform in bankruptcy law in 1994, while there have not been salient changes before that). The PSID asked specific questions on one person's bankruptcy history only in one wave, in 1996.

I follow all the heads of household, that are between the ages of 20 and 64, as long as they had no changes in marital status or in the state of residence for at least one full 5-year period of the three periods under consideration (between 1982 and 1986, between 1987 and 1991, and between 1992 and 1996). The final sample is composed of 4,790 individuals (for details on the sample selection, refer to Table 2 in the Appendix). As I do not model any change of marital status decision, I choose to follow only married heads of households. A change in marital status (i.e. a divorce) would alter a household's preferences with respect to durable goods. In the model, such a change, or moving to another state, are implicitly assumed unforseen and unexpected events in the life of an individual. Individual characteristics of the sample are presented in Table 3.

To match the time spans of the model, I aggregate the head's and wife's labor income over five years.[25] The value of durable wealth consists of the sum of home equity (market value of the house net of mortgages) and the value of vehicles (net of secured debt) owned by the household. The value of non-durable net wealth is the sum of saving and checking accounts, mutual funds, retirement accounts, money market funds, stocks, bonds, farms or business, land and other real estate, less credit card and other unsecured debts, and matches the b variable in the model.

In order to present descriptive statistics, I further divide the states into two groups: states with a low exemption, below \$40,000, and states with a high exemption, above \$40,000 or unlimited. Statistics are presented separately for these two groups of states, and for nine age groups, starting with the 20 to 24 year old group, and ending with the 60 to 64 group.[26]

Table 4 and Figures 1 and 2 show durable wealth, non-durable net wealth, default rates and household labor income statistics by age and exemption group. In both groups of states household earnings profiles show the typical humped shape over the life cycle, and are not significantly different between low and high exemption groups (see also the regression in Table 9). Both durable and non-durable net wealth increase over the life cycle, until at least the age of 60, and accumulation of both types of wealth is substantially higher in high exemption states, at least after the age of 35. This holds true conditioning on education or income quartile, as shown in Tables 5 and 6. Table 7 presents the estimated coefficients of a regression of durable wealth on age, age at marriage, education and exemption level (with a dummy for the unlimited exemption). The effect of the exemption appears to be positive and significant, with an average increase of \$450 in net durable wealth for each additional \$1,000 of exempted value. A positive and significant, but lower, effect of exemptions is that on non-durable net wealth: conditional on age, education and age at marriage, each additional \$1,000 of exemption increases the value of net wealth held by the household by about \$190. The conclusion is that exemptions seem to have an overall positive effect on the accumulation of wealth, especially net durable wealth.[27]

Only 101 households, or 2.11% of the whole sample used for estimation, have filed for bankruptcy during the observation period. Default behavior is aggregated over 5 year periods (a person participating in the sample in 1984 is considered a defaulter if he/she filed for bankruptcy in any of the years between 1982 and 1986, a person participating in the sample in 1989 is considered a defaulter if he/she filed for bankruptcy in any of the years from 1987 to 1991, and so on). There doesn't appear to be a significant difference in the pattern of default rates between low and high exemption states (see also the probit model in Table 10), with the exception of the first age group (a 9% default rate among

[25] The implicit assumption is that all the resources of the family unit are pooled, and decisions about their allocation are made by the head of the household.

[26] The statistical analysis implicitly assumes that there are no cohort effects in the sample, which is consistent with the assumption that the economy is in a steady state.

[27] The objection can arise that high exemption states could simply be wealthier states. In this work I am ignoring the political economy aspects of bankruptcy exemptions.

individuals between 20 and 24 years old in high exemption states, versus a 2.3% rate in the low exemption group).

Table 11 presents individual characteristics of bankruptcies in the sample. The typical individual that files for bankrupcy is about 35 years old, white, with a high school degree, owns about \$17,000 worth of durable assets (over the 5 years period of default), and almost no non-durable wealth. His family labor income is below the average income of a household his age, but not extremely low.

As noticed in Fay, Hurst and White (2000), it is very likely that bankruptcy filings are underreported in the PSID. In fact, the PSID filing rate is only about half as high as the national rate (the correlation between the two rates is 0.67, reported in FHW). I take the underreporting into account by assuming that default is observed with error.

6 Estimation Method

I estimate the parameters of the model by maximum likelihood.[28] Each individual in the sample is assumed to be solving the optimization problem described above. At each age after marriage, given the deterministic state of durables and debt/savings, and shocks to earnings and preferences, the person chooses the stock of durables to own, the net borrowing or saving, and whether to default or not. Conditional on the deterministic state, the solution of the dynamic programming problem allows me to evaluate the probability that the agent is observed to make a certain choice, as a two dimensional integral over the vector of shocks such that that particular choice is the optimal one. The likelihood function is the product, over time and individuals, of these probabilities.

In the present context, the traditional approach of using smooth probability simulators (as the GHK simulator, or the one developed by McFadden (1989)) to evaluate choice probabilities is not feasible, because the short dimension of the panel implies that only a few state variables are observed. I follow the methodology used in Keane and Wolpin (2001).

At each trial parameter vector, and for each permanent state (e, s, a), I simulate outcome histories of initial states $\widetilde{h}_a^n$ and $\widetilde{d}_{a+1}^n$, earnings $\{\widetilde{y}_t^n\}_{t=a+1}^T$, and choices $\left\{\widetilde{h}_t^n, \widetilde{b}_t^n, \widetilde{I}_t^{d,n}\right\}_{t=a+1}^T$, for $n = 1, .., N$.[29] Denote a simulated history by

$$\widetilde{X}^n = (\widetilde{h}_a^n, \widetilde{d}_{a+1}^n, \left\{\widetilde{y}_t^n, \widetilde{h}_t^n, \widetilde{b}_t^n, \widetilde{I}_t^{d,n}\right\}_{t=a+1}^T)$$

The observed initial states, choice variables and labor earnings are assumed to be measured with error, so that any observed outcome history

[28] The total number of parameters to estimate is 37.

[29] I simulate $N = 3,000$ histories for each permanent state.

$$X = \left(h_a, d_{a+1}, \left\{y_t, h_t, b_t, I_t^d\right\}_{t=a+1}^{T}\right)$$

in the data has a positive probability of being generated by a simulated history $\widetilde{X}^n$.

The probability of the observed history X conditional on the simulated history $\widetilde{X}^n$, $\Pr\left\{X \mid \widetilde{X}^n\right\}$, is simply the product of the measurement error densities for the continuous variables and the classification error rates for the discrete choices that are needed to make X and $\widetilde{X}^n$ consistent.

Simulating N histories, I obtain the unbiased simulator of the probability of X:

$$\widehat{\Pr}(X) = \frac{1}{N}\sum_{n=1}^{N} \Pr\left\{X \mid \widetilde{X}^n\right\}$$

The measurement error in earnings is assumed to be multiplicative, while the measurement errors in net durable and non-durable wealth are additive. The classification error for default consists of a probability that the reported answer is not true. The permanent state $\left(e^i, s^i, a^i\right)$ of individual i is assumed to be observed with certainty.

The optimization method used is a simplex algorithm (since the likelihood function is not smooth).

See the Appendix for details on estimation and on the measurement and classification errors processes.

7 Results

7.1 Estimated parameters and sample fit

Table 12 in the Appendix contains the point estimates of the parameters. Households discount the future at an annual factor of 90.97%, which correponds to an annual discount rate of 9.9%, to be compared to an estimated annual interest rate of 5.74%. It is important to notice that the profiles of durable and non-durable wealth are very sensitive to the ratio between discount rate and interest rate. The higher the discount rate with respect to the return on savings, the more impatiently households behave, being more willing to borrow and consume in both durable and non-durable goods early in life, and saving only later, for retirement. In the context of the present model, impatient behavior is needed in order to make individuals more sensitive to the effects of bankruptcy regulations on the credit market. Risk aversion as measured by the CRRA coefficient σ is quite low ($\sigma = 1.40$). Again, households must be risk averse enough to be willing to borrow at the risk of default.[30] The estimated CES coefficient τ is 0.496, while the consumption share θ is 94.4%.[31,32]

The cost of default is estimated to be on average 3.13% of household earnings, over the five-year period. Of interest is also the probability that a non-default is reported in the PSID, conditional on the individual having actually filed for bankruptcy, which appears to be quite high, at 13.56%, supporting the evidence that bankruptcy filings are underreported in the PSID (Fay, Hurst and White (2000)).

With these estimates at hand, I can address how well the model fits the life cycle profiles of durable and non-durable net wealth accumulation, default rates and household income. Table 13 compares mean actual and simulated life cycle profiles (plotted in Figures 3 to 6). The model does a good job at fitting mean earnings, durable and non-durable wealth, only slightly over-assessing the value of the latter at the last three age intervals. Simulated and actual default rates show the same pattern, apart from the middle age interval, when the simulated rate is about 2% higher than in the data. The predicted equilibrium interest rate on unsecured debt is equal to 6.7%, or almost one percentage point higher than the risk free rate, reflecting the average default risk premium.

Comparing the simulated outcomes of the estimated model with the data by exemption level, results are a bit less satisfactory. Table 14 shows mean durable and non-durable net wealth in low versus high exemption states (where a low exemption is one below $40,000).[33] The difference between simulated durable wealth held in high versus low exemption states is positive but a bit underestimated with respect to the actual difference. On the other hand, the model predicts a substitution of non-durable with durable wealth in high exemption states, which seems not to be true in the data. To solve this problem, it will probably be necessary to introduce some kind of unobserved heterogeneity to account for differences in saving behavior in the population.

The predicted equilibrium interest rate in high exemption states is about 8%, more than one percentage point above the mean default risk premium (Table 17).

The effect of exemptions on the accumulation of durable wealth conditional

[30] Carroll and Samwick (1997) estimate a discount rate in the interval of 10 - 15% (using information on the elasticity of assets with respect to uncertainty). Gourinchas and Parker (1999), on the other hand, estimate a discount rate of 3.44% and a CRRA coefficient between 0.5 and 2.2 (for different education groups).

[31] The value of the CES coefficient is somewhat controversial in the literature, ranging from 0.083 (McGrattan and al. (1997)) to 0.429 (Rupert and al. (1995)). Fernandez-Villaverde and Krueger (2000) calibrate a consumption share equal to 0.81 (taking into account gross durable wealth held by the individual, rather than equity in durables).

[32] To prove that all the parameters are identified is actually a complicated problem in structural estimation. In the model there are several sources of exogeneity which are possible sources of identification, such as the exemption level, age, education and history of earnings realizations.

In practice, I will compute the information matrix and determine whether there is an identification problem from looking at how the likelihood function varies with the parameters.

To conduct policy experiments, however, identification is not always an issue.

[33] Refer to Table 15 for Chi Square test of goodness of fit.

on the main state variables is better represented by the estimated coefficients of the regression in Table 16. Conditional on age, age at marriage and education, the estimated effect of an additional \$1,000 exempted value on the amount of net durable wealth held by the household is \$470, very close to the \$450 estimated from the data.

7.2 Discussion

A simple exercise allows us to better understand the origin of the difference in accumulation of durable versus non-durable net wealth. Table 18 and Figure 7 present simulated mean choices by education and exemption, for households who were married very young. The accumulation of durable goods is especially high in high exemption states with respect to low exemption states for the most educated households (which is also true in the data, see Table 5). From the simulated model, households with a college degree in a high exemption state hold on average \$10,000 more in durable wealth than the same type of households in a low exemption state. These individuals are characterized by a higher stream of earnings over the life cycle, and have the incentive to accumulate more durable goods in those states where bankruptcy protection is higher, since they can save more of these goods in case of default. On the other hand, low education-low income households are in general more restricted from borrowing, the result being that for them the negative effects of exemptions on credit conditions almost offsets the positive effects of the insurance value of bankruptcy protection.

As an illustrative example, Figures 8 and 9 graph the interest rate schedules as a function of durable wealth and debt respectively, by exemption level. Interest rates are decreasing in durable wealth and increasing in exemptions, as expected. Net durable wealth is a form of collateral and serves to relax the borrowing constraints, since it can be in part repossessed by banks in the case of bankruptcy. On the other hand, the higher the protection of the debtor, the higher is the risk of default and the expected loss for the creditor, other things being equal, which results in a higher default premium charged on unsecured loans.

Lastly, I conduct a counterfactual experiment to better evaluate the impact of bankruptcy protection on aggregate durable and non-durable wealth in the economy. The experiment consists of completely removing bankruptcy protection. The results are presented in Table 19, where simulated choice variables and interest rates under the change in regime are compared to the simulated profiles from both the benchmark model (the current regime) and a model where borrowing is not allowed.

In an economy where individuals cannot commit to repay their debts, eliminating bankruptcy protection corresponds to setting a zero exemption level. In the experiment, it is still possible to default, but in that case the household is repossessed of all durable wealth. In other words, all loans are fully collateralized by net durable wealth. The household that files for bankruptcy is also still assumed to incur the estimated cost of default proportional to earnings.

When compared with the economy where no borrowing is possible, allowing for a credit market and default, even without any protection, has a positive effect on the accumulation of durable wealth, at least from age thirty on (see Figure 10). Young households (until age 29) remain credit-constrained under both regimes. In other words, in a world where it is possible to borrow at the risk of default, despite the lack of insurance for the defaulters, less constrained households are able to buy more durable goods, being also able to use these goods as collateral.

Introducing bankruptcy protection in the form of exemption levels should tighten the credit supply, other things being equal. Nevertheless, simulated mean durable wealth under the benchmark model is higher than mean durable wealth in an economy where the exemption is zero. I interpret this difference as being the result only of the additional incentive for households who hold debt to insure themselves against the possibility of bankruptcy in the future period. This is especially true in the second half of the life cycle, when the positive effect of exemptions on durable goods as collateral and insurance prevails over the negative effect of exemptions on credit conditions.

7.3 Policy experiment: Bankruptcy Reform proposal H.R. 333 (2002)

In recent years personal bankruptcy has become an important issue to consumers, creditors and legislators alike. Because of the recent surge in personal default cases and the considerable losses suffered by credit card companies, bankruptcy reform has been debated in Congress since at least 1997.

With the estimated model, I evaluate the impact of the most recently proposed Reform H.R. 333 (2002). Backed by the credit card industry, this reform aims at restricting the possibility of filing for bankruptcy. It introduces a means test designed to determine the extent of a debtor's ability to repay his unsecured debt. For an individual with a current monthly income lower than the median income of a household of his age and state of residence, there is no change: he can file for bankruptcy under Chapter 7 as before. On the other hand, an individual with an income higher than the median is subject to a "presumption" of abuse. If, after deductions for support, his disposable income summed over five years is at least \$10,000, he is forced to pay the minimum of his debt and \$10,000, over the next five years. If this disposable income is less than \$10,000, but at least 25% of the debt, then the individual must pay at least 25% of the debt over the next five years. In all other cases, the individual can file for bankruptcy under Chapter 7 as before. The reform also introduces a maximum exemption level, equal to \$125,000 (in 2002).

My quantitative framework allows to evaluate the impact of the proposed reform not only on default rates, but also on household saving behavior and welfare. I introduce this regulation into the theoretical model and simulate household behavior and credit market conditions under the new law.[34] The

[34] All values are transformed into 1984 real terms. Moreover, I assume that the minimum income guaranteed to the debtor is exactly equal to the median income.

reform comprises increasing the expected returns to banks, other things being equal, since it sets a cap to the exemption level and forces some individuals to pay back their debts. That results in an increase in the maximum borrowing allowed at each value of durable assets held and loan requested by the household. However, interest rates depend not only on the interaction between the new supply and demand of credit, but also on the changed default probabilities, in equilibrium.

Results are presented in Table 20 and Figures 11 to 14. Equilibrium default and interest rates increase, by 0.72 and 1.24 percentage points respectively, although the average loss per defaulter suffered by the unsecured loans industry decreases by 11.4% (Table 22). The reform seems to lead to a slight reduction in durable net wealth in the economy, probably due to the increased interest rates for borrowing. There is no significant effect on the accumulation of non-durable wealth, and no change in mean welfare (measured as the average expected value at the initial age, in Table 21).

As expected, the largest effect on interest and default rates, as well as on durable wealth, comes from the introduction of the new policy in the high exemption group, where the cap on the durables that can be exempted is binding for those states with originally unlimited exemptions. As can be seen in Table 23, in this group of states the reform leads to an additional 1.75 percentage points in the equilibrium default risk premium, as a result of the fact that default rates almost double in this group, due to the loosening of the credit constraints.

We can conclude that the means testing reform would not improve upon the current provision, leaving welfare unchanged and leading to an increase in Chapter 7 filings and interest rates.

8 Conclusions

I structurally estimate a dynamic model of durable and non-durable consumption choice and default behavior over the life cycle. The model accounts for the equilibrium effects of bankruptcy exemption levels on consumer saving behavior and the credit sector. I use the estimated model to analyze the overall impact of bankruptcy exemptions on durable assets holdings and the individual specific borrowing conditions.

The model is able to replicate the main features of the data, namely the increasing profiles of durable and non-durable wealth over the life cycle, and the difference in the patterns of these variables between high and low exemption states. The estimated preference parameters are credible. Households discount the future at an annual rate of 9.9%, and have a coefficient of risk aversion equal to 1.4. The average cost of default measured as a percentage of earnings, over five years, is estimated to be 3.13%. The probability that a person defaulted but reported a non default in the PSID is about 13%.

The estimates allow me to evaluate the overall impact of bankruptcy protection on durable wealth using a coherent theoretical framework to derive the credit constraints which are actually unobserved in the data. I find that an individual default risk premium is incorporated into the cost of borrowing and is higher in high exemption states, at least for households that hold low levels of durable assets. Durable goods represent an important source of informal collateral, even if a very tight credit supply and a high risk of default can provide a disincentive for the accumulation of these goods.

Bankruptcy law seems to be one important channel through which policies can affect households savings behavior. I conduct policy analysis of a proposed change of the bankruptcy legislation. The proposed reform would make it more difficult to file for bankruptcy, forcing debtors to pay at least a certain percentage of their debt (25%, or $10,000) out of future earnings, and setting a maximum exemption level.[35] The policy experiment with the estimates of the model shows that this reform would actually have a stronger effect in high exemption states, where the cap on exemptions would bind. Default rates would overall increase, as would interest rates, while welfare would not improve.

The first important modification of the model would be to allow for unobserved heterogeneity, in order to achieve a better fit of the observed data, which is not satisfactory under a few dimensions, especially the pattern of non-durable net wealth as a function of exemption levels.

With the estimates at hand, the model can also be used to conduct several other policy experiments, such as alternative reforms of bankruptcy laws, as well as of banking regulations, e.g. interest rate ceilings on unsecured loans.

This work has treated the value of durables as net of secured debt (i.e., home equity), and has disregarded the households' choice of the kind of debt they hold. This was done because secured debt is senior to bankruptcy exemptions, i.e. the value of the house that is collateralized can never be saved in bankruptcy. A possible extension of the model would be to incorporate the distinction between secured and unsecured loans. The analysis of the equilibrium effects of bankruptcy protection on the demand and supply of both these types of credit is an important question for future work.

[35] The reform bill under consideration was actually rejected in the House of Representatives on November 14th, 2002. The bill was sponsored by credit card companies and banks, but was rejected by anti-abortion Republican law-makers, because of a provision of the bill that would restrict the ability of anti-abortion activists to write off court fines (The New York Times (2002)).

9 Appendix

9.1 Computation

9.1.1 Algorithm

In brief, the algorithm I use is the following:

1) construct grids for the percentage change in durables and debt/credit;[36]

2) calculate

$$E_{T-1}\left\{V_T\left(\underline{x}_T, \underline{\varepsilon}_T\right)\right\} = EMAX\left(\underline{x}_T, T\right)$$

and the borrowing allowed $EBOR\left(\underline{x}_T, T\right)$ as in (1), for a randomly selected number of states $\left(\underline{x}_T, s, e\right)$, using Monte Carlo simulation;[37]

3) run a regression to approximate the Emax and the Ebor functions at each state point. The model that has proved to be the best is a second degree polynomial for both the Emax and Ebor functions (see below for details);

4) recursively, for $t = T-2, ..., a+2$, using Monte Carlo simulations, calculate $EMAX$ and $EBOR$ for a selected number of state points at period $t+1$;

5) approximate the Emax and Ebor at each state point through a regression as in 3) above;

6) simulate the optimal decisions generating shocks $\left\{\varepsilon_{tj}^y, \varepsilon_{tj}^c\right\}_{t=1}^T$, for $j = 1, ..., 3,000$, assigning initial endowments $\left(h_{aj}, d_{a+1,j}\right)$, and using the $EMAX$ and $EBOR$ calculated above to find the stream of choices and utility values.

9.1.2 Monte Carlo Integration

The two random i.i.d. shocks are the following:

$$\varepsilon_t^y \sim LN\left(0, \sigma_y^2\right) \quad \forall t$$

$$\varepsilon_t^c \sim LN\left(0, \sigma_c^2\right) \quad \forall t$$

Use Cholesky decomposition:

$$\ln\left(\epsilon_t^y\right) = \alpha_1 u_{1t}$$

$$\ln\left(\varepsilon_t^c\right) = \alpha_2 u_{2t}$$

where $u_{1t} \sim N\left(0,1\right)$, $u_{2t} \sim N\left(0,1\right)$, i.i.d. $\forall t$.

Then $\sigma_y^2 = \alpha_1^2$ and $\sigma_c^2 = \alpha_2^2$.

The Monte Carlo simulation proceeds as follows.

[36] I choose 19 points between -1 and 9 for the percentage change in durables and 19 points between -2 and 4 for the percentage change in debt.

[37] I randomly select 25 combinations of shocks to earnings and to preferences, at each age. See below for details on Monte Carlo simulation. The number of selected states (combinations of debt and durables) is 2,000.

Given any values of h_t and d_{t+1}, I generate two random numbers u^m_{1t+1} and u^m_{2t+1}, from standard normal distributions (i.i.d), for $m = 1, ...M$ ($M = 25$ has proved to be sufficient), and I perform the following transformation:

$$\epsilon^{y,m}_{t+1} = \exp\left(\alpha_1 u^m_{1t+1}\right)$$

$$\epsilon^{c,m}_{t+1} = \exp\left(\alpha_2 u^m_{2t+1}\right)$$

The value of no default $V^{0,m}\left(\underline{x}_{t+1}, \underline{\varepsilon}^m_{t+1}\right)$ and the value of default $V^{1,m}\left(\underline{x}_{t+1}, \underline{\varepsilon}^m_{t+1}\right)$ are evaluated at each vector of shocks $\underline{\varepsilon}^m_{t+1}$, for $m = 1, ...M$.

The value function $V^m\left(\underline{x}_{t+1}, \underline{\varepsilon}^m_{t+1}\right)$ at each $\underline{\varepsilon}^m_{t+1}$ is then given by the highest of the no-default value and the default value, and the default rule $I^{d,m}_{t+1}\left(\underline{x}_{t+1}, \underline{\varepsilon}^m_{t+1}\right)$ is derived from that.

Then,

$$E_t\left\{V_{t+1}\left(\underline{x}_{t+1}, \underline{\varepsilon}_{t+1}\right)\right\} \approx \frac{1}{M}\sum_{m=1}^{M} V^m_{t+1}\left(\underline{x}_{t+1}, \underline{\varepsilon}^m_{t+1}\right) =$$

$$= EMAX\left(\underline{x}_{t+1}, t+1\right)$$

and (from (1))

$$R\bar{b}_t\left(\underline{x}_{t+1}\right) \approx \frac{1}{M}\sum_{m=1}^{M}\{d_{t+1}(1 - I^{d,m}_{t+1}\left(\underline{x}_{t+1}, \underline{\varepsilon}^m_{t+1}\right))+$$

$$+I^{d,m}_{t+1}\left(\underline{x}_{t+1}, \underline{\varepsilon}^m_{t+1}\right)\max\{(1-\delta)h_{t+1} - E_l, 0\}\} =$$

$$= EBOR\left(\underline{x}_{t+1}, t+1\right)$$

9.1.3 Approximation of EMAX and EBOR functions

To approximate the EMAX function,I use the following second degree polynomial:

$$EMAX(h_t, d_{t+1}, e, s) = \beta_{0t} + \beta_{1t}h_t + \beta_{2t}d_t + \beta_{3t}h_t d_t + \beta_{4t}h_t^2 + \beta_{5t}d_t^2 +$$

$$\beta_{6t}e + \beta_{7t}I_e + \beta_{8t}s + \beta_{9t}h_t s + ...$$

including all interactions between variables and five dummies on the value of the variable h.

I denote with I_e a dummy equal to one if the exemption level e is unlimited, set at a value of $100,000 in the computation (in order to approximate the EMAX and EBOR functions, this value cannot be too high).

Function EBOR is approximated with the same function, but without the dummies on h.

The goodness of fit is assessed by the (adjusted) coefficients of determination R^2 and from out of sample checks (graphing fitted versus real values of Emax and Ebor). The adjusted coefficient of determination varies from a value of 99.75 to 99.999.

9.2 Estimation

9.2.1 Parameters to estimate

Parameters to estimate (45):

- Preference parameters: $\sigma, \theta, \tau,\ \alpha_h, \alpha_d$
- Discount factor β
- Depreciation rate of durables δ
- Gross Interest Rate R
- Coefficients on age dummies in earnings process, $\{\alpha_i\}_{i=1,\ldots,9}$
- Coefficient for schooling in earnings process, α_s
- Variance of shocks to earnings, σ_y^2
- Variance of shocks to preferences, σ_c^2
- Initial states function coefficients, $\alpha_0, \alpha_1, \alpha_2, \beta_0, \beta_1, \beta_2, \sigma_h, \sigma_d, \sigma_{hd}$
- Parameters of Measurement and Classification Errors (see below):

  $\sigma_{\eta^h 0}, \sigma_{\eta^h 1,} \sigma_{\eta^b 0}, \sigma_{\eta^b 1,} \sigma_{\eta^y 0}, \sigma_{\eta^y 1}, \sigma_{\eta^{y0}}, p^y, p^{nd}$
- Cost of default as a percentage of earnings, q^y

9.2.2 Measurement and Classification Error

The observed initial states, choice variables and labor earnings are assumed to be measured with error.

- Measurement error in durables:

$$h_t = \widetilde{h}_t + \eta_t^h$$

$$\eta_t^h \sim N\left(0, \sigma^2_{\eta^h,t}\right)$$

$$\sigma_{\eta^h,t} = \sigma_{\eta^h 0} + \sigma_{\eta^h 1}\widetilde{h}_t$$

(the variance of the measurement error is proportional to the true - simulated - value $\widetilde{h}_t$).

- Measurement error in non-durable wealth:

$$b_t = \widetilde{b}_t + \eta_t^b$$

$$\eta_t^b \sim N\left(0, \sigma^2_{\eta^b,t}\right)$$

$$\sigma_{\eta^b,t} = \sigma_{\eta^b 0} + \sigma_{\eta^b 1} \mid \widetilde{b}_t \mid$$

(the variance of the measurement error is proportional to the true - simulated - value $\widetilde{b}_t$).

Measurement error in the initial states (h_a, d_{a+1}) is assumed to be characterized by analogous distributions as above.

- Measurement error in household labor income:

$$y_t = \widetilde{y}_t \eta_t^y$$

$$\eta_t^y \sim LN\left(0, \sigma^2_{\eta^y,t}\right)$$

$$\sigma_{\eta^y,t} = \sigma_{\eta^y 0} + \sigma_{\eta^y 1} \mid \ln(\widetilde{y}_t) \mid$$

(the variance of the measurement error is proportional to the logarithm of the true - simulated - value, $\ln(\widetilde{y}_t)$).

- Classification error for bankruptcy:

$$\Pr\left\{I^{d,i} = 0 \mid \widetilde{I}^{d} = 1\right\} = p^{nd} \in (0,1)$$

$$\Pr\left\{I^{d,i} = 1 \mid \widetilde{I}^{d} = 0\right\} = p^{d} \in (0,1)$$

In order to have an unbiased measurement error it must be that

$$p^{d} = \frac{p^{nd}\Pr\left(I^{d} = 1\right)}{1 - \Pr\left(I^{d} = 1\right)},$$

where $\Pr\left(I^{d} = 1\right) = \frac{1}{I}\sum_{i=1}^{I} I\left(I^{d,i} = 1\right)$, frequency of default in the data (=2.11%).

All measurement errors are assumed to be independent and serially uncorrelated.

9.3 Tables and Figures

U.S. State	Exemption in 1984 ($)	Exemption in 1992 ($, 1984 real value)	Average exemption 1984-1992 ($)	Category**
DELAWARE	5,075	370	2,723	1
MARYLAND	6,000	4,073	5,037	1
WEST VIRGINIA	6,000	6,739	6,370	1
GEORGIA	9,500	4,740	7,120	1
KENTUCKY	11,000	6,295	8,647	1
MISSOURI	11,500	7,220	9,360	1
TENNESSEE	12,250	6,665	9,458	1
UTAH	13,000	7,035	10,018	1
INDIANA	11,600	8,590	10,095	1
VIRGINIA	12,000	8,887	10,443	1
NEBRASKA	12,000	9,257	10,628	1
SOUTH CAROLINA	8,750	12,738	10,744	1
ALABAMA	13,000	9,627	11,314	1
NORTH CAROLINA	16,000	11,108	13,554	1
MAINE	17,300	10,072	13,686	1
OHIO	19,000	8,739	13,869	1
MICHIGAN	19,000	9,516	14,258	1
ILLINOIS	17,750	13,478	15,614	2
NEW HAMPSHIRE	10,500	22,957	16,729	2
CONNECTICUT	19,000	15,070	17,035	2
DIST OF COLUMBIA	19,000	15,070	17,035	2
NEW JERSEY	19,000	15,070	17,035	2
PENNSYLVANIA	19,000	15,070	17,035	2
RHODE ISLAND	19,000	15,070	17,035	2
HAWAII	21,000	15,552	18,276	2
WYOMING	23,000	16,292	19,646	2
OREGON	22,650	17,551	20,101	2
LOUISIANA	25,000	18,514	21,757	2

Table 1 (to be continued): Exemption levels *

U.S. State	Exemption in 1984 ($)	Exemption in 1992 ($, 1984 real value)	Average exemption 1984-1992 ($)	Category**
NEW YORK	25,600	18,440	22,020	2
COLORADO	25,000	22,957	23,979	2
WISCONSIN	25,900	31,251	28,576	2
WASHINGTON	36,750	24,142	30,446	2
VERMONT	40,000	30,067	35,033	2
MONTANA	40,200	30,511	35,355	2
NEW MEXICO	46,500	32,955	39,727	2
IDAHO ***	6,400	75,166	40,783	.
ALASKA	55,500	42,212	48,856	3
MISSISSIPPI	38,000	62,947	50,474	3
CALIFORNIA	47,500	56,727	52,113	3
ARIZONA	57,600	75,278	66,439	3
MASSACHUSETTS	63,500	75,296	69,398	3
NORTH DAKOTA	90,000	63,836	76,918	3
NEVADA	99,000	74,944	86,972	3
ARKANSAS	unlimited	unlimited	unlimited	4
FLORIDA	unlimited	unlimited	unlimited	4
KANSAS	unlimited	unlimited	unlimited	4
MINNESOTA	unlimited	unlimited	unlimited	4
OKLAHOMA	unlimited	unlimited	unlimited	4
TEXAS	unlimited	unlimited	unlimited	4
IOWA ***	4,500	unlimited	.	.
SOUTH DAKOTA***	unlimited	25,179	.	.
Average (excluding unlimited)	25,451	23,938	24,923	
Average category 1	11,940	7,745	9,843	
Average category 2	25,269	20,557	22,913	
Average category 3	64,443	64,463	64,453	

* Exemptions are the sum of homestead exemption, exempted value of vehicles and wild card exemption
Source: Elias, Renauer and Leonard (1986,1992)

** Category 1: average exemption 1984-1992 below $15,000
Category 2: average exemption 1984-1992 above $15,000 and below $40,000
Category 3: average exemption 1984-1992 above $40,000
Category 4: unlimited exemption

*** States eliminated from the sample (see text for details)

Table 1 (continued): Exemption levels *

1) PSID Heads of Households, total observations 1984-1994	9,983
2) Observations in 1) that are married at least in one of the years 1984, 1989 or 1994	5,797
3) Observations in 2) whose marriage history is observed	5,701
4) Observations in 3) whose state of residence is observed	5,673
5) Observations in 4) whose age is between 20 and 64	5,234
6) Observations in 5) whose age at marriage is observed	4,974
7) Observations in 6) whose education is observed	4,954
8) Observations in 7) after eliminating outliers on earnings, durable and financial wealth	4,790

Table 2: PSID sample selection

Age	% 20-24	1.92	
	% 25-29	9.9	
	% 30-34	17.15	
	% 35-39	19.57	
	% 40-44	16.21	
	% 45-49	11.56	
	% 50-54	8.21	
	% 55-59	7.98	
	% 60-64	7.5	
Sex	% Male	98.98	
Race	% White	68.62	
	% Black	27.64	
	% Other	3.74	
Education	% No High School	21.09	
	% High School	38.52	
	% Some College	19.95	
	% College	20.43	
Age at Marriage	Before 20 y.o.	7.95	
	% 20-24	41.52	
	% 25-29	25.72	
	% 30-34	11.32	
	% 35-39	5.74	
	% 40-44	3.4	
	% 45-49	2.38	
	% 50-54	1.46	
	% 55-59	0.5	
Mean durable wealth at the age of marriage		$14,200	(21,000)
Mean financial wealth at the age of marriage		$10,400	(39,400)
Mean household earnings over 5 years		$182,200	(110,800)
Median household earnings over 5 years		$164,400	
Mean durable wealth		$42,100	(48,500)
Median durable wealth		$28,000	
% Zero durable wealth		3.62	
Mean financial wealth		$33,200	(86,200)
Median financial wealth		$2,900	
% Negative or zero financial wealth		40.92	
% Zero financial wealth		11.22	

Table 3: Individual characteristics of PSID sub-sample

	Mean durable wealth ($/10,000 1984 real value)		Mean non-durable net wealth ($/10,000 1984 real value)	
Age	Low Ex.	High Ex.	Low Ex.	High Ex.
20-24	0.26 (0.33)	1.25 (2.23)	0.09 (0.94)	0.02 (0.19)
25-29	1.25 (1.72)	1.32 (1.81)	0.14 (3.18)	0.53 (3.38)
30-34	2.24 (2.48)	2.67 (3.24)	1.29 (4.66)	1.67 (5.63)
35-39	3.33 (3.66)	4.25 (4.80)	1.99 (5.21)	2.79 (8.94)
40-44	4.68 (4.50)	5.85 (6.45)	3.25 (7.20)	3.96 (10.22)
45-49	5.06 (4.57)	7.00 (6.67)	4.51 (9.49)	5.76 (11.52)
50-54	5.55 (4.85)	6.55 (7.32)	4.77 (10.24)	6.04 (10.97)
55-59	6.21 (5.54)	6.92 (6.96)	6.83 (11.87)	7.04 (13.73)
60-64	6.34 (5.26)	7.36 (6.05)	6.80 (12.16)	7.19 (13.71)

	Mean household earnings ($/10,000 1984 real value)		Default rates	
Age	Low Ex.	High Ex.	Low Ex.	High Ex.
20-24	7.14 (4.03)	8.52 (5.29)	2.27%	9.09%
25-29	13.20 (6.26)	13.48 (6.82)	4.65%	4.12%
30-34	17.02 (8.62)	17.91 (9.18)	2.74%	0.93%
35-39	19.74 (10.3)	19.99 (9.77)	2.45%	2.48%
40-44	21.20 (11.2)	23.06 (10.98)	1.36%	2.53%
45-49	22.24 (12.21)	23.99 (12.82)	1.29%	1.54%
50-54	19.08 (12.63)	19.00 (11.40)	0.64%	1.47%
55-59	16.33 (11.98)	15.65 (10.95)	0.35%	0.72%
60-64	11.93 (11.42)	11.88 (10.74)	0.00%	0.00%

(Standard deviation in parenthesis)

* Low exemption = groups 1 and 2, High exemption = groups 3 and 4 (see Table 1)

Table 4: Statistics by exemption *

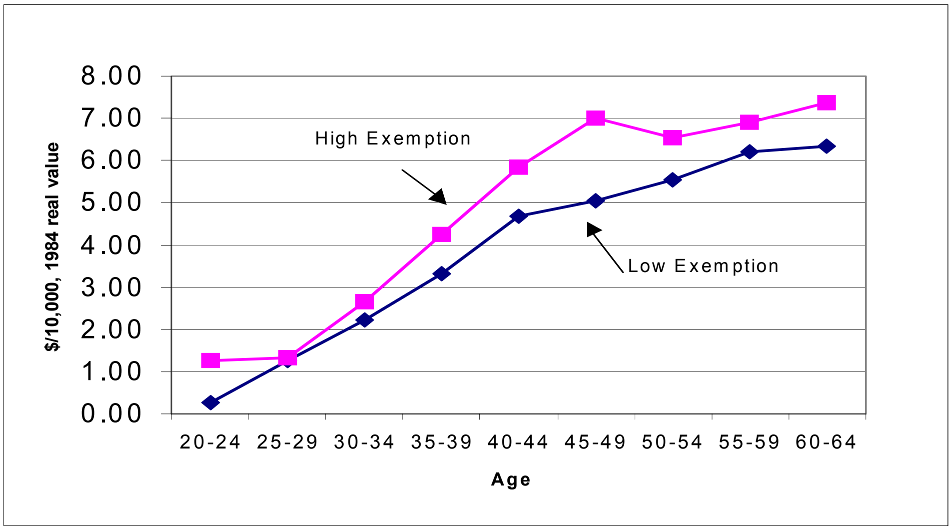

Figure 1: Mean durable wealth by exemption level

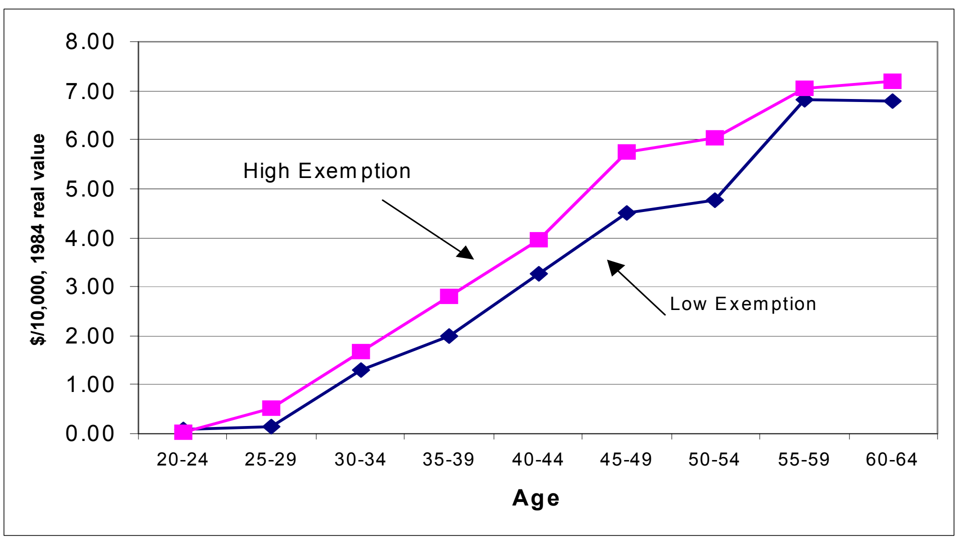

Figure 2: Mean non-durable net wealth by exemption

Mean Durable wealth ($/10,000 1984 real value)

	High School or Less		Some College or College	
Age	Low Exemption	High Exemption	Low Exemption	High Exemption
20-34	1.51 (2.01)	1.70 (2.19)	2.31 (2.56)	2.64 (3.48)
35-49	3.27 (3.54)	3.49 (4.14)	5.45 (4.77)	6.99 (6.69)
50-64	4.84 (4.26)	5.18 (4.72)	8.81 (6.15)	10.33 (8.77)

Mean Financial wealth ($/10,000 1984 real value)

	High School or Less		Some College or College	
Age	Low Exemption	High Exemption	Low Exemption	High Exemption
20-34	0.50 (3.82)	0.69 (3.62)	1.46 (4.51)	1.79 (5.95)
35-49	1.89 (5.52)	2.15 (5.99)	4.52 (8.72)	5.3 (12.24)
50-64	4.11 (9.29)	3.61 (8.45)	10.62 (14.3)	12.63 (16.97)

Mean household earnings (over five years, $/10,000 1984 real value)

	High School or Less		Some College or College	
Age	Low Exemption	High Exemption	Low Exemption	High Exemption
20-34	12.53 (6.76)	12.83 (7.10)	18.39 (8.95)	18.83 (9.44)
35-49	16.82 (8.88)	17.57 (8.97)	26.6 (11.41)	25.71 (11.32)
50-64	12.73 (9.00)	11.93 (8.64)	24.2 (15.18)	22.91 (12.54)

(standard deviation in parenthesis)

Table 5: Statistics by education and exemption level

Mean Durable wealth ($/10,000 1984 real value)

	Earnings less than median		Earnings more than median	
Age	Low Exemption	High Exemption	Low Exemption	High Exemption
20-34	1.27 (1.85)	1.48 (2.34)	2.77 (2.59)	3.25 (3.31)
35-49	2.68 (3.15)	3.29 (4.63)	5.23 (4.58)	6.69 (6.30)
50-64	4.76 (4.3)	5.24 (4.78)	8.02 (5.89)	9.56 (8.53)

Mean Financial wealth ($/10,000 1984 real value)

	Earnings less than median		Earnings more than median	
Age	Low Exemption	High Exemption	Low Exemption	High Exemption
20-34	0.31 (2.86)	0.68 (4.53)	1.83 (5.65)	2.06 (5.08)
35-49	1.13 (3.68)	1.84 (9.60)	4.26 (8.53)	5.09 (10.23)
50-64	4.41 (9.53)	4.23 (10.45)	8.68 (13.5)	10.78 (15.10)

(standard deviation in parenthesis)

Table 6: Statistics by income quantile and exemption

Dependent variable: Durable wealth

Independent variable	Coefficient	Std. Error	Pr. > t
Intercept	-82061	3036.67	<0.0001
Years of schooling	5739.08	200.71	<0.0001
Age group at marriage	-4406.78	428.07	<0.0001
Age group	10098	269.27	<0.0001
Exemption level	0.452	0.03	<0.0001
Dummy for unlimited exemption*	-43402	2839	<0.0001
R-Squared	0.26		
F-value	449.63		

* unlimited exemption is set to $100,000 (1984 value)

Table 7: Regression of durable wealth on initial states and age

Dependent variable: Financial wealth

Independent variable	Coefficient	Std. Error	Pr. > t
Intercept	-120920	6146.97	<0.0001
Years of schooling	7556.51	405.97	<0.0001
Age group at marriage	-3531.63	876.07	<0.0001
Age group	12110	549.98	<0.0001
Exemption level	0.195	0.063	0.0022
Dummy for unlimited exemption*	-188438	62355	0.0025
R-Squared	0.11		
F-value	153.9		

* unlimited exemption is set to $999,999

Table 8: Regression of non-durable net wealth on initial states and age

Dependent variable: Household Earnings

Independent variable	Coefficient	Std. Error	Pr. > t
Intercept	-115122	7074.48	<0.0001
Years of schooling	21107	466.58	<0.0001
Age group at marriage	-1925.11	998.71	0.0539
Age group	6506.43	627.08	<0.0001
Exemption level	0.127	0.073	0.0838
Dummy for unlimited exemption*	-135067	71754	0.0598
R-Squared	0.25		
F-value	420.8		

* unlimited exemption is set to $999,999

Table 9: Regression of household earnings on initial states and age

Dependent variable: bankruptcy filing

Independent variable	Coefficient	Std. Error	Pr. > ChiSq.
Intercept	-0.371	0.2604	0.1542
Years of schooling	-0.0812	0.0178	<.0001
Age group at marriage	0.0864	0.0401	0.0309
Age group	-0.1805	0.028	<.0001
Exemption level	-2.51E-06	2.79E-06	0.3677
Dummy for unlimited exemption*	2.6204	2.7289	0.3369
LR	66.51		
-2 log likelihood	928.517		

* unlimited exemption is set to $999,999

Table 10: Probit of default decision on initial states and age

		Defaulters		Non defaulters	
Total number of defaulters in sample		101			
Distribution by Age	% 20-24	3.96		1.36	
	% 25-29	22.77		9.21	
	% 30-34	18.81		16.55	
	% 35-39	26.73		19.59	
	% 40-44	13.86		16.69	
	% 45-49	6.93		12.19	
	% 50-54	4.95		8.36	
	% 55-59	1.98		8.26	
	% 60-64	0		7.79	
Sex	% Male	99.01		99.57	
Race	% White	71.29		73.16	
	% Black	26.73		23.02	
	% Other	1.98		3.83	
Education	% No High School	24.75		18.93	
	% High School	47.52		38.19	
	% Some College	21.78		20.1	
	% College	5.94		22.78	
Age at Marriage	Before 20 y.o.	16.83		9.37	
	% 20-24	45.54		52.15	
	% 25-29	24.75		22.07	
	% 30-34	6.93		8.62	
	% 35-39	1.98		3.2	
	% 40-44	0.99		2.11	
	% 45-49	2.97		1.54	
	% 50-54	0		0.81	
	% 55-59	0		0.14	
Mean household earnings over 5 years		$133,200	(68,900)	$191,700	(111,600)
Median household earnings over 5 years		$127,400		$174,100	
Mean durable wealth		$17,200	(24,800)	$45,500	(50,400)
Median durable wealth		$8,200		$31,500	
% Zero durable wealth		5.94		2.9	
Mean financial wealth		$3,400	(22,500)	$37,200	(89,300)
Median financial wealth		$0		$5,000	
% Negative or zero financial wealth		62.38		37.63	
% Zero financial wealth		10.89		9.76	

Table 11: Individual characteristics of defaulters

Preference parameters	beta (transformed in annual discount factor)	0.9097
	sigma (CRRA coeff.)	1.4051
	teta (consumption share)	0.9440
	CES coefficient	0.4955
	bequest motive on h (coeff. on h in linear function)	0.0282
	bequest motive on d	0.0231
Parameters that characterize the economy	depreciation rate	0.0477
	interest rate (annual)	0.0574
	cost of default (as % of earnings)	0.0313
	st. deviation of shock to utility	0.5687
Earnings process	coeff.schooling on earnings f.	0.1248
	g1 (age 1 specific earnings)	0.5399
	g2 (age 2 specific earnings)	0.8580
	g3	1.0407
	g4	1.1818
	g5	1.2836
	g6	1.3361
	g7	1.1487
	g8	0.9955
	g9	0.5939
	st. deviation shock to earnings	0.6121
Initial assets functions	alfa0 (intercept in function of initial h)	-2.3201
	alfa1 (coeff. on age at marriage in f. of initial h)	0.3197
	alfa2 (coeff. on education in f. of initial h)	0.1726
	beta0 (intercept in function of initial d)	-4.3599
	beta1 (coeff. on age at marriage in f. of initial d)	0.3680
	beta2 (coeff. on education in f. of initial d)	0.2819
	st. deviation random component of initial h	0.7606
	st. deviation random component of initial d (Choleski dec.)	0.7458
	st. deviation of random component of initial d (Choleski dec.)	0.9600
Measurement error processes	sigma_h0	1.3492
	sigma_h1	-0.0028
	sigma_b0	0.7343
	sigma_b1	0.0279
	sigma_y0	0.4298
	sigma_y1	-0.0052
	probability (observe no default/default)	0.1356

Table 12: Estimated parameters

Means	Durable wealth $/10,000 1984 real value		Financial wealth $/10,000 1984 real value		Default rates		Household Earnings $/10,000 1984 real value	
Age	data	model	data	model	data	model	data	model
20-24	0.66	1.18	0.04	0.18	5.19%	3.85%	7.65	8.83
25-29	1.35	1.81	0.31	0.35	4.50%	3.37%	13.28	13.65
30-34	2.42	2.38	1.53	0.81	2.21%	1.11%	17.29	17.12
35-39	3.54	3.17	2.42	1.76	2.46%	3.58%	19.82	19.58
40-44	4.98	4.41	3.51	2.87	1.71%	3.70%	21.74	22.22
45-49	5.52	6.13	4.97	4.74	1.37%	0.95%	22.76	22.97
50-54	5.80	6.40	5.26	6.37	0.89%	1.22%	19.06	19.31
55-59	6.35	6.13	6.78	7.81	0.47%	1.66%	16.12	15.96
60-64	6.73	6.39	6.73	7.46	0.00%	0.02%	11.91	10.96
Mean over age	4.07	4.86	3.24	4.40	2.11%	1.86%	18.18	17.81
Means for defaulters	1.72	2.66	0.34	-4.28			13.32	16.45
Equilibrium Interest Rate:			6.70%					

Table 13: Model Fit of Data

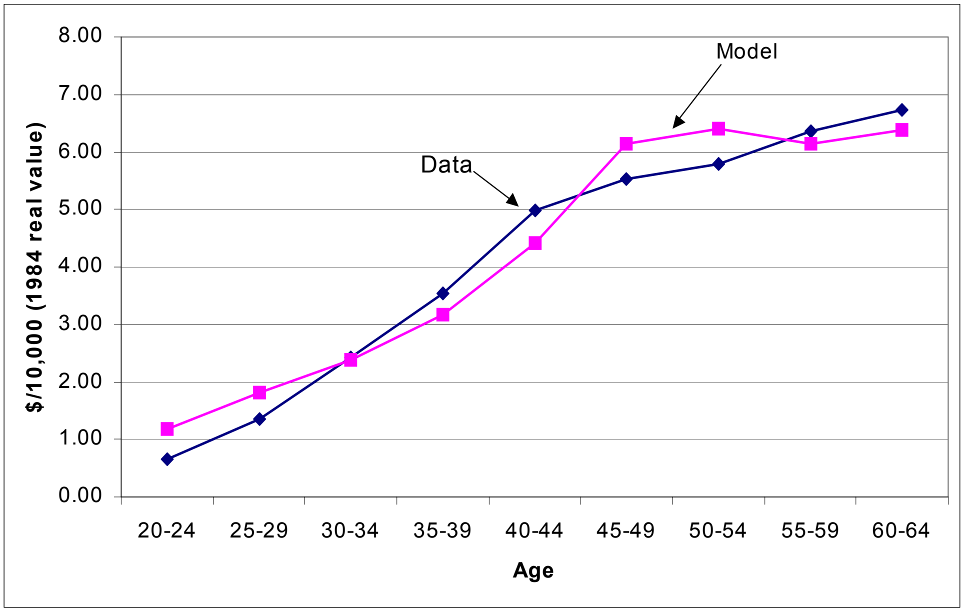

Figure 3: Mean actual and simulated durable wealth

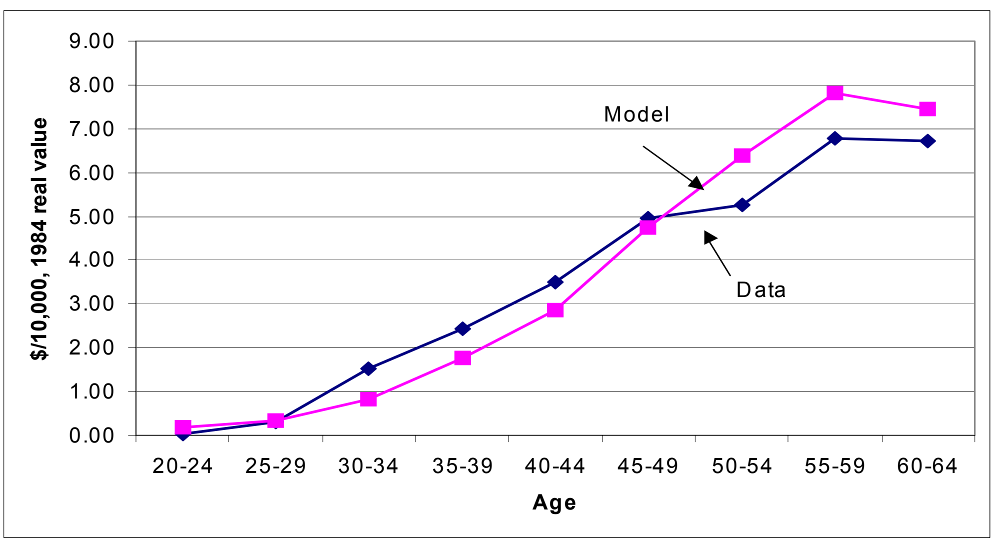

Figure 4: Mean actual and simulated non-durable net wealth

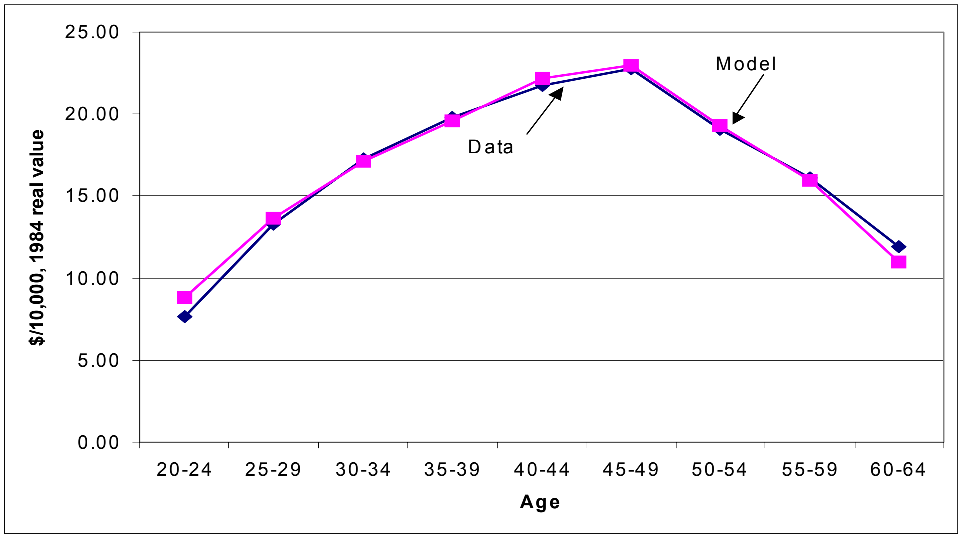

Figure 5: Mean actual and simulated household earnings (over 5 years)

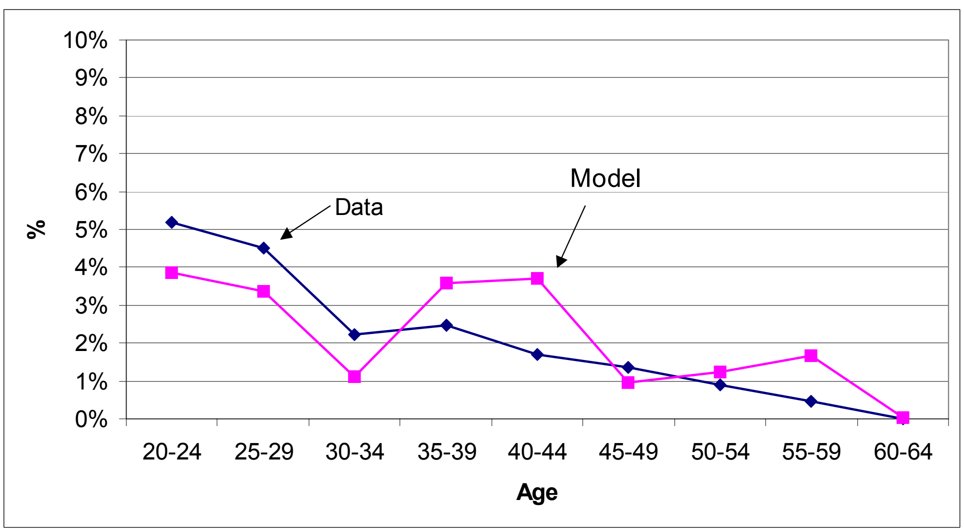

Figure 6: Mean actual and simulated default rates

	Mean durable wealth ($/10,000, 1984 real value)				Mean non-durable net wealth ($/10,000 1984 real value)			
	Low Exemption		High Exemption		Low Exemption		High Exemption	
Age	Data	Model	Data	Model	Data	Model	Data	Model
20-24	0.28	1.09	1.23	1.35	0.08	0.17	-0.02	0.20
25-29	1.35	1.67	1.36	2.13	0.13	0.32	0.74	0.41
30-34	2.32	2.32	2.65	2.54	1.46	0.78	1.67	0.88
35-39	3.30	3.13	4.09	3.26	2.26	1.83	2.80	1.58
40-44	4.70	4.52	5.64	4.15	3.33	2.94	3.94	2.72
45-49	5.04	6.19	6.67	6.00	4.59	4.92	5.85	4.33
50-54	5.55	6.27	6.38	6.72	4.95	6.78	5.99	5.42
55-59	6.22	5.94	6.63	6.56	6.68	8.37	6.98	6.55
60-64	6.45	6.48	7.40	6.20	6.52	7.92	7.22	6.41

* Low exemption = groups 1 and 2, High exemption = groups 3 and 4 (see Table 1)

Table 14: Model fit of data by exemption level *

Age	Durable wealth		Non-durable net wealth		Earnings	
	Low Ex.	High Ex.	Low Ex.	High Ex.	Low Ex.	High Ex.
20-24	0.58	0.41	1.02	2.62	0.26	0.12
25-29	0.64	0.72	1.03	2.23	0.29	0.22
30-34	0.26	0.16	1.14	2.68	0.16	0.31
35-39	0.36	0.30	1.05	3.00	0.17	0.29
40-44	0.20	0.32	1.86	8.99	0.11	0.29
45-49	0.35	0.34	1.74	1.86	0.08	0.10
50-54	0.49	0.34	1.13	1.14	0.07	0.09
55-59	0.50	0.61	6.33	1.66	0.09	0.20
60-64	1.43	1.93	1.47	1.63	0.25	0.21

All economy

Age	Durable wealth	Non-durable wealth	Earnings
20-24	0.48	1.66	0.16
25-29	0.55	1.43	0.21
30-34	0.18	1.32	0.19
35-39	0.28	1.43	0.18
40-44	0.20	2.02	0.13
45-49	0.28	0.57	0.08
50-54	0.36	0.54	0.07
55-59	0.50	1.64	0.10
60-64	1.49	1.53	0.22
Mean over age	0.19	0.69	0.11

* Chi Square has 9 degrees of freedom

Table 15: Chi-Square Test for Goodness-of-Fit

Dependent variable: Durable wealth

Independent variable	Data		Model	
	Coefficient	Std. Error	Coefficient	Std. Error
Intercept	-82061	3036.67	-61109	3751.17
Years of schooling	5739.08	200.71	5794	603.23
Age group at marriage	-4406.78	428.07	-4339	519.08
Age group	10098	269.27	7603	558.79
Exemption level	0.452	0.03	0.47	0.058
Dummy for unlimited exemption*	-43402	2839	-2396	152.72
R-Squared	0.26		0.075	

* unlimited exemption is set to $100,000 (1984 value)

Table 16: Regression of durable wealth on initial states and age, model vs. data

Equilibrium Borrowing Interest rates

Age	Low Exemption	High Exemption
20-24	5.84%	11.61%
25-29	5.83%	5.88%
30-34	7.96%	12.76%
35-39	6.78%	7.04%
40-44	5.94%	5.86%
45-49	6.06%	6.73%
50-54	8.44%	9.74%
55-59	5.76%	11.40%
60-64	NaN	NaN
Average	6.69%	8.02%

Table 17: Predicted equilibrium interest rates by exemption, benchmark model

	Mean durable wealth				Default Rates			
	High School		College		High School		College	
Age	Low ex.	High ex.	Low ex.	High ex.	Low ex.	High ex.	Low ex.	High ex.
20-24	1.03	1.44	1.00	2.06	4.90%	4.93%	3.90%	3.27%
25-29	1.64	2.37	0.98	3.20	0.67%	0.00%	0.67%	0.00%
30-34	1.98	2.46	1.59	3.28	0.80%	0.00%	0.40%	0.03%
35-39	3.04	3.06	2.99	4.27	0.93%	0.00%	7.10%	0.07%
40-44	4.11	4.10	4.98	5.83	0.47%	0.03%	0.37%	0.03%
45-49	5.99	5.85	7.42	8.23	0.50%	0.00%	2.13%	0.00%
50-54	5.97	6.26	8.62	9.59	1.03%	0.20%	2.03%	0.03%
55-59	5.95	5.82	8.13	9.02	1.60%	0.20%	2.57%	0.10%
60-64	5.44	5.10	12.54	11.25	0.00%	0.03%	0.00%	0.03%

	Mean financial Wealth				Equilibrium borrowing interest rates			
	High School		College		High School		College	
Age	Low ex.	High ex.	Low ex.	High ex.	Low ex.	High ex.	Low ex.	High ex.
20-24	0.30	0.24	0.64	0.41	6.06%	NaN	7.67%	NaN
25-29	0.98	0.88	2.00	1.20	5.95%	5.74%	6.47%	5.79%
30-34	1.88	1.90	3.02	2.41	6.37%	5.74%	12.82%	6.75%
35-39	2.81	2.97	3.92	3.49	5.94%	6.95%	5.96%	5.80%
40-44	3.60	3.80	5.27	4.61	5.81%	5.74%	6.53%	5.74%
45-49	5.02	4.89	8.13	6.60	5.85%	7.67%	7.27%	5.74%
50-54	6.53	5.61	11.22	8.62	7.75%	7.06%	10.38%	9.01%
55-59	7.14	6.18	15.69	11.57	5.74%	8.02%	5.78%	11.30%
60-64	6.80	5.65	14.75	11.67	NaN	NaN	NaN	NaN

Table 18: Predicted life-cycle profiles by education and exemption level

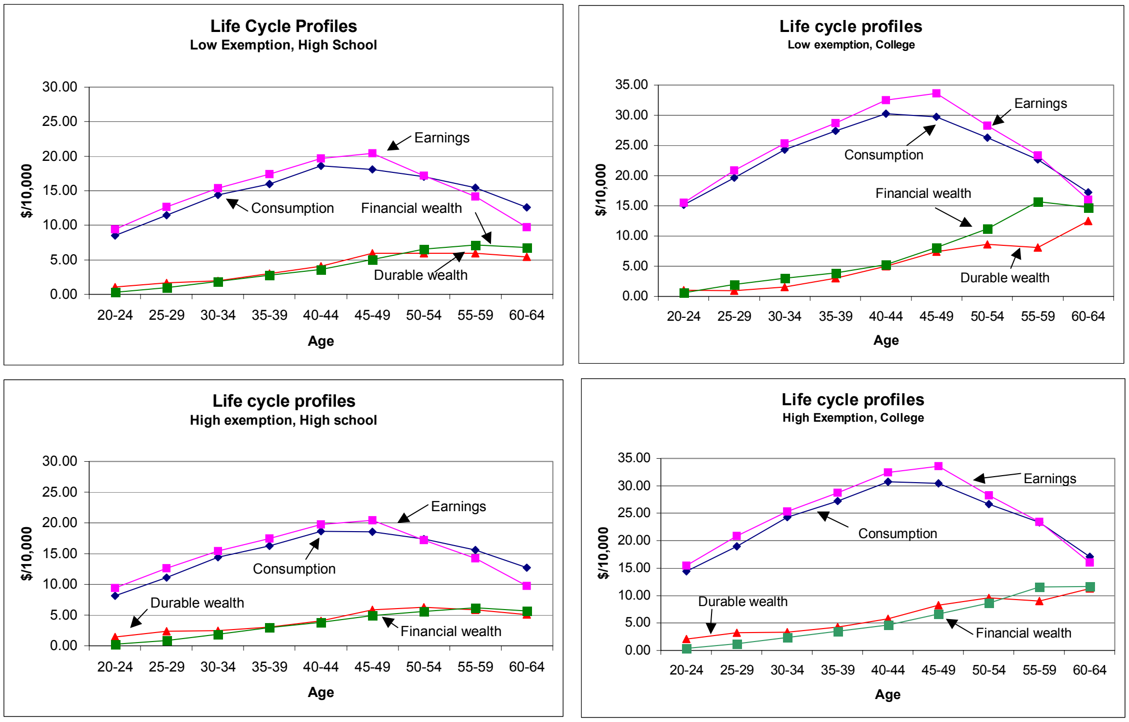

Figure 7: Life-cycle profiles by education and exemption, for households married at 0

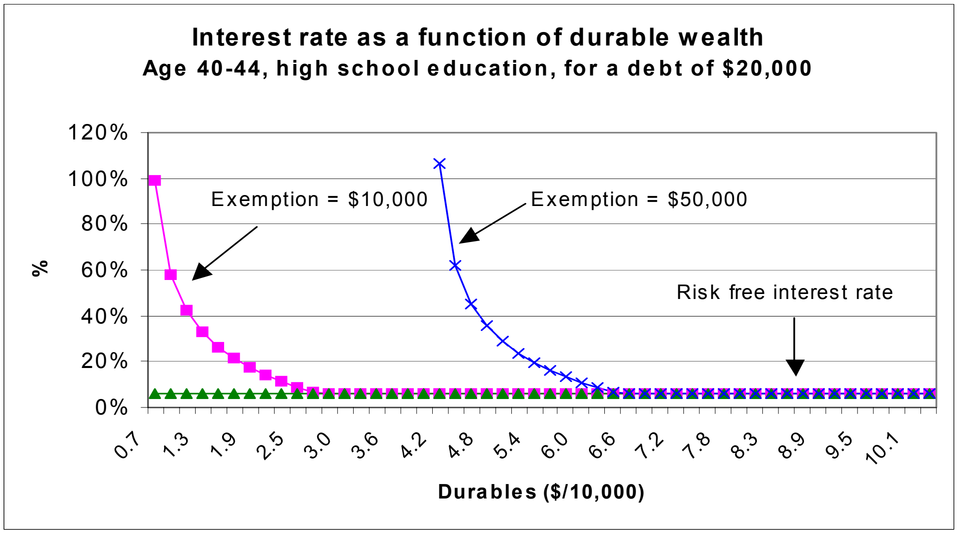

Figure 8: Interest rate schedule as a function of durable wealth

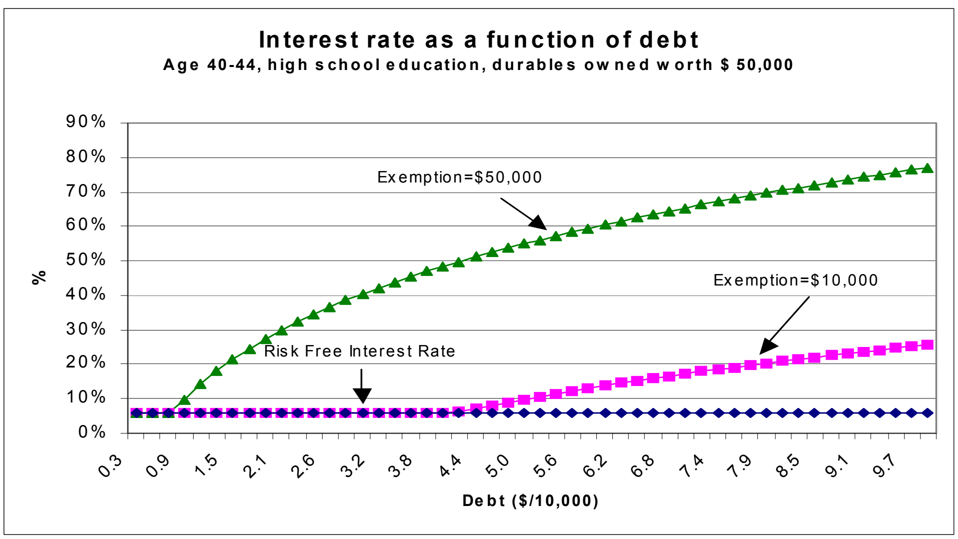

Figure 9: Interest rate schedule as a function of debt

	Mean durable wealth			Mean financial wealth		
Age	Benchmark	No Borrowing*	No bankruptcy**	Benchmark	No Borrowing	No bankruptcy
20-24	1.18	0.75	0.88	0.18	0.41	0.08
25-29	1.81	1.43	1.53	0.35	0.54	0.04
30-34	2.38	1.56	2.40	0.81	1.19	0.24
35-39	3.17	2.40	2.82	1.76	2.14	1.35
40-44	4.41	3.41	4.31	2.87	3.40	2.39
45-49	6.13	4.17	5.19	4.74	5.54	4.97
50-54	6.40	4.69	5.08	6.37	7.03	6.88
55-59	6.13	4.85	5.41	7.81	8.39	8.13
60-64	6.39	6.40	6.35	7.46	7.31	7.67

	Default rates		Equilibrium Borrowing Interest rates	
Age	Benchmark	No bankruptcy	Benchmark	No bankruptcy
20-24	3.85%	1.51%	5.84%	5.81%
25-29	3.37%	0.72%	5.84%	5.86%
30-34	1.11%	0.61%	8.00%	7.36%
35-39	3.58%	5.42%	6.79%	6.39%
40-44	3.70%	2.16%	5.93%	6.15%
45-49	0.95%	1.88%	6.06%	6.10%
50-54	1.22%	1.17%	8.44%	7.71%
55-59	1.66%	2.81%	5.78%	5.76%
60-64	0.02%	0.02%	NaN	NaN
			6.70%	6.49%

* No borrowing allowed in the economy

** The exemption level is set to zero: no bankruptcy protection in the economy

Table 19: Simulated choice variables under different regimes

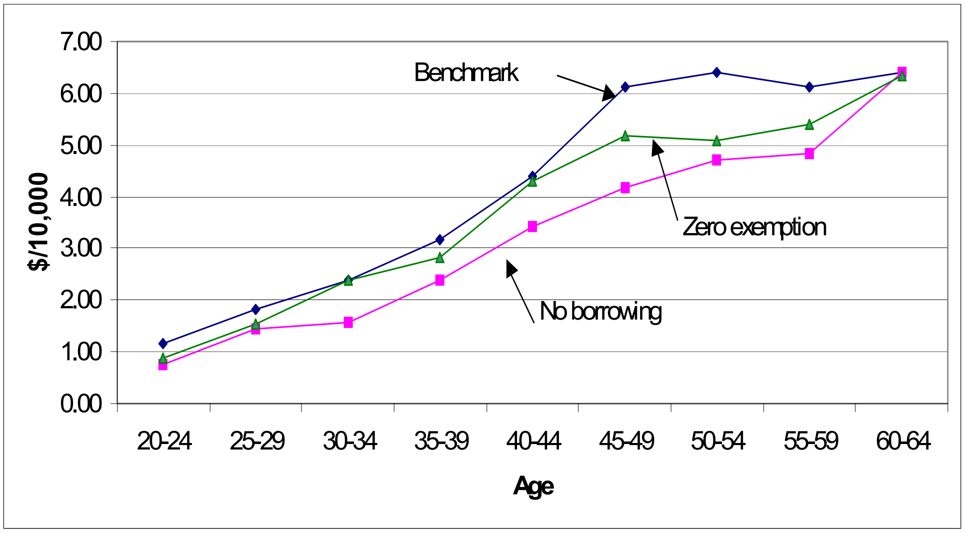

Figure 10: Mean durable wealth under different regimes

	Durable wealth		Financial Wealth	
Age	Benchmark	Policy reform	Benchmark	Policy Reform
20-24	1.18	1.10	0.18	0.20
25-29	1.81	1.61	0.35	0.38
30-34	2.38	2.05	0.81	0.79
35-39	3.17	2.74	1.76	1.75
40-44	4.41	3.75	2.87	2.84
45-49	6.13	5.40	4.74	4.54
50-54	6.40	5.86	6.37	5.85
55-59	6.13	5.59	7.81	7.21
60-64	6.39	5.88	7.46	6.78

	Equilibrium Borrowing Interest		Default rates	
Age	Benchmark	Policy Reform	Benchmark	Policy Reform
20-24	5.84%	6.24%	3.85%	2.34%
25-29	5.84%	7.11%	3.37%	2.42%
30-34	8.00%	9.77%	1.11%	2.76%
40-44	5.93%	6.63%	3.70%	2.41%
45-49	6.06%	6.53%	0.95%	1.31%
50-54	8.44%	10.23%	1.22%	2.86%
55-59	5.78%	5.88%	1.66%	3.84%
60-64	NaN	NaN	0.02%	0.17%
Overall Mean	6.70%	7.94%	1.86%	2.58%

Table 20: Predicted life-cycle profiles, Reform H.R. 333 vs. benchmark model

Value at Age 0	Benchmark	Policy Reform	% Change
Whole economy	-3.4375	-3.4344	0.0009
Low Exemption	-3.4716	-3.4676	0.0012
High Exemption	-3.3703	-3.3688	0.0004

Table 21: Welfare comparison between Reform H.R. 333 and benchmark model

	Benchmark	Policy Reform	% Change
Whole economy	5.7858	5.1278	-0.114
Low Exemption	6.6301	5.8245	-0.122
High Exemption	1.3748	3.6978	1.690

Table 22: Mean loss per defaulter, Reform H.R. 333 vs. benchmark model

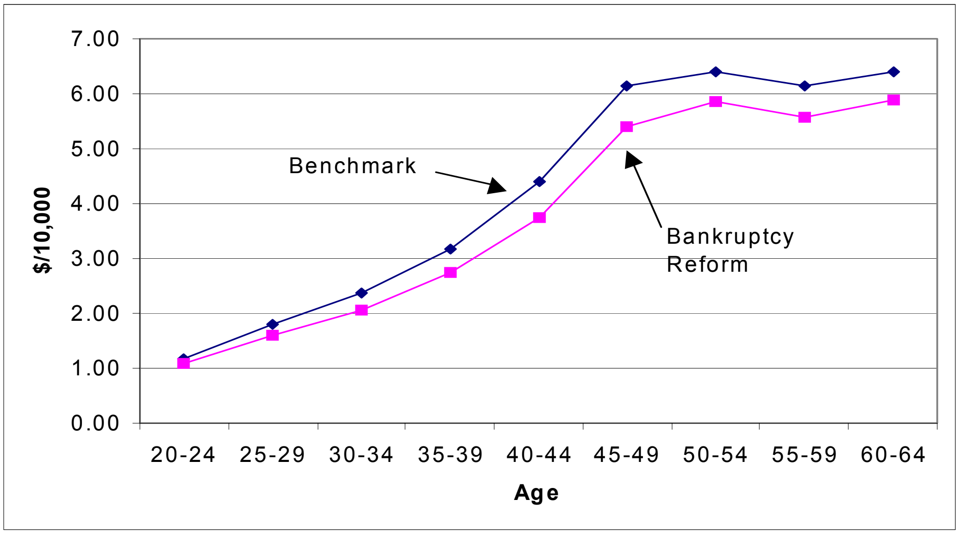

Figure 11: Predicted mean durable wealth, Reform H.R. 333 (2002) versus benchmark model

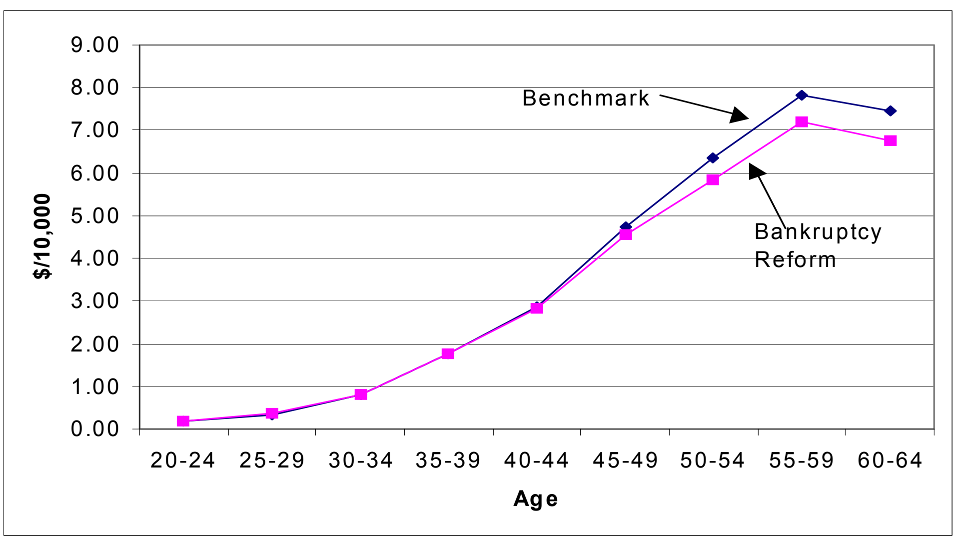

Figure 12: Predicted mean non-durable wealth, Reform H.R. 333 (2002) versus benchmark model

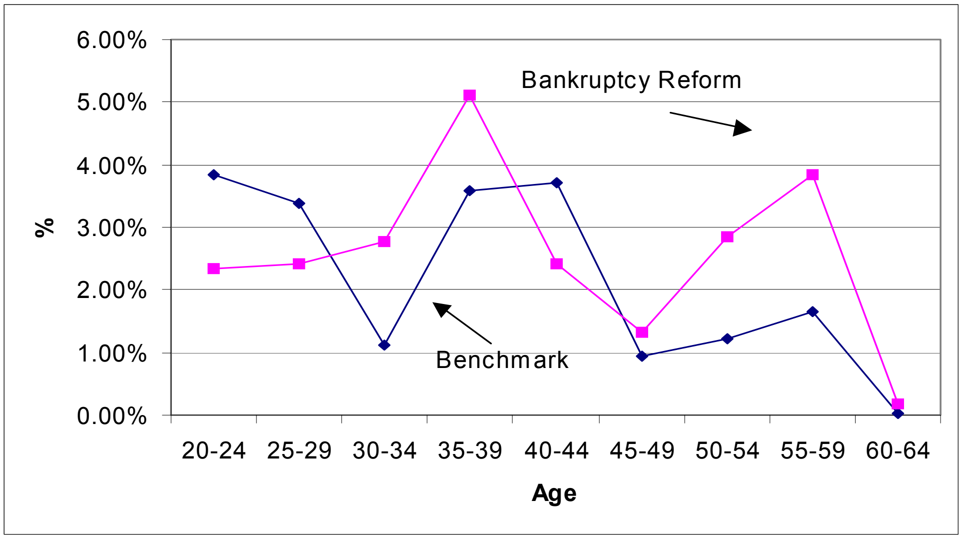

Figure 13: Predicted default rates, Reform H.R. 333 (2002) versus benchmark model

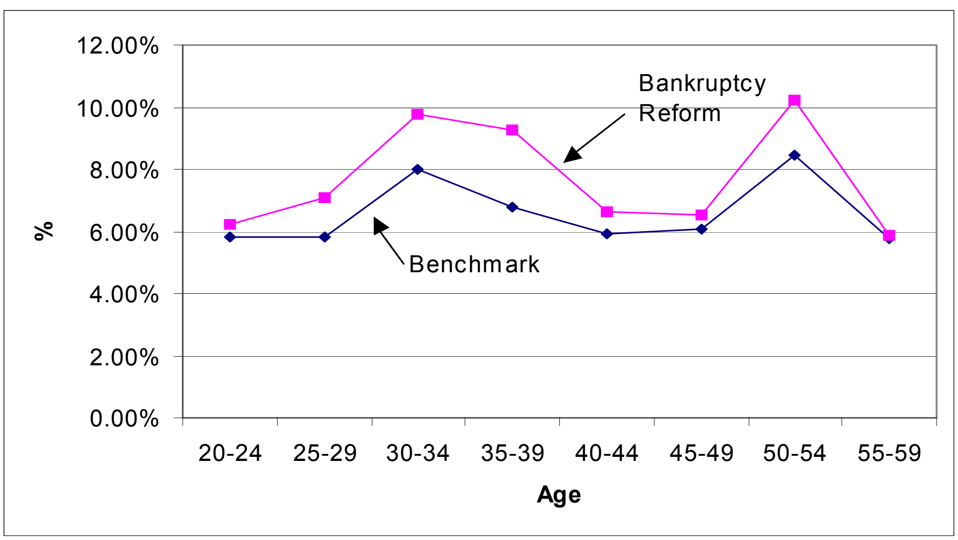

Figure 14: Predicted equilibrium interest rates, Reform H.R. 333 (2002) versus benchmark model

Age	Mean durable wealth ($/10,000, 1984 real value): Low Exemption		High Exemption		Mean financial wealth ($/10,000, 1984 real value): Low Exemption		High Exemption	
	Benchmark	Reform	Benchmark	Reform	Benchmark	Reform	Benchmark	Reform
20-24	1.09	1.01	1.35	1.27	0.17	0.19	0.20	0.21
25-29	1.67	1.40	2.13	2.10	0.32	0.36	0.41	0.41
30-34	2.32	1.92	2.54	2.22	0.78	0.85	0.88	0.64
35-39	3.13	2.60	3.26	2.97	1.83	1.85	1.58	1.52
40-44	4.52	3.67	4.15	3.93	2.94	2.91	2.72	2.68
45-49	6.19	5.31	6.00	5.59	4.92	4.65	4.33	4.29
50-54	6.27	5.57	6.72	6.51	6.78	6.18	5.42	5.10
55-59	5.94	5.45	6.56	5.88	8.37	7.56	6.55	6.42
60-64	6.48	5.89	6.20	5.85	7.92	7.02	6.41	6.22

Age	Equilibrium Borrowing Interest rates: Low Exemption		High Exemption		Default rates: Low Exemption		High Exemption	
	Benchmark	Policy	Benchmark	Policy	Benchmark	Reform	Benchmark	Reform
20-24	5.84%	6.22%	11.61%	19.84%	4.05%	2.52%	3.34%	2.01%
25-29	5.83%	7.09%	5.88%	9.74%	3.21%	2.50%	3.64%	2.23%
30-34	7.96%	10.05%	12.76%	8.99%	1.34%	3.67%	1.09%	0.59%
35-39	6.78%	9.37%	7.04%	6.47%	4.17%	2.95%	2.85%	10.03%
40-44	5.94%	6.60%	5.86%	9.93%	2.39%	3.18%	2.21%	0.62%
45-49	6.06%	6.49%	6.73%	13.44%	1.75%	1.63%	0.88%	0.57%
50-54	8.44%	10.06%	9.74%	11.33%	1.84%	4.00%	1.17%	0.25%
55-59	5.76%	5.82%	11.40%	8.41%	2.19%	2.26%	0.79%	7.44%
60-64	NaN	NaN	NaN	NaN	0.02%	0.06%	0.03%	0.43%
Average	6.69%	7.80%	8.02%	9.77%	2.05%	2.48%	1.44%	2.79%

Table 23: Predicted life-cycle profiles by exemption, Reform H.R. 333 vs. benchmark

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