Does Bankruptcy Protection Affect Risk-Taking in Household Portfolios?*

Mariela Dal Borgo†

May 27, 2016

Abstract

This paper examines empirically the relationship between personal bankruptcy provisions and stock market participation. Exploiting the time variation in home equity protection, I find that bankruptcy protection encourages stock ownership when protection is low. Such protection reduces exposure to uninsurable risks, which increases financial risk-taking under certain conditions. In contrast, at intermediate protection levels stock ownership declines. As bankruptcy becomes more lenient, unprotected assets become less attractive. The effects are restricted to wealthier households, facing relatively lower entry and participation costs. These findings contribute to the bankruptcy policy debate and to the literature on social programs and household finances.

Keywords: personal bankruptcy law, home equity protection, background risk, stock market participation
JEL: D14, G11, G12, K35

*I am grateful to my supervisors Christopher Woodruff and Sascha Becker for their constant guidance and support. For insightful discussions, I thank Frank Stafford, Francisco Palomino and Pablo Beker. I also thank Wiji Arulampalam, Orazio Attanasio, Dan Bernhardt, Clément de Chaisemartin, Jorge Luis García Ramírez, Francois Gourio, Hilary Hoynes, Peter Hudomiet, Miles Kimball, Dave Knapp, Gretchen Lay, Neale Mahoney, Alexander Michaelides, Stefan Nagel, Edie Ostapik, Roberto Pancrazzi, John A. E. Pottow, Matthew D. Shapiro, Mel Stephens, Kjetil Storesletten, Thijs van Rens, Fabian Waldinger and Jeffrey Wooldridge for helpful advice. For their hospitality, I thank the labor economics group at the University of Michigan and the MiCDA Data Enclave. I also thank seminar participants at the Michigan Labor Lunch seminar, CAGE Work in Progress Seminar, the 9th NHH-UiO Workshop on Economic Dynamics, the Royal Economic Society Annual Conference, the 2nd Young Finance Scholars' Conference at Sussex and the 30th Annual Congress of the European Economic Association for their comments. I am grateful to the Warwick Department of Economics, to the Warwick Transatlantic Fellowship and to Prof. Christopher Woodruff for providing financial support.

†*Email address:* m.dal-borgo@warwick.ac.uk

1 Introduction

A long-standing question in finance, important for asset pricing and investment theory, is what determines portfolio choice. Many U.S. households are exposed to risks resulting from labor and entrepreneurial income volatility, unemployment and out-of-pocket medical expenses. If these risks materialize, they can trigger household bankruptcy. Ex-ante they can affect households' decision to invest in risky financial assets, which not only depends on the volatility of the returns but also on other sources of risk. In that context, the U.S. personal bankruptcy system is one of the largest social programs in the country, providing debtors with insurance against the consequences of negative shocks. Given the limited participation in the stock market, there could be welfare gains if this insurance encourages the demand for equities. The bankruptcy law is more generous towards debtors in U.S. than in other countries.[1] In turn, U.S. households not only hold more non-collateralized debt, at least than their european counterparts, but they are also more likely to own stocks even after controlling for differences in characteristics (Christelis et al., 2015, 2013).

This paper is the first to examine empirically the ex-ante effects of Chapter 7 bankruptcy protection on households' stock market participation. The existing empirical literature has focused mostly on the effects of that protection on entrepreneurship and on the demand and supply of credit.[2] The scant evidence on household portfolio decisions includes Lehnert and Maki (2002) and Persad (2005), but they do not examine stock ownership. Even though the primary functions of the bankruptcy system are to act as a consumption insurance and to discourage over-borrowing, two features of its design imply that it could have unintended consequences on equity holdings.

On the one hand, as an implicit insurance with widespread coverage, the bankruptcy provisions substantially reduce households' exposure to background risk. Under certain conditions, investors demand less risky assets in the presence of non-diversifiable risk (Kimball, 1993). Thus, government-supplied consumption insurance can affect portfolio decisions by decreasing exposure to such background risk (Elmendorf and Kimball, 2000; Gormley et al., 2010). In particular, if background risk is uncorrelated or positively correlated with the portfolio risk, having more protection in case of default should increase the demand for risky assets. On the other hand, by providing such insurance in the form of asset protection, the bankruptcy law can affect investment decisions beyond its effect on risk-taking. When a household files for Chapter 7 bankruptcy, it can retain some assets up to a given exemption level, plus the human capital, and can discharge some debts. The home is typically the most important asset in household net worth and therefore receives the highest level of protection. Homestead exemptions determine the maximum amount of home equity that the household can retain after declaring bankruptcy.[3] In turn, all unprotected assets are surrendered

[1] This generosity remains even after the pro-creditor changes introduced in 2005 with the "Bankruptcy Abuse Prevention and Consumer Protection Act" (BAPCPA). In the light of its benefits, on average five in one thousand individuals have commenced a personal bankruptcy case between 1999 and 2011.

[2] White (2007a) surveys the theoretical and empirical literature on the economic effects of the corporate and personal bankruptcy law.

[3] Other protected assets are vehicles, retirement accounts (IRAs and Keoghs), and a small amount of bank deposits in some states.

to a trustee, who will sell them to pay debts. Thus, a decline in participation can result from the fact that unprotected assets, including stocks, become less attractive when homestead exemptions increase. Investing in stocks that are lost in bankruptcy reduces the amount of resources available to invest in protected assets.

To identify the effect of exemptions on stockholdings I exploit the fact that different states set different levels of exemptions at different times, making the U.S. bankruptcy law a unique lab to evaluate their effects empirically. In this way I deal with the possible correlation between the exemption level and state unobservable characteristics. Another merit of my empirical approach is that in the presence of several mechanisms with opposite effects, it allows the marginal effects to vary along the exemption distribution. More risk-taking is expected when the probability of bankruptcy and therefore the protection level are relatively low. At higher exemption levels, bankruptcy becomes more lenient and households are less willing to invest in stocks. While some previous studies account for nonlinearities (Berkowitz and White, 2004; Georgellis and Wall, 2006; Greenhalgh-Stanley and Rohlin, 2013), this is the first to do it using splines, less sensitive to anomalies within the data than polynomials.

I estimate the main effects separately for three subsamples of households, defined based on their position in the within-state home equity distribution. Only high-asset households obtain additional insurance from increases in protection since they are more likely to have seizable assets, that is, home equity above the state exemption level. In addition, they are the only that may be able to afford participation; a lower background risk may not be enough to compensate poorer households for the pecuniary and non-pecuniary costs of participation. Indeed, fixed costs of entry and participation can deter stockholdings as documented by Haliassos and Bertaut (1995); Vissing-Jorgensen (2002); Haliassos and Michaelides (2003); Gomes and Michaelides (2005) and Alan (2006), among others.

The main contribution of this study to the literature is to estimate a nonlinear effect of bankruptcy protection on stock market participation. Using data from the Panel Study of Income Dynamics (PSID) for the period 1999 to 2011, I find a significant relationship between exemptions and stockholdings among households with high levels of home equity. In that group, doubling exemptions increases participation by 2p.p. when exemptions are below $22,000, but when they are between $22,000 and $98,000 it reduces participation by 3p.p.. Given that on average 31% of high-asset households own stocks, these effects represent a 6% increase and a 10% decline in participation respectively. The findings at low protection levels are consistent with bankruptcy protection encouraging more risk-taking because it guarantees a minimum level of wealth if a negative shock occurs. As it becomes more lenient, the opposite effect prevails since there is a lower preference for assets that will be lost in bankruptcy. No effect is found at high exemption levels, i.e. above $98,000, when homes are likely to be fully protected.

I extend the analysis to provide additional insight on the underlying mechanisms. First, higher protection in case of a negative wealth shock should lead not only to more risk-taking but also to lower savings. Among high-asset households I find a decline in the ownership of safe liquid assets

(checking accounts, CD's savings, etc.) at low protection levels. Second, as bankruptcy becomes more lenient, savings in protected assets should increase. I do not find an impact on home equity, conditional on ownership, possibly because it is measured with noise. But there is a decrease in the ownership of mortgage debt, consistent with households saving in protected assets by paying down the mortgage. Even when unprotected, the holdings of safe liquid assets also increase. Thus, higher savings in home equity and in safe liquid assets are the counterpart of the decline in stockholdings. Third, bankruptcy leads to a stronger decline in participation among self-employed, more exposed to entrepreneurial income risk. In particular, this corresponds to the incorporated self-employed that own larger firms and are wealthier. In contrast, no stronger decline is observed among households in bad health, more exposed to risk of medical expenses but also poorer and therefore less able to respond at this margin. Finally, since I do not find any effect on non-mortgage debt, a proxy for unsecured debt, I rule out that debt holdings are mediating the effect of exemptions on the demand for stocks. This could occur, for example, if lenders increase the cost of borrowing and/or reduce the availability of credit as a result of the lower collateral value of assets - only those above the exemption level can be seized. Credit rationing can reduce participation if households "borrow to save". But also, being denied a loan may require drawing down liquid assets from the buffer of stocks for consumption purposes.[4]

Identification is based on the assumption that after controlling for individual and state characteristics and state linear trends, changes in the state exemption level only affect households living in the treated state. If households move states over time, relying on pure cross-section variation or state fixed-effects as in Gropp et al. (1997), Berger et al. (2011) and Greenhalgh-Stanley and Rohlin (2013) may result in biased estimates of the effects of exemptions. By using both individual and state fixed-effects, I compare the same household from a particular state before and after the change in the exemption law. In addition, I estimate a dynamic specification to rule out the possibility of pre-existing trends driving the results. The results pass the falsification test, since I confirm that future changes in exemptions do not have a contemporaneous effect on stock holdings. The second assumption is that the timing of exemption changes is orthogonal to the determinants of stock market participation. To account for the correlation between exemptions and state-level variables that could also affect portfolio decisions, I directly control for home prices and unemployment rates and use state-specific linear time trends. I also use quadratic time trends to capture any variation induced by the financial crisis in the longer term trends. Moreover, by exploring differential effects across home equity levels, I am dismissing the effects of local economic shocks affecting all households in the state increasing the exemption. Any aggregate shocks affecting households with different asset levels should be captured by the year dummies.[5]

[4]Although not tested here, a higher cost of borrowing can also have a negative effect on participation. Conditional on holding debt, higher interest rates reduce the perceived expected excess return to investing in the risky asset because households earn less on each dollar invested in stocks (Becker and Shabani, 2010). In any case, an increse in interest rates should be observed among poorer, not richer households, the ones more likely to default ex-ante (Gropp et al., 1997; von Lilienfeld-Toal and Mookherjee, 2016).

[5]Some of the tests for the validity of the identification assumptions have already been used in the empirical

This paper broadly relates to the literature looking at the effects of insurance provision on household risk-taking. It is well known in the theoretical literature that risk-taking is higher in the presence of a guaranteed minimum wealth or limited liability, because it gives investors the equivalent of a put free option (Gollier et al., 1997).[6] Recent studies in the empirical literature pioneered by Rosen and Wu (2004) show that the availability of health insurance offset background risk, affecting risky asset holdings (Atella et al., 2012; Goldman and Maestas, 2013; Christelis et al., 2014). In particular, my findings for high-asset households are in line with Christelis et al. (2014), who show that Medicare availability increases stock ownership only among the most educated households, facing relatively lower costs of participation. But despite that the bankruptcy law acts as an implicit health insurance (Mahoney, 2015), I do not observe a stronger effect on stock market participation among sick households. The bankruptcy insurance provides coverage to every household exposed to background risk, not only those in bad health, who in turn are less likely to trade in stocks. An advantage of examining the effects of this informal insurance over the effects of formal health care is the absence of endogeneity of insurance choices. The most novel feature is that the effect of bankruptcy, unlike formal insurance, is not unambiguosly positive due to its distinctive design.

The present study also adds directly to the empirical literature on the effects of bankruptcy protection. My main methodological improvements are the use of splines rather than polynomials to account for non-linear marginal effects and the use of within-household variation rather than purely within-state or cross-sectional variation. This literature, which has focused mostly on entrepreneurship, distinguishes between the positive effect of bankruptcy protection as an insurance for borrowers from its negative effect through credit conditions. Some studies find a positive effect of bankruptcy protection on self-employment (Fan and White, 2003; Armour and Cumming, 2008). In turn, Berkowitz and White (2004); Berger et al. (2011); Fossen (2014); Cerqueiro and Penas (2016) and Mankart and Rodano (2015) find a differential impact of the law on entrepreneurship depending on entrepreneurs' asset level and firm size. This is consistent with my finding that the effects vary across households with different asset levels.

The closest study to this is Persad (2005), who uses difference-in-differences to look at the effect of exemption changes on the portfolio share of safe liquid assets.[7] He also provides estimates by home equity level, but obtains mixed results using data from the Consumer Expenditure Survey. I pool several states in a single regression via fixed-effects, which gives more precise and robust estimates. In addition, I focus on the participation decision, given the high measurement error from survey recall data at the intensive margin (Fagereng et al., 2016). Another study looking at effects on household portfolios is Lehnert and Maki (2002), who explore to which extent bankruptcy provisions affect the decision to simultaneously hold high-interest debt and low-return assets. This is also part

literature on bankruptcy, including Severino et al. (2014) and Cerqueiro and Penas (2016).

[6] Gollier et al. (1997) show that "betting for resurrection" may arise when there is a critical level of initial wealth, close enough to bankruptcy, under which risk-averse investors with limited liability choose maximal risk exposure.

[7] He considers the increase in exemptions in California (1990), Colorado (1991), the federal exemption (1994) and the 1993 decline in the Minnesota exemption.

of the branch of the literature that studies the effect of bankruptcy provisions on household asset and debt accumulation. In their seminal work, Gropp et al. (1997) find that an increase in exemptions impose higher credit constraints on low-asset households. Similarly, Lin and White (2001) find that higher exemptions increase the probability of borrowers being denied mortgage loans. In contrast, Severino et al. (2014) suggest that the insurance effect prevails leading to an increase in the holdings of credit card debt, especially in low-income regions. On the asset side, Pavan (2008) predicts a negative effect on the accumulation of durable wealth (home equity and vehicles) in the context of a life-cycle model. But the empirical evidence in Repetto (1998), Corradin et al. (2013) and Greenhalgh-Stanley and Rohlin (2013) shows a positive correlation between bankruptcy protection and home equity, stronger among high-asset households that are less credit constrained. The mixed results on the asset side may reflect methodological differences and the fact that the home equity measure is arguably noisy. I find effects of exemptions on the ownership of mortgage debt, but not on other debt nor on home equity. Severino et al. (2014) do not find significant effects either on holdings of unsecure debt when the sample is extended up to 2009.

The rest of the paper is organized as follows. In Section 2, I discuss the institutional details of the U.S. bankruptcy system. The data set and the description of the sample are presented in Section 3. Section 4 contains the main empirical predictions and the empirical strategy, followed by the description of the results in Section 5. The discussion of the magnitude and scope of the effect and of the most plausible mechanisms is summarized in Section 6. In Section 7, I offer some concluding remarks. Further information about the definition of the variables, the choice of the functional form for the regressions and the theoretical background is provided in the Appendix.

2 U.S. Personal Bankruptcy Law

2.1 Main functions

There are two main underlying functions of the bankruptcy law. One is to act as a consumption insurance. Individuals smooth consumption over the life-cycle by taking loans. However, there is uncertainty over future income and future expenses, and if income turns out to be low or expenses high, individuals would have to reduce their consumption dramatically or will not be able to meet their financial obligations. The bankruptcy insurance allows discharging unsecured debt in exchange for assets above the exemption level (Chapter 7) or for payments out of disposable income (Chapter 13). Since the possibility of default is higher in presence of this consumption insurance, lenders charge a "premium" in the form of higher interest rates. However, the bankruptcy insurance should not be so high that induces moral hazard from debtors and leads to inefficiencies resulting from excessive borrowing costs.

The other main function of the bankruptcy law, in conflict with the previous one, is to discourage households from borrowing without considering if they are or will remain solvent. Debtors'

moral hazard can lead to default, followed by credit rationing and higher interest rates, which is detrimental for future borrowers. However, the consequences of going bankrupt cannot be so severe that they induce moral hazard from the lenders. A high cost of default makes more attractive to lend to risky borrowers and to charge high interest rates. The costs imposed by the US bankruptcy law include future exclusion from credit markets, bankrupts' names are made public, bankruptcy filings appear on credit records for 10 years, and defaulters are not allowed to file again for several years.

These costs could imply that households do not widely see bankruptcy as an insurance. However, the frequency of the bankruptcy episodes, even after the 2005 reform, suggests that debtors do not refrain from ultimately relying on this mechanism.

2.2 Chapter 7 versus Chapter 13

When a household files for bankruptcy, it can discharge most unsecured debt, including credit card debt, installment loans and medical bills. Debts that are not dischargeable include tax obligations, student loans, alimony, child support obligations, debts incurred by fraud, credit card debt incurred just before filing, and some secured debt such as mortgages and car loans.[8] There are two repayment options: Chapter 7 and Chapter 13. Under Chapter 7 creditors can seize assets above exemption levels according to state laws. Under Chapter 13 households pay out of post-bankruptcy income over the following three to five years.

The effect of Chapter 7 asset exemptions is to provide extra insurance to households by emerging from bankruptcy with positive net worth. These exemptions appeared in U.S. towards the end of the 18th century, when some states in the South wanted to protect landowners from their creditors in the North, and spread over the following century in part as an incentive to attract migrants. Asset categories that have some level of protection under Chapter 7 are equity in owner-occupied homes, vehicles, retirement assets (IRA and Keogh accounts), and bank deposits. In addition, there are "wildcard exemptions" that can be used for assets in excess of the exemption in other asset categories. The asset exemptions vary by state and by the marital status of the individual, and in occasions also by age (65 or over) and disability status. Some states give the option to file using the level of exemptions set by the federal law.

Before 2005, Chapter 13 filers were able to propose their own repayment plans and typically proposed to repay an amount equal to the value of their non-exempt assets: They were not allowed to repay less and since they had the option to choose Chapter 7, they had no incentives to repay more (White, 2007b). This means that even for those who decided to file under Chapter 13, Chapter 7

[8]Even after filing for Chapter 7 the borrower has to continue making mortgage payments, otherwise the lender can foreclose the house. But Chapter 7 eliminates the personal liability for mortgage loans. This means that the borrower cannot be liable for a deficiency judgment, which occurs when the house is sold through foreclosure but the sale proceeds are lower than the mortgage balance. In that case, Chapter 7 prevents the lender to go after the borrower's personal assets to collect the mortgage deficiency.

exemptions would still affect the repayment amount and therefore the probability of bankruptcy.

Table 1 shows the average exemption level for couples by year. The average protection to home equity was $75,600 over the period 1999-2011, increasing from $57,200 in 1999 to over $100,000 in 2011. In Figure 1, Panels A and B show a large cross-state variation both at the beginning and at the end of the sample period. In 1999 homestead exemptions went from zero in Delaware and Maryland to unlimited in seven states (Arkansas, Florida, Iowa, Kansas, Oklahoma, South Dakota and Texas). The within-state time variation is better captured in Figure 2. The exemptions from some states (Alabama, Connecticut, Kentucky, Virginia, Vermont, Mississippi, Wyoming, Michigan and Alaska) exhibit little or no variation in nominal values during the 12-year period, and therefore experience a decline in real values. The federal exemption has only increased to compensate for the inflation, as can be seen for Hawaii, New Jersey and Pennsylvania. The larger increases in real terms were in Delaware, South Carolina, Rhode Island, New York and Maryland, whereas DC was the only state that changed to unlimited (from the federal exemption level).

Before 2005 debtors could choose under which Chapter they wanted to file and the most common choice was Chapter 7. Under that Chapter, debtors have to surrender all their non-exempt assets but can retain their future income. Under Chapter 13 borrowers are forced to repay from post-bankruptcy income, a less attractive alternative. Chapter 7 implied that even if defaulters had a very high income, it was not committed to future repayments. This system encouraged strategic behavior and became beneficial for individuals with high income and wealth.

2.3 The 2005 bankruptcy reform

In 2005 there was a reform in the bankruptcy law, known as the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA), to reduce the distortions which had lead to historically high levels of bankruptcy. The reform included the removal of the debtor's right of choosing between Chapters 7 and 13, aimed at preventing high-income debtors to file for bankruptcy under Chapter 7. In order to qualify for Chapter 7, debtors' family income in the six months before filing must be smaller than the median income in their state. Sometimes debtors are allowed to file under Chapter 7, even if they do not pass the "means test", as long as their monthly disposable income is below a certain threshold.[9] In addition, the means test does not apply for people whose debts come primarily from the operation of a business (self-employed).

Other changes implemented by the BAPCPA included the increase in the costs of filing. Average total filing costs increased from $900 to $1,500 under Chapter 7 and from $3,700 to $5,700 under Chapter 13 (United States Government Accountability Office, 2008). In addition, the minimum time that debtors must wait before filing again also increased from six to eight years for Chapter 7, from six months to two years for Chapter 13, and from no minimum to four years for

[9] "Disposable income" is defined as the difference between debtors' average monthly family income during the six months prior to filing and a new income exemption. The income exemption determines for each debtor an allowance for living expenses.

a Chapter 7 followed by a Chapter 13 filing. Finally, debtors could no longer propose their own repayment plans under Chapter 13 and have to use all their disposable income to make repayments over the next 5 years after filing.

The BAPCPA imposed three measures that restricted the speculative behavior under Chapter 7. First, for debtors moving between states before filing the exemptions that apply are those of the state with the lower levels within the last two years. Second, the homestead exemption cannot exceed $125,000 if the house was purchased within the $2^1/_2$ years prior to filing. Third, the fraction of the home equity accumulated by paying down mortgage within the 3 years and 4 months before filing is not protected. In addition to these restrictions, the only modification to Chapter 7 exemptions was a new exemption for tax-protected individual retirement accounts (up to $2 million for couples and half of that amount for singles).

The reform reduced the number of Chapter 7 filings from a peak of around 1.3 million per year in 2005 to near 800 thousand a year later. In subsequent years, they increased again and reached a level of over 1 million by 2011. Hence, despite the BAPCPA, the filings under Chapter 7 are still important: They represented around 75% of total bankruptcy filings in 2005 and 2006, dropped to 60% in 2007 and raised again to 71% by 2011.[10] The bankruptcy law became more pro-creditor, but it still allows debtors to gain financially by filing for bankruptcy (White, 2007b). High-income debtors can plan strategically and file under Chapter 7. In consequence, the reform did not reduce filings under that Chapter from high-income borrowers more than it did from other borrowers either because they could pass the means test or because they are self-employed (White, 2008).

3 Data and sample definition

The source of household data is the Panel Study of Income Dynamics (PSID), which provides the best panel data for this analysis. It has detailed information on portfolio composition, publicly available state identifiers and household socio-demographic characteristics tracked over an extended period of time. Asset holdings are contained in the wealth survey, conducted in 1984, 1989, 1994, and every other year from 1999 onwards. The measure of risky assets includes stocks invested in publicly held corporations, mutual funds or investment trusts. Thus, I restrict the sample to the period 1999-2011, since before 1999 the PSID definition of stocks includes those invested into retirement accounts. I exclude the fraction of individual retirement accounts (IRAs) invested in stocks because after 2005 IRA accounts are protected from bankruptcy up to $2 million.[11] In addition, stocks held outside retirement accounts are subject neither to penalties from early withdrawal nor to deposit limits.

[10] U.S. Bankruptcy Courts Judicial Facts and Figures. Retrieved 24 December 2015 at http://www.uscourts.gov/statistics-reports/analysis-reports/judicial-facts-and-figures.

[11] The effect of IRA's exemptions on stocks invested into those accounts cannot be identified to the extent that there is no cross-state variation and little time variation in the corresponding exemption levels.

I estimate heterogeneous effects for entrepreneurs and for households in bad health. I define entrepreneurship based on the self-employment status of the household head, restricting to heads that report being "self-employed only". The measure of health status is a binary indicator, taking value one if the individual reports fair or poor health and zero if reports excellent, very good or good health.

I also estimate models for safe liquid assets, which include money in checking or savings accounts, money market funds, certificates of deposit, government savings bonds or treasury bills, bond funds and other assets, excluding those in employer-based pensions or IRAs. Other outcomes considered are home ownership, the value of home equity and ownership of non-mortgage debt. The latter includes all debts except for mortgages and vehicle loans; namely, credit card balances, student loans, medical or legal debts, or loans from relatives. Thus, this measure may slightly overestimate the level of unsecured debt since it includes categories that are not dischargeable, such as student loans.

The level of exemptions from each state and year was extracted from bankruptcy filing manual books.[12] In my baseline analysis, I only include homestead plus wildcard exemptions. Other categories added for robustness checks are vehicles, business wealth and other real estate. For states with unlimited homestead exemptions, I set the corresponding value to \$550,000 for singles and \$1,000,000 for couples, which are the maximum exemptions across all states in 2011. The state level variables used as controls are taken from the Bureau of Labor Statistics (unemployment rate), the Bureau of Economic Analysis (proprietor employment, per capita personal income, real GDP), Freddie Mac (the house price index), CMS[13] (per capita medical expenses) and the Statistics Division of the Administrative Office of the U.S. Courts (non-business bankruptcy filings). I deflate all nominal values by the US NIPA implicit price deflator for personal consumption expenditures ($2004\,q1 = 100$).

I restrict the sample to households where the head is 65 years old or younger in every year, which reduces the original sample to 49,218 observations. The life-cycle model and the empirical evidence indicate that households hold more conservative portfolios as they age, and therefore, older households may be less willing to increase their stockholdings in response to the changes in bankruptcy protection. In addition, they are relatively less likely to file for bankruptcy, although the most recent years have been characterized by an upsurge in filings among older households (Pottow, 2012). I also exclude 2,636 observations where some of the variables are missing (self-employment, unemployment and retirement status, years of education and state of residence), 1,333 observations where some wealth components are missing (home equity, mortgage, other debt and business equity) and 44 observations with negative income. This results in 44,905 observations corresponding to 50 states plus Washington, D.C.

[12] "How to File for Chapter 7 Bankruptcy", Albin Renauer J.D., Stephen Elias Attorney, and Robert Leonard J.D., Nolo, several editions.

[13] Centers for Medicare & Medicaid Services (2011). Health Expenditures by State of Provider. Retrieved 26 June 2014 at http://www.cms.gov/NationalHealthExpendData/downloads/provider-state2009.zip.

Table 2 reports descriptive statistics on households' stockholdings and their determinants.[14] Only one-fifth of households own stocks at all, whereas ownership of safe liquid assets is much more widespread (81% on average). Stock market entry and exit relative to the previous wave are also low; on average only 6% of households enter the market and 9% leave. The average amount invested in home equity is $65,500, just below the $75,600 average homestead exemption, whereas the ownership rate is 60%. For retirement accounts, with much higher protection, the average holdings amount to $25,100 and only 31% of the households own such assets. When looking at liabilities, 47% of households have a mortgage and 57% have other debt. The average outstanding mortgage is $53,300 and the non-mortgage debt shrinks to $8,200. Lower values at the median than at the mean reflect the fact that the assets and debts' distributions are positively skewed. Only 12% of the heads in the sample are self-employed and most of them own unincorporated firms (65%).

When the sample is restricted to stockholders, the average share of stocks in liquid wealth amounts to 57%. Stock market participants are 5p.p. more likely to be self-employed than the entire sample and conditional on being self-employed, the probability of being incorporated increases from 35% to 48%. This reflects the correlation between stockholdings and wealth, given that incorporated self-employed typically own larger firms. In contrast, among stock market participants, only 6% of households are in bad health. In the last rows I include the summary statistics for the state-level variables that might be correlated with the exemptions. The number of personal bankruptcy fillings amounts on average to 5 in one thousand inhabitants per year, revealing that these episodes are not extremely infrequent in the US. Data on medical expenses is available only until 2009, which explains the drop in the corresponding sample size.

4 Empirical Analysis

4.1 Empirical predictions

In this section I first describe the main channels through which the bankruptcy protection can affect stock market participation. The main two mechanisms occur via the demand-side of the stock market and are formalized in the theoretical framework in Appendix C.[15]

- **Risk channel:** Bankruptcy protection affects the demand for risky assets by providing insurance against other risks that can trigger bankruptcy. Examples of such uninsurable risks, typically referred as "background risk", are the risk on human capital, in the form of shocks on

[14] See Table A.1 in the Appendix for definitions of all the variables. Note that the totals do not add up to the final sample size because I use the PSID weights in Table 2.

[15] The model predictions show, on the one hand, the positive effect on participation of introducing a bankruptcy protection and, on the other hand, the negative effects of subsequent increases in the level of such protection. Thus, the model captures the effects of changes in the bankruptcy protection at the intensive and extensive margin. With my empirical strategy, I can only examine the effects of changes at the intensive margin, since all states during the period considered have some level of bankruptcy protection. However, the effects at low protection levels can be seen as analogous to the effects of changes at the extensive margin.

labor income, and the risk of out-of-pocket medical expenses. In particular, if stock returns are *not correlated* with the non-financial risk, so that the latter is defined as pure background risk, bankruptcy insurance should lead to higher investment in risky assets. Background risk reduces risk-taking under certain assumptions (Pratt and Zeckhauser, 1987; Kimball, 1993; Gollier and Pratt, 1996) and lowers investment in risky assets (Elmendorf and Kimball, 2000; Guiso et al., 1996). The intuition is that the variance of non-financial income generates a crowding-out effect on stockholdings. In that context, the bankruptcy system acts as an insurance against income risk, reducing the gap in consumption between the states with high and low income. This reduction in downside risk increases the willingness to take more risks in the financial portfolio.

- **Protection channel:** An increase in home equity protection makes bankruptcy more lenient and this leads to a lower demand for unprotected assets, and for stocks in particular. By increasing the probability of bankruptcy, higher exemptions reduce the marginal benefit of holding assets that are lost in bankruptcy. Stocks held outside retirement accounts are not protected, so they become less attractive. By increasing consumption in bankruptcy up to the level of protected assets, higher exemptions increase the marginal cost of investing in stocks. Higher investment in unprotected assets crowds-out savings in protected assets.

The theoretical prediction of an increase in exemptions, leading to opposite effects from different channels, depends on the exemption level. Next I state the main predictions that will guide the empirical tests.

- H1. If the risk of the portfolio is uncorrelated with background risk, at low exemption levels there should be an increase in stock market participation resulting from higher exemptions.

- H2. If the probability of bankruptcy is nonzero, at intermediate exemption levels there should be a decrease in stock market participation resulting from higher exemptions.

- H3. At very high exemption levels, increases in exemptions should not affect stock market participation.

H1 states the implication from the risk channel that the household finds optimal to participate in the stock market when there is a consumption floor in case of a negative wealth shock (see Proposition 2.i in Appendix C). *H2* reflects the consequences of higher protection in terms of increasing both the probability of bankruptcy and the level of consumption in bankruptcy (see Propositions 2.ii to 2.iv). This leads to a decline in participation if the probability of a negative wealth shock is positive. *H3* captures the fact that no effects are expected among households for which higher exemptions affect neither the probability of bankruptcy nor the level of consumption in bankruptcy. This means that no response may be observed if exemptions are sufficiently high relative to the home equity level.

Stronger positive and negative effects on participation are expected among home owners, since they are the only able to exploit the implicit insurance from bankruptcy. Increases in exemptions should not affect renters' stockholdings. In addition, the risk and protection channels should only have an effect on high-asset households. Wealthy households, facing relatively lower costs of entry

and participation, are able to increase stockholdings when exposure to pure background risk declines. The poorer may not be able to afford the brokerage fees and the non-pecuniary (information and opportunity) costs. And only high-asset households that participate in the stock market will have incentives to liquidate stocks when the bankruptcy insurance becomes more generous.

Heterogeneous effects are expected among entrepreneurs and households in bad health, with a higher exposure to background risk. The risk channel implies that the optimal level of stockholdings is increasing in the probability of a negative wealth shock. If the shock occurs, stocks help to avoid bankruptcy in presence of high returns, providing a large marginal benefit. The protection channel implies that exemptions should lead to a stronger decline in participation among households facing a higher probability of a negative wealth shock and, therefore, of bankruptcy. Self-employed have more volatile income, positively correlated with stock returns (Heaton and Lucas, 2000), and typically face a higher probability of filing under Chapter 7. Moreover, they receive an especial Chapter 7 treatment after the 2005 reform because they are not required to pass the means test.[16] In turn, households in bad health are exposed to higher risk of out-of-pocket medical expenses to the point that bankruptcy acts as an implicit health insurance (Mahoney, 2015).

The risk and protection channels also have implications for savings.[17] As in Gormley et al. (2010), the risk channel leads to a decline in savings, which are less necessary in the presence of wealth insurance. In turn, the protection channel can lead to an increase in savings resulting from the lower investment in stocks and, generally, lower consumption.[18] However, this holds only for protected assets, whereas savings in unprotected assets are expected to decline, mirroring the fall in stock holdings.

4.2 Empirical strategy

My empirical analysis focuses on the extensive margin effect of bankruptcy protection on household stockholding decisions. There are some drawbacks of identifying that effect using purely cross-state variation. State-level heterogeneity may confound the results if the asset exemption levels are correlated with state unobservable characteristics. Thus, I exploit both state and time variation in the dollar amount of asset exemptions. This is possible since different states have changed the levels of exemptions by different amounts at different times. I cannot identify the effect of unlimited exemptions with this approach because only one state (D.C.) ever changed from a finite exemption

[16] Only unincorporated firms can use personal bankruptcy to discharge debts. In practice, lenders may not distinguish the legal form when approving a loan for a small firm. The owners of corporations can easily transfer funds from the firm to themselves (Berkowitz and White, 2004). Thus, even if incorporated self-employed are not personally responsible for the debts of the firm, banks may still ask them to personally guarantee the loans.

[17] The model in Appendix C does not explicitly incorporate savings in unprotected, safe liquid assets. This distinction is more important for the protection than for the risk channel.

[18] Proposition 2.ii predicts that consumption may increase with exemptions when they increase the probability of filing for bankruptcy and savings are not fully protected. Otherwise, when savings become fully protected after the increase in exemptions, consumption declines.

to unlimited.

A second empirical challenge is to deal with the potentially non-linear effects of changes in the bankruptcy protection. On the one hand, the multiple channels through which bankruptcy can affect portfolio decisions imply different marginal effects prevailing along the exemption distribution. On the other hand, the actual protection can increase only for households that have home equity in excess of the exemption level. When the exemption is too high for a given level of home equity, increases in exemptions do not provide additional insurance. Loken et al. (2012) show that linear fixed-effect (FE) estimates may be misleading in the presence of nonlinearities, since the FE estimator depends on how the marginal effects are weighted. These weights consist on two components: the proportion of households with a change in the exemption of size "Z" and the proportion of households at each exemption level given that they experience a within-state exemption change of size "Z". Thus, marginal effects corresponding to states that experience little within-state variation receive a lower weight in the linear FE estimand, and these weights can even become negative. When the underlying relationship is nonlinear, the linear FE estimator can yield a negative or zero estimate even if all the marginal effects are strictly positive, or vice versa. In this case, the FE estimator will not be representative of any particular marginal effect.

To capture nonlinearities requires using some flexible functional form that does not impose the same sign to the relationship of interest for all exemption levels. Hence, I use restricted cubic splines, which represent the curve by a different cubic function on each interval between data points (knots).[19] In Appendix B I justify the choice for the placement and number of knots.

I do not look at the effects on the risky portfolio share because survey data generally suffers from high measurement and reporting errors in the dollar amount held in stocks (Fagereng et al., 2016). Moreover, it is arguably hard to infer risk-taking from the risky portfolio share because households holding the same share of stocks may have different risk exposures depending on their stock-picking strategy (Goldman and Maestas, 2013).[20] In addition, at the intensive margin, passive variations in the value of stocks may conceal active rebalancing decisions made by households (Calvet et al., 2009). Even when the PSID asks about active savings in stocks, defined as changes in the risky share not resulting from passive realized returns but from portfolio rebalancing decisions, they are also measured with error (Chen and Stafford, 2016).

The four-knot restricted cubic spline for household i, living in state s, at time t is estimated using the following panel specification:

$$Y^*_{ist} = \beta_0 + \beta_t + \beta_s + \beta_s \times t + \beta_i + \beta_1 X_{1,st} + \beta_2 X_{2,st} + \beta_3 X_{3,st} + \beta_4 Q_{ist} + \beta_5 R_{st} + \varepsilon_{ist} \qquad (1)$$

[19] Cubic is the most commonly used degree for splines since the resulting fitting curve is continuous both in the first and second derivatives, even at the interpolating nodes. Although its popularity in the economics literature is still limited, the use of a spline approach for regression discontinuity designs and regression kink designs, which typically rely on local linear or quadratic regressions, has been advocated by Rau (2011), Ganong and Jager (2014) and Gelman and Zelizer (2015). In that context, Gelman and Imbens (2014) argue that high-order polynomial regressions (cubic or higher) can be misleading for reasons that may apply to this study as well.

[20] For example, funds invested in more mature companies that provide a steady stream of income are seen as less risky than funds invested in high-risk young companies looking for fast growth.

where the dependent variable, Y_{ist}, is an indicator for holding positive amounts of risky assets, i.e. we observe $Y_{ist} = 1$ if $Y^*_{ist} > 0$. The coefficients are estimated using OLS and Logit models.[21]

The parameters specific to the restricted cubic spline are:

$$X_{1,st} = X_{st}$$

$$X_{2,st} = \frac{(X_{st} - k_1)^3 - (k_4 - k_3)^{-1}\left\{(X_{st} - k_3)^3 (k_4 - k_1) - (X_{st} - k_4)^3 (k_3 - k_1)\right\}}{(k_4 - k_1)^2}$$

$$X_{3,st} = \frac{(X_{st} - k_2)^3 - (k_4 - k_3)^{-1}\left\{(X_{st} - k_3)^3 (k_4 - k_2) - (X_{st} - k_4)^3 (k_3 - k_2)\right\}}{(k_4 - k_1)^2}$$

where:

$$(X_{st} - k_i) = \begin{cases} X_{st} - k_i & \text{if } X_{st} - k_i > 0 \\ 0 & \text{if } X_{st} - k_i \leq 0 \end{cases} \qquad i = 1, 2, 3, 4$$

and k_1, k_2, k_3, k_4 denote the knot values, X_{st} is the log of homestead plus wildcard exemptions and $X_{1,st}$, $X_{2,st}$, and $X_{3,st}$ are the variables created to estimate the cubic spline. Note that restricted cubic splines use a linear function before the first knot and after the last knot to guarantee that the curve does not behave poorly in the tails. The specification in (1) allows conducting a test of linearity in X_{st} by testing the null hypothesis that the coefficients of the nonlinear terms are zero, i.e.: $H_0 = \beta_2 = \beta_3 = 0$.

In equation (1) I include a constant, β_0, which measures aggregate financial parameters (such as the risky asset premium) and a time dummy, β_t, capturing changes in such parameters that affect the entire cross-section of individuals in any given year. The inclusion of the time dummy responds to a common identifying assumption in this literature, namely, that there are age and time effects in portfolio choice but no cohort effects. β_s is a state dummy that controls for all state-specific factors - whether observable or unobservable - that are constant over time and can affect outcomes. I also account for differential state-specific linear trends in all variables that capture unobserved state characteristics changing over time, $\beta_s \times t$. Note that it is possible that the 2007-08 financial crisis has a large influence in the state-specific trends. The crisis had different effects across states and occurred in the last years of the sample.[22] Thus, it is necessary to separate the longer term trends in stock investment, captured by $\beta_s \times t$, from the effects of the business cycle. Following Neumark et al. (2014), I also estimate my main results controlling for state-specific quadratic time trends to capture the variations induced by the crisis. I also include individual-level fixed-effects, β_i,

[21] In the specifications with individual fixed-effects I only estimate OLS models, given the computational problems to cluster the standard errors and to estimate the marginal effects for the Logit model. In the specifications without individual fixed-effects, I confirm that the OLS and Logit marginal effects are very similar.

[22] The sharp increase in housing prices that started in the mid-90s has been stronger in California, Arizona, Nevada and Florida. These states also were among the most affected by the house price collapse in 2007.

that account for time-invariant factors affecting participation, such as the degree of risk aversion, and ε_{it} is an idiosyncratic error.

I follow the recent literature in the choice of the control variables, by including regressors with a demonstrated effect on participation (see Table A.1 in the Appendix for definitions). In equation (1), Q_{ist} denotes the set of socio-economic and demographic controls. It includes: i) labor income to rule out that the results are driven by income shocks, ii) dummies for the head's race and ethnicity and for whether the head is married, unemployed and looking for work or retired, and iii) measures for the head's age, years of education, and for the number of children and adults in the household. The time-invariant controls are only preserved in the specifications without individual fixed-effects. To reflect economic conditions, I control for state-level variables in R_{st}, namely, house price levels and unemployment rates.

Since exemptions vary at the state level but the dependent variable is observed at the individual level, the effect of changes in exemptions is likely to be correlated within a state. Thus, I cluster the standard errors at the state level. This allows for correlation of the error term in equation (1) for households from a given state at a particular point in time, since the error may include a state-year shock in addition to the idiosyncratic individual component. Also, it allows for any time series correlation of these state-year shocks.

As with most nonlinear models, the interpretation of the individual coefficients of restricted cubic splines is not straightforward. Thus, I also estimate piecewise linear regressions that provide a good balance between flexibility of the functional form and interpretation of the coefficients. By relying on a linear function, the resulting curve has first-order discontinuities ("elbows") and provides a poorer fit than the cubic splines, but allows to recover point estimates of the relationship of interest.

The piecewise linear regression with two knots is estimated based on the following latent model:

$$Y^*_{ist} = \beta_0 + \beta_t + \beta_s + \beta_s \times t + \beta_i + \beta_1 X_{1,st} + \beta_2 X_{2,st} + \beta_3 X_{3,st} + \beta_4 Q_{ist} + \beta_5 R_{st} + \varepsilon_{ist} \qquad (2)$$

where:

$$X_{1,st} = \min\left(X_{st}, 10\right)$$
$$X_{2,st} = \max\left\{\min\left(X_{st}, 11.5\right), 10\right\} - 10$$
$$X_{3,st} = \max\left\{\min\left(X_{st}, 13.3\right), 11.5\right\} - 11.5$$

X_{st} is the log exemption level, 13.3 is the maximum value taken by X_{st} in the dataset and 10 and 11.5 are the two knots (see Appendix B for the choice of the number and placement of the knots). β_1 represents the slope of log exemptions when they are below 10, β_2 is the slope of log exemptions when $X_{st} \geq 10$ and $X_{st} < 11.5$, and β_3 is the slope when $X_{st} \geq 11.5$.

Following Severino et al. (2014), the empirical strategy used in models (1) and (2) relies on two identifying assumptions. First, after controlling for observed individual and state characteristics, state linear trends and unobserved state characteristics, exogenous changes in the exemption level will only affect households living in the state where the change took place. Second, the timing of

the changes in exemptions is orthogonal to the determinants of the demand for risky assets. If this assumption is valid, the change in exemptions should be an exogenous shock to households' demand for risky assets.

The first assumption can be assessed by ruling out that identification is driven by people moving across states. A household may chose to move to a state that has just increased exemptions. If this household was already participating in the stock market, we will observe an increase in stock holdings in the receiving state. Around 5-7% of the households in the sample moved states across waves, and these moves may lead to biases in the estimated effects of exemptions. By controlling for household fixed-effects I ensure that I am comparing the same individual over time within the same state, since each individual serves as its own control group. In addition, I re-estimate my results using the state where the individual was living at the time of the first interview for the whole period. If the results are robust to this specification, then there is more evidence that self-selection bias is not a big concern.

Accounting for household fixed-effects in addition to the set of controls described above, the first assumption implies that the differences in stockholdings across states are purely determined by exogenous changes in the exemption level. This can be tested by ruling out the presence of other factors that could drive the results, such as state-level pre-existing trends that are captured neither by the state-specific time trends nor by the state-level observable characteristics. Thus, I look at dynamic effects by including a lead of the exemption level. This can be interpreted as a placebo test: If the coefficient associated with the lead is not significant, I can rule out that pre-existing trends or anticipatory effects are biasing the results. In addition, I include one lag of the exemption level to explore the presence of short-term effects. These could arise if the response to the changes occurs with some delay or if it is persistent over time.

The second assumption can be tested by exploring the correlation between the state exemption level and possible determinants of exemption changes that also affect portfolio decisions. According to Cerqueiro and Penas (2016), the level of protection was typically changed to keep up with increasing home prices and rising medical costs. Another reason is the purpose to match higher exemptions in neighboring states that attracted "deadbeat" filers, who would transfer their exemptible assets. In this context, I regress the state exemption level on the contemporaneous and lagged values of a set of state-level variables that are potentially correlated both with increases in asset exemptions and with entry or exit from the stock market.

I also estimate equations (1) and (2) for the subsample of renters and homeowners separately. I restrict the sample to households that rent (own) a house in the first wave in which they entered into the sample and in the current wave (or in 1999 for those entering before). With this restriction I avoid that the results get contaminated by sample selection, since home ownership itself may be affected by the treatment.

To elucidate how the effects change with asset holdings, I split the sample by terciles of the within-state home equity distribution. The terciles are defined state-by-state, for singles and couples separately, based on the average home equity level from all the years that the household was

interviewed. Moreover, this strategy allows me to rule out the presence of local economic shocks affecting the entire cross-section of households in a given year. If such shocks are confounding the effect of exemptions, then they should simultaneously affect high, low and medium asset households. Any other shocks with a differential effect across asset levels should be captured by the year fixed-effects.

I test for heterogeneous effects among entrepreneurs, defined as self-employed. The estimates will be biased if the treatment also affects the decision to enter or exit entrepreneurship. To deal with this selection problem I restrict the group of entrepreneurs to those that have already that status in the first year in which they enter into the sample and exclude individuals eventually changing status since they could lead to a mitigation bias. I also test for heterogeneous effects among households where the head reports being in bad - i.e. fair or poor - health. Even when the treatment does not influence health status, I restrict the sample to households that had always the same - good or bad - health status to avoid the mitigation bias. With those restrictions, only 3.2% of the households in the sample are defined as always self-employed and 3.5% as always in bad health.

I also look at the effects of exemptions on other assets and debt holdings. Thus, I estimate the same model for the ownership of safe liquid assets, home ownership, home equity, and ownership of mortgage and non-mortgage debt. The regressions for home equity may be biased if there is self-selection into home ownership given that only a fraction of the households owns a house. To address this issue and the fact that the bankruptcy exemptions also may affect ownership, I include among the regressors the inverse Mills ratio based on the models for the probability of home ownership.

As a robustness analysis, I perform estimations with stock ownership specified as a cubic function of log exemptions. I address possible differences in the treatment intensity in the pre-reform period by restricting the sample to the years 1999-2005 and 2005-2011. The purpose is to isolate the effects before and after the 2005 reform. I rule out that the dynamics in the real estate sector are driving my results by excluding states were the housing boom and bust were more severe. In other checks I re-estimate the models with a broader measure of asset protection (adding vehicles and bank deposits), using the PSID longitudinal sample weights and dropping from the sample outliers that correspond to observations with very low exemption levels (from Delaware for the period 1999-2005).

5 Results

5.1 Risky asset ownership

The estimated coefficients from the linear spline model from equation (1) are presented in Panel A of Table 3. The knots are placed at log exemptions equal to 10 and 11.5 (i.e. exemptions equal to \$22,000 and \$98,000 approximately). In column 1 the marginal effects from the pooled cross section

are negative and significant at high exemptions (above $98,000), but they become insignificant in the Probit model from column 2. These estimates could be biased in the presence of fixed unobserved state characteristics correlated with the exemption level and with stockholdings, such as the state business climate. Thus, in columns 3 and 4 I use a within-state transformation that eliminates the unobserved state-level component of the error term. As a result, the positive effect at low exemption levels becomes significant.

However, time-invariant unobserved individual characteristics, such as risk aversion, could still bias the estimates in columns 1 to 4. I eliminate the unobserved individual-level error components by adding individual-level fixed-effects. In addition, this allows to consider separately the effects of exemptions on an individual who lived, for instance, two waves in state A and four waves in state B. In the resulting estimates, the positive effects at low exemption levels remain significant, except when I include state-specific linear trends (column 6). At intermediate levels, negative effects are observed but are not precisely estimated generally. In columns 8 to 10 the sample is restricted to home owners, resulting in the same pattern as in columns 5 to 7 with larger estimated coefficients. In the final column the sample is restricted to households that were always renters and no significant effects are found.

Panel B of Table 3 shows the estimates of OLS regressions using a smoother restricted cubic spline model and the same specifications as in Panel A. The coefficient of the linear term (log exemptions) is positive but only marginally significant across the different specifications, even among home owners. The two nonlinear terms (log exemptions' and log exemptions") have the same sign in all but the cross-sectional estimates, and only become significant after including state-specific time trends. The test of nonlinearity based on the F-statistic supports the non-linear specification in columns 1 and 2 and when the sample is restricted to home owners (columns 6 to 8). The null hypothesis is that the nonlinear coefficients are zero. For the model with state-specific linear time trends in column 7, the corresponding test statistic is $F(2, 50) = 7.489$ and significant at the 1% level.

5.1.1 Heterogeneous effects by asset level

The overall results from Panels A and B of Table 3 suggest the presence of a non-linear relationship between bankruptcy protection and stockholdings, but the estimates are not robust. Thus, no implications can be drawn for the entire sample or for home owners. In Table 4 I explore the presence of heterogeneous effects across different asset levels using the preferred specification with individual fixed-effects. Panel A shows that households at the top tercile of the home equity distribution, for which the average stock ownership is 31%, are the only ones responding to changes in the bankruptcy protection. Based on the estimates in column 7, doubling exemptions increases stock ownership by over 2p.p. when exemptions are low, and decreases stock ownership by 3p.p. at intermediate exemption levels. For those at the bottom and at the middle of the home equity distribution, with average stock ownership of 7% and 16%, the effects are insignificant or non-robust to the removal of the state-specific time trends. Panel B of Table 4 corroborates those findings relying on restricted

cubic splines. At the top tercile of the home equity distribution, the coefficients of interest are all significant at the 1% level, whereas no effects are found at the bottom and middle terciles. The similarity in the estimated coefficients in columns (8) and (9) suggests that quadratic time trends do not change the results substantially relative to the linear trends. Thus, in what follows I only present the results without controlling for any time-varying state trend and controlling only for linear trends.

Given the difficulty in interpreting the individual coefficients estimated with the restricted cubic splines, I plot in Figure 3 the corresponding marginal effects based on the model without state-specific time trends (columns 1, 4 and 7 of Table 4, Panel B). The curve with the marginal effects represents the change in the probability of stock ownership when exemptions increase, that is, the derivative of the probability with respect to exemptions at different exemption levels. I confirm that the non-zero marginal effects are restricted to households with higher holdings of home equity, facing low or medium protection levels. In the top tercile, the median value of home equity amounts to $82,500 and the mean to $125,000. Thus, in that tercile most homes are not fully protected at low and intermediate exemption levels (i.e. below $22,000 and between $22,000 and $98,000) and therefore can gain additional insurance from increases in exemptions.

Sample selection. To test for the validity of the first identifying assumption, in Table 5 I address the possibility that the effects are contaminated by individuals moving endogenously into states with higher bankruptcy protection. Thus, I re-estimate my main effects using the same state where the household was living at the time of joining the sample for all subsequent years. If self-selection bias is not a big concern, the results should be robust to this specification. Moreover, this strategy is consistent with the post-reform regulation that, for debtors changing state before filing, the exemptions from the previous state apply if they are lower. The results do not change qualitatively for the whole sample and for home owners relative to those in Table 3, Panel B, even when no clear pattern is identified for those groups. More importantly, at the top tercile of the home equity distribution the sign of the estimated coefficients remain similar as in Panel B of Table 4, only their magnitude becomes slightly smaller. Overall, individuals moving across states do not seem to affect substantially the estimated effects of exemptions.

Dynamic effects. Table 6 presents dynamic evidence on the timing of exemption changes, where one lag and one lead are added to capture the effect of the treatment two years after and two years before.[23] The results in Table 6 are only estimated by home equity level for the period 2001-2009, since the first and last years of the sample are dropped after including the lags and leads. The empirical model passes the falsification test for pre-existing trends or anticipatory effects. Indeed, the coefficients on the leads are generally non-significant at the 5% level, which gives convincing evidence that the contemporaneous effects are not biased. The coefficients for the lagged variables in general are not significant across models either. This indicates that the estimated effects do not remain two years after the policy change. Relative to the baseline model in Table 3, Panel

[23] I only include one lag (lead) because the loss of degrees of freedom is large for models with piecewise-linear splines, since each lag (lead) requires the estimation of three additional parameters.

A, the magnitude of the contemporaneous effects at low and intermediate exemption levels is not substantially altered among high-asset households. For medium-asset households, even when the contemporaneous coefficients at high protection levels are significant, they are not when the lags and leads are removed, as seen in Table 3.

Effect of state background variables on exemptions. The assumption that the timing of exemption changes is exogenous can be threatened if their determinants are also driving stock market participation. Table 7 explores the correlation between the log of homestead (plus wildcard) exemptions and state house prices, unemployment rate, proprietor employment, per capita personal income, GDP, medical expenditures and the number of bankruptcy filings per capita. In the third and sixth columns I restrict the sample to the period 1999-2009 for which data on per capita medical expenses was available. All columns are estimated using OLS regressions where I cluster the standard errors at the state level. The dummy for couples is always positive and significant since couples can double the exemption level in selected states. When I control for state and year fixed-effects in the models without lagged regressors, I find that exemption levels are positively correlated with home prices, the state unemployment rate and the number of filings. These results confirm the need to control for the contemporaneous values of house prices and unemployment rates in the regressions for stock ownership. Since the number of bankruptcy filings is likely influenced by the treatment, adding it as a control is not appropriate in general. Thus, conditional on state home prices, unemployment rates, individual-level controls and the full set of fixed-effects, exemption changes are plausibly exogenous to the demand for risky assets. In section 6.2 I discuss the possibility that bankruptcy filings are driving the results and how this will affect the causal interpretation of the effect of bankruptcy protection.

5.1.2 Heterogeneous effects by self-employment and health status

Table 8 shows the estimates of heterogeneous effects on households with a higher exposure to background risk. First I look at entrepreneurs, who have higher income risk than wage workers. Since many of the insurance opportunities available to poor households (unemployment and disability insurance, inter-vivos transfers, etc.) cannot insure the potentially large losses coming from entrepreneurial income risk, they are more likely to file for bankruptcy. The estimates with linear splines from Panel A show stronger negative effects for self-employed than for wage workers at intermediate exemptions in columns 1 and 2. The definition of self-employed encompasses owners of small and large firms. In particular, the unincorporated self-employed own smaller firms and outnumber the incorporated by 2:1. When I look separately at each group, I find slightly larger negative effects for the incorporated self-employed (columns 3 to 4). The corresponding estimates in Panel B using restricted cubic splines show that only the coefficients of the incorporated self-employed are significant. This is consistent with the fact that wealthier and more sophisticated entrepreneurs are more likely to respond to the lower marginal benefit of investing in stocks as bankruptcy protection increases. However, no stronger positive effect is observed at low protection

levels, as predicted by the risk channel.

In columns 7 and 8 I look at households in bad health that face a high probability of filing to discharge medical debts. In Panel A a stronger decline is observed but at high protection levels. Moreover, in the estimates with restricted cubic splines from Panel B the effects are not significant. This finding contrasts with other studies in which access to formal health care increases participation among sick households. It suggests that households in bad health are not considering ex-ante the possibility to file for bankruptcy when making investment decisions, despite of acting ex-post as an implicit health insurance (Mahoney, 2015).

5.2 Other assets: Safe liquid assets, housing

A question that arises is: If higher protection affects investment in stocks, are the holdings of other assets affected as well?

In Table 9, Panel A, I explore the effect of exemptions on ownership of safe liquid assets. First, the risk channel predicts a decline in savings at low exemptions: Access to bankruptcy protection reduces the need to save all the wealth for the future, regardless of whether it is in protected or unprotected assets. Second, as exemptions increase, not only stocks but also savings in unprotected, safe liquid assets may decline as well. Whereas no significant effects are estimated for the whole sample and for home owners (columns 1 to 4), I find a response from high-asset households (columns 9 and 10). In that group, the restricted cubic splines from Figure 4, Panel A, indicate that the marginal effects experience a decline at low exemptions and increase at intermediate levels. The decline is consistent with the lower savings predicted by the risk channel. However, the increase in savings at intermediate levels is less consistent with the implications of the protection channel.

In Panel B of Table 9 I look at the effects on the protected asset at the extensive and intensive margins. The risk channel should lead to lower savings in home equity at low protection levels. At intermediate levels, an increase is expected if the probability of a negative wealth shock is not too low. The first two columns show that bankruptcy protection has a positive effect on home ownership, significant at the 10% level in the specification without time trends. But the plots of the restricted cubic splines in Panel B of Figure 4 reveal that they are actually quite small. In the remaining columns of Table 9 the outcome variable is home equity, conditional on ownership. Note that the inverse Mills ratio is generally not significant, which does not support the presence of a selection bias The estimates by asset level show that the linear coefficients at the top tercile are negative, as expected, but not significant (columns 9 and 10). Moreover, income has no significant effect either and the pointwise confidence bands in Panel B of Figure 4 are considerably wider than at the extensive margin. Thus, in Panel C I explore the effect on the ownership of mortgage debt, which is less noisy than the measure of home equity. It is plausible that at least home owners are accumulating protected assets by paying down the mortgage rather than by buying a house or moving home, which carry higher costs. I find significant effects on mortgages among high asset households, and even for the whole sample. The graphs in Figure 5 indicate that there is

an increase in ownership at low protection levels and a decline at higher levels. Higher ownership of mortgage debt does not necessarily imply lower savings because it typically also leads to home ownership. However, paying off the mortgage does imply higher savings because increases home equity, conditional on ownership.

Finally, home equity protection could also affect investment in other assets also protected from bankruptcy, such as retirement accounts (note that they are only protected since the 2005 reform). In results not reported here, I find no significant effects on ownership of retirement accounts for high-asset households. Overall, the evidence at low exemptions of lower savings in unprotected, safe liquid assets lends support to the risk channel. At intermediate levels, more savings in protected assets are inferred from lower holdings of mortgage debt, consistent with the protection channel. The increase in safe liquid assets, however, is less expected.

5.3 Effects on holdings of household debt

Next, I explore how exemptions affect the holdings of non-mortgage debt to test for the plausibility that the results are driven by credit market conditions. On the one hand, the prevalence of supply-side restrictions would lead to a decline in debt holdings. Higher exemptions lead to worse credit market conditions that in turn may reduce the demand for stocks. When exemptions increase, the value of the collateral declines and this reduces lenders' expected repayment. Lenders respond by increasing interest rates and/or by rationing access to credit. Higher interest rates imply higher costs to get funds in case of a low stock realization and could discourage stock market participation. Conditional on holding debt, the increase in interest rates reduces the expected excess return of the risky asset relative to the safe asset - the unsecured debt in this case -, and as a result investing in stocks becomes less attractive (Becker and Shabani, 2010). Credit rationing also reduces the probability of entry in the stock market if households are liquidity constrained and "borrow to save".[24] But even if households borrow for consumption purposes, there will be a lower participation in the stock market if they need to liquidate stocks to compensate for the lack of bank financing. Moreover, if credit rationing were the prevailing mechanism, it would have a stronger effect among poorer households. This is because ex-ante higher exemptions increase more the probability of default for poor households, which as a result experience more credit constraints. On the other hand, an increase in debt holdings resulting from higher bankruptcy protection indicates that the demand response dominates. Households are willing to take more loans when bankruptcy becomes more generous. This in turn may increase the demand for stocks either if households borrow to invest or to consume.

In Table 10 the estimated effect of home protection on debt ownership is not significant for

[24]Even when households typically borrow to consume rather than to invest, in the period 2003-2007 some households were increasing leverage to invest in the stock market. Also, in those years households with a mortgage were more likely to open a stock market account to build a buffer of liquid assets, possibly because stock returns were seen as stochastically dominant and uncorrelated with labor or housing market risk (Chen and Stafford, 2016).

the whole sample and for home owners. Then I split the sample by home equity levels, and do not find significant effects either. This is also captured by the plots of the marginal effects estimated using restricted cubic splines in Figure 6.[25] These results depart from Severino et al. (2014), who using county level data find that exemptions lead to an increase on the holdings of credit card debt for the period 1999-2005. In contrast to their study, I use the less precise measure of unsecure debt available in the PSID, which only excludes mortgages and vehicle loans but contains some not dischargeable components, such as student loans, tax obligations, alimony, child support obligations, etc. However, I can exploit the within-individual variation that rules out some biases present in the within county variation. In any case, when Severino et al. (2014) extend the sample until 2009 the effect on unsecured debt is no longer significant. The results presented here do not suggest that household debt holdings mediate the effect of exemptions on stock market participation.

5.4 Robustness Analysis

In this section I discuss a number of robustness checks that provide further evidence on the effects of bankruptcy protection on stockholdings. The results of the additional tests are in line with the findings from the main specifications.

Functional form. Polynomials are the most common approach in economics to allow for bends in the curve fitting the data. Thus, in Table 11 I replace the splines with a cubic polynomial transformation of the exemption level to account for non-linearities. The estimated coefficients become significant both for the whole sample and for home owners, but only after including state-specific linear trends. In columns 5 to 10, I split the sample by home equity terciles and confirm the findings from Table 4, which indicate that high-asset households are the ones responding to changes in the level of protection. Since the interpretation of the individual coefficients is not straightforward, in Figure 7 I plot the marginal effects as estimated in columns 5, 7 and 9 of Table 11. For high-asset households I find small negative marginal effects when log exemptions are above 10 and below 12, as in the restricted cubic splines. The plot in the first column also shows large positive marginal effects at the lower end of the distribution, which are highly significant. They become substantially smaller when I exclude outliers (19 observations for Delaware with log exemptions smaller than 8). The comparison between the plots in the first and second columns illustrate the sensitivity of the polynomial fitting curve to the presence of outliers, resulting in poor behavior in the tails of the distribution.

Pre- and post-reform period. To detect any difference in the treatment effect over time, in Table 12 I re-estimate my main results for stock ownership restricting the sample to the years 1999-2005 and 1995-2011. After the BAPCPA was passed in 2005, high-income households in principle became ineligible to file under Chapter 7 or were less able to exploit its benefits. As explained in Section 2, in practice many households still are able to overcome the requirements

[25] In results not reported here no significant effects are found either on the log of non-mortgage debt, conditional on ownership.

and file under Chapter 7. On the other hand, the recession of 2008-2009 was characterized by substantial disruption in the credit and stock markets, so investors' behavior in this period may differ from former years. Actually, Table 12 shows that mean stock ownership was smaller by 4p.p. in 1999-2005 than in the pre-reform period, and the difference increases to 7p.p. among high-asset households. The results in Table 12 indicate that the effects of exemptions are only observed in the post-reform years. Moreover, the effects corresponding to 2005-2011 are significant not only for high-asset households but also for the whole sample and for home owners. Relative to the entire period (Panel B in Table 3 and Table 4), the coefficients for 2005-2011 are larger and more precisely estimated.

States with lower exposure to the housing boom and bust. In Table 13 I exclude from the sample states where the housing boom previous to the 2007/8 financial crisis and the subsequent bust were more pronounced. These states are Arizona, California, Nevada and Florida. Additionally, note that Nevada is among the states with the highest number of bankruptcy filings in the country. In Florida the level of homestead exemption was unlimited throughout the sample period. This implies that excluding Florida is unlikely to change the estimates at low and middle exemption levels. I find that the estimates excluding those four states remain very similar to those in the main specification. This finding does not lend support to the conjecture that the real estate bubble and the subsequent market correction are driving the results.

Other checks. Additional robustness checks on the results by home equity level are presented in Table 14. The first three columns show the effect of adding the exemptions for vehicles and bank deposits to the homestead and wildcard exemptions. Including other asset categories in the regressor of interest has no substantial effect on the results relative to the baseline estimates in Table 4, Panel B. This is consistent with the fact that homestead exemptions are the main exemption category and that housing typically represents the biggest fraction of households' wealth. In the next three columns I re-estimate the main specifications using sample weights (the PSID Core/Immigrant Family Longitudinal Weight) from the first year that the individual enters into the sample. Relative to the unweighted regressions, there is a 10% drop in the sample size at the top tercile. In this case, the estimated coefficients become smaller and therefore the effects at low and intermediate exemptions for high asset households are less precisely estimated. In the final three columns I drop from the sample outlier observations where log exemptions are smaller than 8, using the same criterion as in Figure 7. The estimated coefficients remain of the same magnitude and significant at the 1% level at low and middle exemptions. The plots with the marginal effects in Figure 8 look similar to those in Figure 3, although the wide confidence intervals at the lower tail disappear as expected. This also corroborates the adequacy of using spline transformations to model non-linearities, less sensitive to the presence of outliers than polynomials.

6 Discussion

This section discusses the magnitude and scope of the results and different explanations for my empirical findings.

6.1 Magnitude and scope of the effect

The results in section 5 indicate that higher bankruptcy protection only affects stock market participation of households in the top tercile of the home equity distribution. The estimated effect is non-linear; i.e. positive when exemptions are low and negative at intermediate levels, whereas there is no effect at high protection levels. Specifically, stock market participation increases by 2p.p. when the home equity exemptions are below \$22,000 and declines by 3p.p. when they are between \$22,000 and \$98,000 approximately. Given that just around 31% of the selected PSID sample of high-asset households holds stocks, these estimated marginal effects represent a 6% increase and a 10% decline when exemptions double. Many households are fully protected at exemptions above \$98,000 (the median home equity level in the sub-sample of high asset households is \$82,500). In those cases increases in exemptions do not provide additional insurance and thus should not have any effect on households' or on lenders' decisions. From an econometrics perspective, the lack of time variation in unlimited exemptions implies larger standard errors in the estimated coefficients at high protection levels.

Table 1 shows the number of states at each exemption level per year, defined based on the cutoffs found in the data (\$22,000 and \$98,000). The states with high levels are outnumbered by the ones with low and high exemptions over the entire period. On average, 35% of the households in the sample are from states with low exemptions, 39% from states with medium exemptions, whereas the rest are split between high (10%) and unlimited exemption states (16%).

6.2 Alternative explanations

The most plausible explanation for these non-linear effects are the risk channel at low protection levels and the protection channel at intermediate levels. Bankruptcy protection increases the willingness to invest in risky assets up to a certain level. Beyond that point, further increases lead to a reduction in participation by making bankruptcy more attractive and reducing the willingness to invest in unprotected assets. The effects are restricted to households in the top tercile of the home equity distribution, who are more likely to trade in the stock market. For these households the costs of entry and participation are relatively lower than for poorer households. Such costs include brokerage commissions, sign-up fees, information costs and other non-pecuniary costs related to overcoming investor inertia. In addition, they are less likely to have their homes fully protected, which implies that increases in exemptions do provide additional insurance and affect the probability

of filing for bankruptcy.

Some caveats related to my preferred interpretation need to be raised. First, I do not find heterogeneous effects for households in bad health, despite their higher exposure to medical expense risk and their relatively high probability of filing for bankruptcy. The positive effects of additional insurance on participation are increasing in the probability of a negative wealth shock. The importance of medical costs in the household bankruptcy decision is documented by Himmelstein et al. (2005) and Gross and Notowidigdo (2011) and was also acknowledged explicitly by the law through the Medical Bankruptcy Fairness Act of 2009. Thus, my results depart from other studies, such as Atella et al. (2012); Goldman and Maestas (2013) and Christelis et al. (2014), who find that access to health insurance encourages stock market participation. In turn, the protection channel implies a stronger decline in participation when the probability of filing is higher. In that case stocks become less attractive because of the chances of losing the entire investment in bankruptcy and of the crowding-out of savings in protected assets. The absence of heterogeneous effects can be attributed to the fact that that sick households are poorer and therefore do not trade in stocks. This is plausible since I restrict to households that were always in bad health during the sample period. They have lower levels of home equity and only 5% own stocks.

Second, the theoretical framework predicts a decline in savings at low protection levels because the bankruptcy protection reduces the need to consume only the subsistence level and save the rest. As the protection increases, a positive effect is generally but not always expected, so the theoretical impact is more ambiguous. I find that savings in protected assets - namely, home equity - do not change with exemptions generally and not even with income. This departs from Corradin et al. (2013) and Greenhalgh-Stanley and Rohlin (2013), who find that households tend to bias their portfolios towards home equity when exemptions increase. The high measurement error in the home equity measure at the intensive margin may lead to an attenuation bias in a fixed-effect model that exploits within individual variation. Thus, I also estimate a model for the ownership of mortgage debt and find a decline. This is consistent with households accumulating home equity by paying down the mortgage. I also estimate the marginal effects for savings in unprotected, safe liquid assets. The effects are negative at low exemptions and become positive at intermediate levels. Whereas the decline provides support to the risk channel, the increase is not expected in the context of the protection channel. This suggests that the counterpart of the disinvestment in stocks are higher holdings of both home equity and safe liquid assets.

An alternative explanation for the effects of exemptions on participation is that they are driven by changes in the demand and supply of credit. I measure the importance of the credit channel by looking at holdings of non-mortgage debt, a proxy for unsecure debt. My data shows that higher bankruptcy protection does not have a significant effect on debt ownership, not even when the sample is split by home equity tercile. The absence of evidence on credit rationing or higher household leverage does not lend support to the credit market channel, although it can

also operate through prices rather than quantities.[26] But even if that were the case, other studies have shown that the supply side restrictions of the bankruptcy protection impact more on poorer households, whereas the access to credit among wealthier households may actually increase (Gropp et al., 1997; von Lilienfeld-Toal and Mookherjee, 2016). Worse credit market conditions among poor households are inconsistent with the effects on stockholdings only found among richer households.

A different concern arises from the fact that the bankruptcy exemptions are positively correlated with the number of bankruptcy filings, as shown in Table 7. If people file more for bankruptcy when the protection increases, then it could be that bankruptcy itself rather than the higher protection provided by the law ex-ante is driving their participation decision. This may challenge the causal interpretation of my results at intermediate but not at low protection levels. The decision to declare bankruptcy can only be associated with exit from the stock market. Stocks are unprotected and should be sold by households that are in the process of filing to pay off debts. Thus, filing for bankruptcy could hardly be driving an increase in stockholdings. Furthermore, in every period the number of people eventually filing is arguably smaller than the number of people who are just considering bankruptcy, especially among high-asset households. Thus, the ex-ante effects of the higher protection are likely more important than the ex-post effects to explain the decline in participation.

The effects of exemptions on stockholdings, both the positive and negative, are less precisely estimated for the years 1999-2005 than for 2005-2011. On the one hand, the bankruptcy insurance became more salient after the 2005 reform. In addition, background risk increased among wealthier households during the 2007-2008 financial crisis. If the availability of formal insurance did not increase simultaneously, this could have lead to a higher elasticity of participation to exemption changes. On the other hand, exit from the stock market during the crisis was the path taken by households in financial distress to meet housing consumption commitments, such as mortgage payments (Chen and Stafford, 2016). By reducing the attractiveness of unprotected assets, an increase in exemptions could have accentuated this trend. However, this does not imply that distress in the mortgage market is driving the decline in participation, which is observed only among households with high levels of home equity, less likely to have underwater mortgages. Indeed, the median ratio of mortgage to property value is just 35% for high-asset households versus 67% and 90% for those at the middle and bottom of the distribution. In addition, after the introduction of the means test in 2005, it is possible that high exemptions increase the incentives of wealthier households to reduce their capital income by selling stocks and become eligible for Chapter 7. Even if they eventually fail the means test, they do not have incentives to keep income producing assets since all their disposable income should be used for repayment under Chapter 13.

[26] A positive effect of exemptions on the interest rates faced by households, especially those with low income, has been documented by Gropp et al. (1997) and Severino et al. (2014).

7 Conclusion

This research addresses an important policy question: How do public insurance programs affect household investment decisions? Understanding how households make portfolio choices is one of the major challenges faced by positive household finance. Despite the amount of wealth insurance provided by the government through social programs, its impact on households' portfolio decisions has received little attention. Addressing this question is important because insuring individuals who fear the risk of negative wealth shocks may have positive externalities in their financial portfolios. At the aggregate level, the presence of uninsurable risks may lead to suboptimal risk-taking. This paper examines the effects of the asset protection guaranteed by the U.S. bankruptcy law on stock market participation.

My results highlight that the insurance from bankruptcy encourages participation in stock markets at low protection levels but, as protection levels increase beyond $20,000, participation declines. This effect is restricted to high-asset households, the ones more likely to trade in stocks. When the protection level is above $100,000 approximately, no portfolio effects result from additional changes in the law. In that case most homes are fully protected and therefore further increases in exemptions do not provide additional insurance. The possibility to keep a minimum level of assets in case of a negative wealth shock may lead ex-ante to more investment in risky assets. But as the protection level goes up, bankruptcy becomes more attractive. This reduces the demand for stocks, since they will be lost if the household defaults. The effects are restricted to high-asset households that have home equity in excess of the state exemption level and face relatively lower costs of entry and participation in the stock market.

Stronger negative effects are estimated among self-employed, with higher exposure to background risk and therefore a higher probability of filing for bankruptcy. In contrast, no heterogeneous effects are estimated among households in bad health that are more exposed to medical expense risk. Households where the head is sick for a long period of time are poorer and therefore less likely to trade in stocks. I rule out that tighter credit constraints mediate the decline in participation at medium protection levels because and more likely to affect poorer households and debt holdings do not decline with exemptions. On the other hand, the number of bankruptcy filings is correlated with the exemptions and could explain the decline at intermediate protection levels. But since there are fewer households actually filing than concerned about potential bankruptcy, this channel is unlikely to play a major role. Note that the interpretation of the mechanisms driving the main findings is not conclusive but is the most plausible in the light of the existing evidence. A related issue that deserves further investigation is the study of the ex-ante effects of bankruptcy protection on consumption.

What are the implications of these findings in terms of social welfare? According to textbook financial theory, stock market participation should be widespread if the equity premium is positive (Campbell, 2006). In that context, bankruptcy exemptions would lead to welfare gains at low protection levels and to losses at intermediate levels. But before making that assessment it is necessary to take into account the counterpart of such investment behavior. These is no evidence that changes in

stockholdings translate into changes in retirement accounts, which in turn can be invested into risky assets, offseting the welfare gains or losses. Instead, the evidence supports the presence of changes in safe liquid assets and on mortgage debt; moreover, although not tested directly, an impact on consumption cannot be ruled out. Thus, from the perspective of the desirability of the bankruptcy protection, this implies that the optimal exemption level is positive but low. This implication is in line with previous quantitative models balancing the costs and benefits of the law (Pavan, 2008). The present results highlight the need to consider unintended consequences on household portfolios of increasing bankruptcy provisions.

Table 1: Summary statistics for bankruptcy exemptions

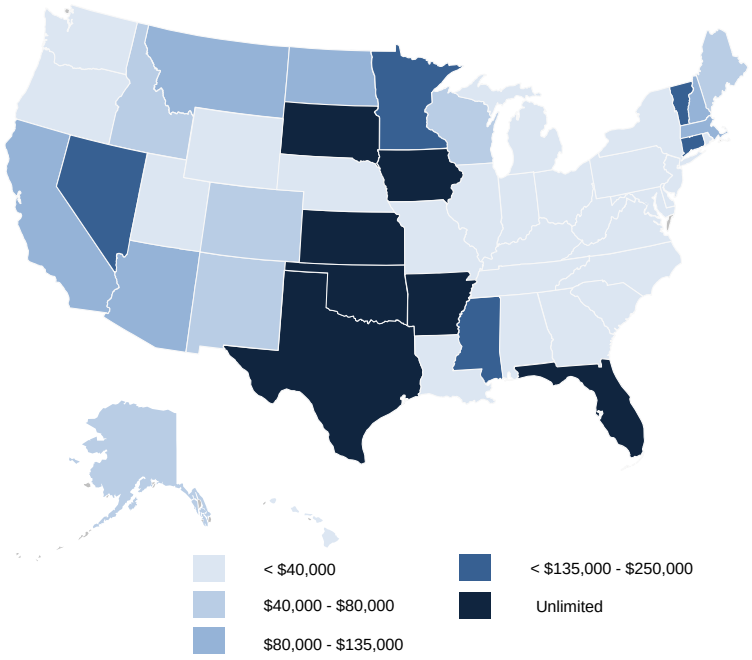
Average exemption levels for couples, 1999-2011

		All the sample	Exemptions < $22,000		Exemptions > $22,000 & < $98,000		Exemptions > $98,000		
		Average	Average	Number of	Average	Number of	Average	Number of states	
		exemption ($)	exemption ($)	states	exemption ($)	states	exemption ($)	Finite	Unlimited
1999	Homestead + wildcard	57,209	13,146	12	46,047	24	156,787	8	7
	Total asset exemptions	61,602	13,858	11	50,708	25	161,296	8	
2001	Homestead + wildcard	58,210	13,692	13	48,477	21	145,227	9	8
	Total asset exemptions	63,274	13,577	10	51,368	24	150,244	9	
2003	Homestead + wildcard	63,659	14,963	15	52,240	19	168,927	9	8
	Total asset exemptions	69,562	14,546	11	53,311	23	178,338	9	
2005	Homestead + wildcard	74,812	15,329	15	49,785	18	209,083	10	8
	Total asset exemptions	80,999	15,712	11	50,481	22	219,956	10	
2007	Homestead + wildcard	80,605	14,384	10	48,269	23	221,199	10	8
	Total asset exemptions	86,997	15,656	8	52,023	25	231,505	10	
2009	Homestead + wildcard	94,975	15,650	7	51,362	23	214,851	13	8
	Total asset exemptions	101,952	16,528	5	48,762	22	201,784	16	
2011	Homestead + wildcard	100,145	15,712	6	50,489	20	188,363	17	8
	Total asset exemptions	108,255	17,081	4	54,167	22	199,704	17	
1999-2011	Homestead + wildcard	75,598	14,587		49,413		189,207		
	Total asset exemptions	81,739	14,954		51,548		194,756		

Notes. This table shows the average exemption levels for couples split among states with low (<$22,000), medium (>$22,000 and <$98,000) and high (>$98,000) exemptions in real 2004 dollars. The thresholds are defined based on the sum of the homestead and wildcard exemptions. Total asset exemptions include vehicles and bank deposits in addition to homestead and wildcard exemptions.

Figure 1: Bankruptcy exemption levels by state; values in real 2004 USD

Panel A. Homestead plus wildcard exemption levels for couples, 1999



Panel B. Homestead plus wildcard exemption levels for couples, 2011

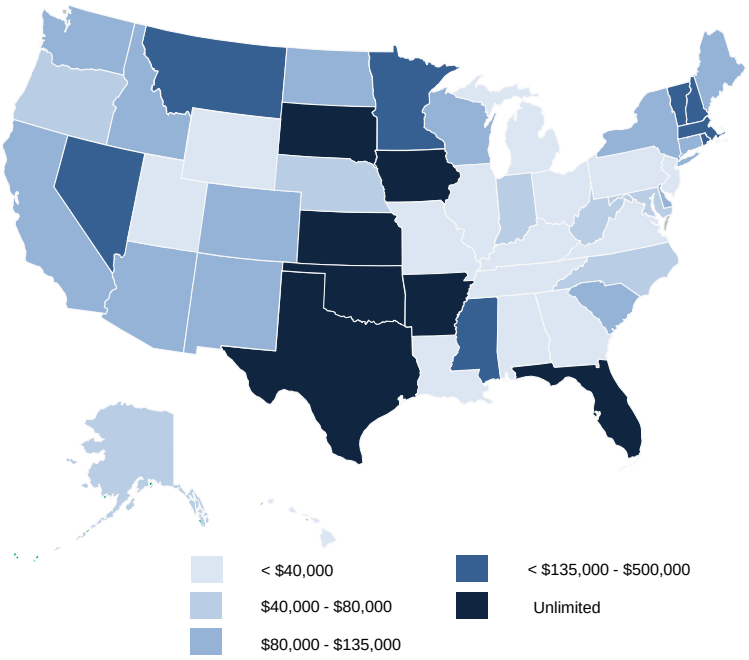
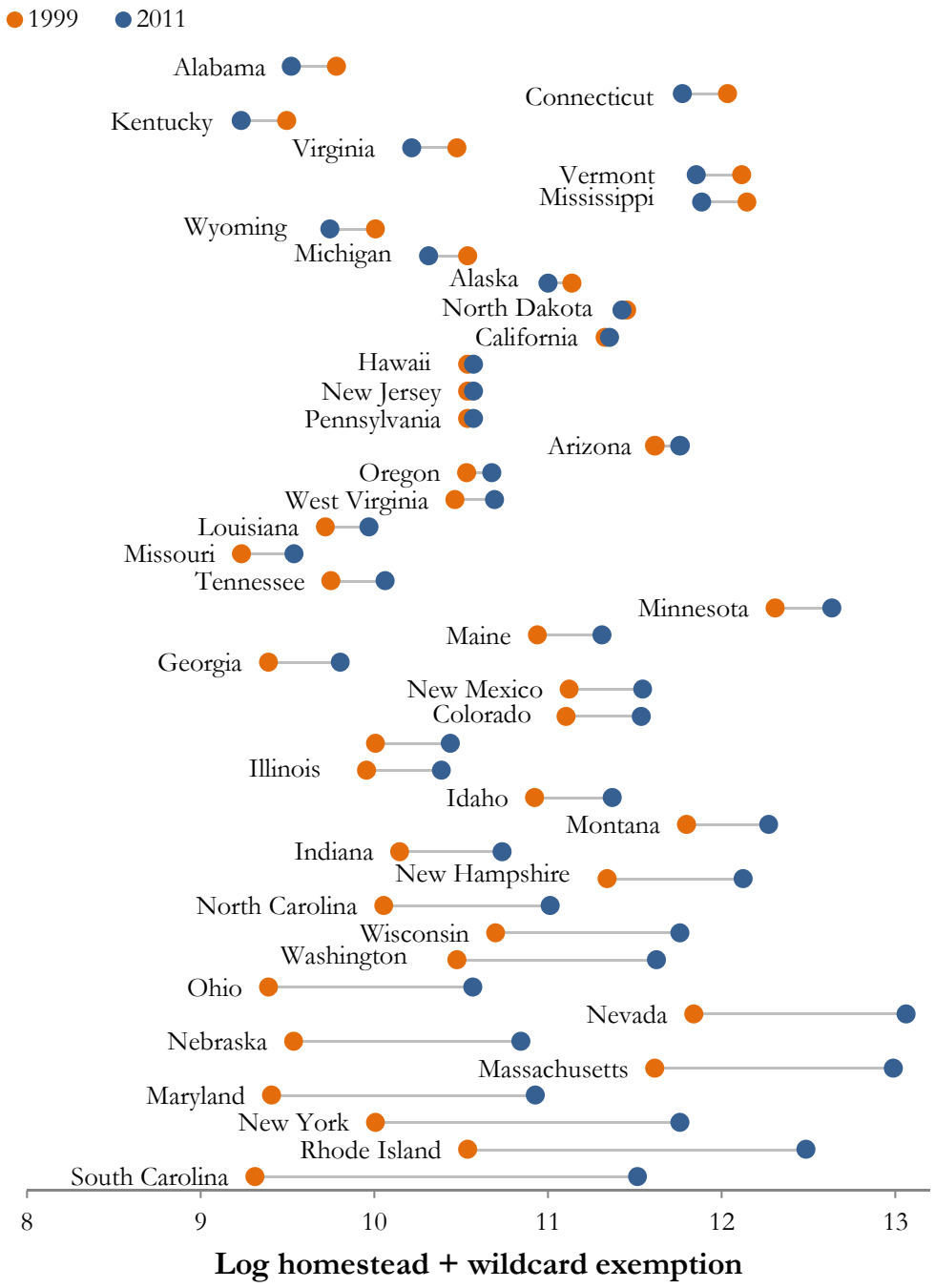


Figure 2: Log state exemption levels for couples, 1999-2011 (2004 USD)



Notes. Excludes states with unlimited exemptions (Arkansas, Florida, Iowa, Kansas, Oklahoma, South Dakota, Texas and District of Columbia) and Delaware that was an outlier for the first years of the sample.

Table 2: Summary statistics for selected data, 1999-2011

	Mean	Std. Dev.	Median	N
All households				
Stock market participation (%)	22.07	41.48	0.00	44,358
Stock market entry (%)	6.43	24.53	0.00	44,358
Stock market exit (%)	9.18	28.87	0.00	44,358
Ownership of safe liquid assets (%)	80.92	39.30	100.00	44,358
Safe liquid assets ($)	23,118	60,399	2,914	44,358
Total liquid assets ($)	48,109	136,086	3,682	44,358
Income ($)	41,630	43,603	31,833	44,358
House ownership (%)	60.24	48.94	100.00	44,358
Home equity ($)	65,531	115,973	15,167	44,358
Retirement account ownership (%)	30.81	46.17	0.00	44,358
Retirement account ($)	25,082	74,911	0	44,358
Non-mortgage debt ownership (%)	56.67	49.55	100	44,358
Non-mortgage debt ($)	8,178	17,159	971	44,358
Mortgage debt ownership (%)	47.18	49.92	0	44,358
Mortgage debt ($)	53,267	82,117	0	44,358
Self-employed (% of household heads)	11.54	31.96	0	44,358
Unincorporated firm (% of self-employed)	64.55	47.84	100	4,542
Incorporated firm (% of self-employed)	35.35	47.81	0	4,542
Bad health (% of pop)	13.43	34.10	0	44,307
Age of the head	43.23	12.17	44.00	44,358
Male (% of pop)	72.94	44.43	100.00	44,358
Married (% of pop)	54.83	49.77	100.00	44,358
Years of education	13.48	2.49	13.00	44,358
Number of children	0.72	1.09	0.00	44,358
Minority (% of pop)	17.41	37.92	0.00	44,358
Stock market participants				
Stocks (% liquid assets)	56.78	32.00	60.87	7,412
Non-mortgage debt ownership (%)	53.34	49.89	100.00	7,412
Self-employed (% of household heads)	16.99	37.56	0.00	7,412
Unincorporated firm (% of self-employed)	51.41	50.00	100.00	1,202
Incorporated firm (% of self-employed)	48.42	50.00	0.00	1,202
Bad health (% of pop)	6.03	23.80	0.00	7,405
Age of the head	46.62	11.28	48.00	7,412
Male (% of pop)	83.68	36.96	100.00	7,412
Married (% of pop)	69.61	46.00	100.00	7,412
Years of education	14.92	1.95	16.00	7,412
Number of children	0.63	0.97	0.00	7,412
Minority (% of pop)	3.56	18.54	0.00	7,412
State-level variables				
House price index	126.20	27.02	123.68	357
Unemployment rate (%)	5.83	2.08	5.26	357
Nr. of non-business bankruptcy filings	4.74	2.01	4.43	357
Per capita medical expenses ($)	5,510	1,424	5,390	306

Notes. Household-level data includes the descriptive statistics for the household heads in the 1999, 2001, 2003, 2005, 2007, 2009 and 2011 PSID panels, who are 65 years old or younger. I weight observations using the PSID core/immigrant family longitudinal weights. State-level data are annual averages for the same years. All monetary values are in real 2004 dollars and winsorized at the 1st and 99th percentile. All variables are described in Appendix Table A.1.

Table 3: Regressions of stock market participation - Panel A: Piecewise-linear splines

	All the sample							Home owners			Renters
	OLS	Logit	OLS	Logit	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Coefficients											
Low exemptions	.015	.131	.033***	.241***	.017**	.016	.023**	.021*	.036*	.044*	.004
	(.009)	(.096)	(.007)	(.069)	(.007)	(.011)	(.011)	(.012)	(.019)	(.024)	(.011)
Middle exemptions	.002	-.008	-.004	-.018	-.010	-.020	-.018	-.014	-.023	-.013	-.001
	(.010)	(.080)	(.009)	(.078)	(.009)	(.012)	(.013)	(.011)	(.014)	(.017)	(.015)
High exemptions	-.013**	-.099*	-.019	.089	.007	.037*	.042**	-.012	.070***	.104***	.015
	(.007)	(.056)	(.021)	(.119)	(.018)	(.018)	(.016)	(.024)	(.015)	(.023)	(.017)
Log income	.003	-.065**	.004*	-.059**	-.001	-.000	-.000	.002	.002	.002	.003*
	(.002)	(.029)	(.002)	(.029)	(.001)	(.001)	(.001)	(.003)	(.003)	(.003)	(.001)
Log income'	-.003	.133***	-.004	.125***	-.001	-.001	-.001	-.004	-.004	-.004	-.004**
	(.003)	(.034)	(.003)	(.035)	(.002)	(.002)	(.002)	(.004)	(.004)	(.004)	(.002)
Log income"	10.330***	30.789***	10.169***	30.065***	2.092***	2.135***	2.119***	4.005***	4.231***	4.277***	1.256***
	(.592)	(4.520)	(.582)	(4.434)	(.476)	(.483)	(.477)	(1.293)	(1.324)	(1.331)	(.420)
Marginal effects											
Low exemptions		.013		.022***							
		(.010)		(.007)							
Middle exemptions		-.001		-.002							
		(.009)		(.009)							
High exemptions		-.011		.015							
		(.007)		(.022)							
Demogr. and state-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE			Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE					Y	Y	Y	Y	Y	Y	Y
State x time trend						Linear	Quadratic		Linear	Quadratic	
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.167	.167	.167	.167	.167	.167	.167	.282	.282	.282	.047
Akaike's information criterion	29,055	31,590	28,737	31,289	-7,972	-8,106	-8,194	3,446	3,353	3,293	-16,108
No. of Obs.	44,905	44,905	44,905	44,905	44,905	44,905	44,905	17,856	17,856	17,856	12,708
No. of Clusters	51	51	51	51	51	51	51	51	51	51	50
R-Squared	.20		.20		.01	.01	.02	.02	.02	.02	.02
Pseudo R-Squared		.22		.23							

Notes. This table shows OLS and Logit estimates using two-knots linear splines. The dependent variable is a dummy indicating stock ownership. The coefficients correspond to log exemptions smaller than 10, between 10 and 11.5 and greater than 11.5. Marginal effects are estimated for the logit models at log exemptions equal 10, 11.5 and at 13.3 and at the sample means of the remaining covariates. Columns 8 to 10 (11) are restricted to households that own (do not own) a house in the first wave that appeared in the sample and in the current wave. The demographic controls include a restricted cubic spline for the log of household income, head's age, race/ethnicity and number of years of education, dummies for whether the head is male, married, unemployed or retired, and the number of adults and children in the household. State-level controls include home price and unemployment rate. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 3: Regressions of stock market participation - Panel B. Restricted cubic splines

	All the sample					Home owners			Renters
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log exemptions	.013	.034***	.018*	.022	.030**	.021*	.040*	.050*	-.004
	(.011)	(.008)	(.009)	(.014)	(.014)	(.013)	(.020)	(.025)	(.015)
Log exemptions'	-.020	-.114**	-.092	-.166*	-.190*	-.102	-.242**	-.269**	.030
	(.077)	(.055)	(.070)	(.099)	(.096)	(.071)	(.100)	(.118)	(.084)
Log exemptions"	-.000	.188	.193	.419*	.465**	.217	.781***	.926***	-.066
	(.179)	(.135)	(.169)	(.234)	(.228)	(.217)	(.272)	(.331)	(.224)
Log income	.003	.004*	-.001	-.000	-.000	.002	.002	.002	.003*
	(.002)	(.002)	(.001)	(.001)	(.001)	(.003)	(.003)	(.003)	(.001)
Log income'	-.003	-.004	-.001	-.001	-.001	-.004	-.004	-.004	-.004**
	(.003)	(.003)	(.002)	(.002)	(.002)	(.004)	(.004)	(.004)	(.002)
Log income"	10.331***	10.170***	2.089***	2.132***	2.115***	4.013***	4.237***	4.276***	1.263***
	(.593)	(.583)	(.476)	(.483)	(.477)	(1.292)	(1.323)	(1.330)	(.421)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE		Y	Y	Y	Y	Y	Y	Y	Y
Individual FE			Y	Y	Y	Y	Y	Y	Y
State x time trend				Linear	Quadratic		Linear	Quadratic	
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.167	.167	.167	.167	.167	.282	.282	.282	.047
Akaike's information criterion	29,055	28,739	-7,970	-8,102	-8,190	3,445	3,354	3,293	-16,108
Test of nonlinearity	3.625**	4.257**	1.401	1.694	2.095	2.485*	7.489***	6.034***	.120
No. of Obs.	44,905	44,905	44,905	44,905	44,905	17,856	17,856	17,856	12,708
No. of Clusters	51	51	51	51	51	51	51	51	50
R-Squared	.20	.20	.01	.01	.02	.02	.02	.02	.02

Notes. This table shows OLS estimates using restricted cubic splines with four knots placed at the 5th, 35th, 65th, and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating stock ownership. The coefficient on "Log exemptions" corresponds to the linear term, and the ones on "Log exemption"' and "Log exemption"" capture nonlinearities. The "Test of nonlinearity" is a test of H_0 : Log exemptions' = Log exemptions" = 0. Columns 6 to 8 (9) are restricted to households that own (do not own) a house in the first wave that appeared in the sample and in the current wave. The demographic controls include a restricted cubic spline for the log of household income, head's age, race/ethnicity and number of years of education, dummies for whether the head is male, married, unemployed or retired, and the numbers of adults and children in the household. State-level controls include home price and unemployment rate. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 4: Heterogeneous effects on stock market participation by home equity level

Panel A. Piecewise-linear splines

	Bottom tercile			Middle tercile			Top tercile		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Low exemptions	.003	-.005	-.001	.027*	.001	.020	.032***	.058***	.066***
	(.008)	(.013)	(.016)	(.016)	(.024)	(.024)	(.011)	(.020)	(.022)
Middle exemptions	.004	-.004	-.002	.010	.004	.016	-.044***	-.056**	-.048*
	(.012)	(.016)	(.015)	(.017)	(.017)	(.016)	(.016)	(.023)	(.025)
High exemptions	.003	-.007	-.006	-.025	.134***	.194***	.012	.046**	.030
	(.012)	(.012)	(.017)	(.021)	(.019)	(.024)	(.035)	(.022)	(.029)
Log income	-.000	-.000	-.000	-.005	-.004	-.005	.002	.002	.002
	(.002)	(.002)	(.002)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)
Log income'	.000	.000	.000	.005	.004	.005	-.005	-.005	-.005
	(.002)	(.002)	(.002)	(.005)	(.005)	(.005)	(.005)	(.005)	(.005)
Log income"	1.188**	1.209**	1.220**	2.143	2.704	2.754	3.003**	2.933**	2.872**
	(.510)	(.497)	(.506)	(2.191)	(2.192)	(2.226)	(1.163)	(1.166)	(1.155)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear	Quadratic		Linear	Quadratic		Linear	Quadratic
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.065	.065	.065	.158	.158	.158	.311	.311	.311
No. of Obs.	19,972	19,972	19,972	10,124	10,124	10,124	14,809	14,809	14,809
No. of Clusters	51	51	51	50	50	50	51	51	51
R-Squared	.01	.02	.03	.02	.03	.04	.02	.02	.03

Notes. This table shows panel estimates using two-knots linear splines. The dependent variable is a dummy indicating stock ownership. Household data is from the PSID for the period 1999-2011. The coefficients correspond to log exemptions smaller than 10, between 10 and 11.5 and greater than 11.5 respectively. The sample is split by home equity terciles, defined based on the within-state home equity distribution by marital status. Demographic and state-level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 4: Heterogeneous effects on stock market participation by home equity level

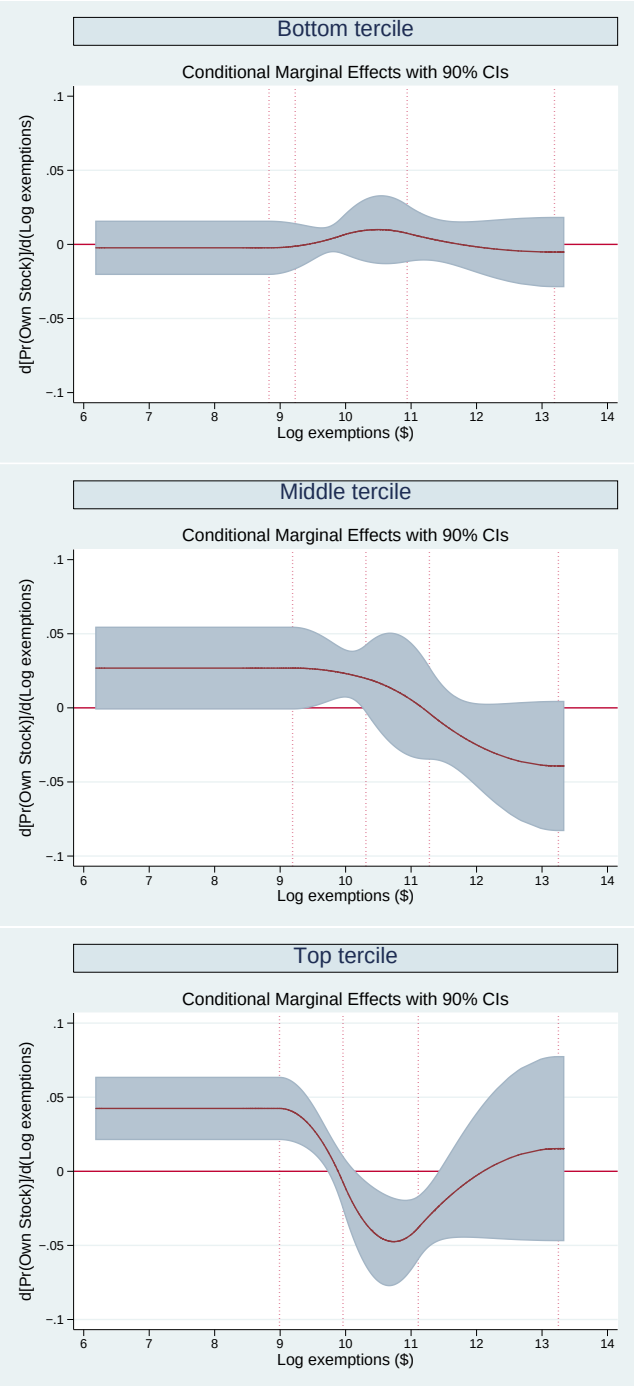
Panel B. Restricted cubic splines

	Bottom tercile			Middle tercile			Top tercile		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log exemptions	-.002	-.009	-.004	.026	.001	.026	.043***	.079***	.086***
	(.011)	(.019)	(.022)	(.016)	(.023)	(.023)	(.012)	(.025)	(.024)
Log exemptions'	.043	.036	.021	-.025	-.028	-.103	-.320***	-.520***	-.502***
	(.074)	(.107)	(.111)	(.099)	(.110)	(.093)	(.104)	(.160)	(.147)
Log exemptions"	-.125	-.110	-.076	-.056	.381	.701**	.724**	1.207***	1.125***
	(.202)	(.278)	(.283)	(.295)	(.305)	(.275)	(.277)	(.388)	(.371)
Log income	-.000	-.000	-.000	-.005	-.004	-.005	.002	.002	.002
	(.002)	(.002)	(.002)	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)
Log income'	.000	.000	.000	.005	.004	.005	-.005	-.005	-.005
	(.002)	(.002)	(.002)	(.005)	(.005)	(.005)	(.005)	(.005)	(.005)
Log income"	1.189**	1.208**	1.220**	2.176	2.691	2.739	2.998**	2.933**	2.871**
	(.511)	(.498)	(.507)	(2.188)	(2.192)	(2.226)	(1.160)	(1.164)	(1.153)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear	Quadratic		Linear	Quadratic		Linear	Quadratic
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.065	.065	.065	.158	.158	.158	.311	.311	.311
No. of Obs.	19,972	19,972	19,972	10,124	10,124	10,124	14,809	14,809	14,809
No. of Clusters	51	51	51	50	50	50	51	51	51
R-Squared	.01	.02	.03	.02	.03	.04	.02	.02	.03

Notes. This table shows panel estimates using restricted cubic splines with four knots placed at the 5th, 35th, 65th, and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating stock ownership. Household data is from the PSID for the period 1999-2011. The coefficient on "Log exemptions" corresponds to the linear term, and the ones on "Log exemption"' and "Log exemption"" capture nonlinearities. The "Test of nonlinearity" is a test of H_0 : Log exemptions' = Log exemptions" = 0. The sample is split by home equity terciles, defined based on the within-state home equity distribution by marital status. Demographic and state-level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Figure 3: Regressions of stock market participation using restricted cubic splines: Marginal effects at various exemption levels

By home equity level



Notes. The figures show the marginal effects of exemptions on stock ownership estimated using restricted cubic splines and the same specifications as in columns 1, 4 and 7 of Table 4, Panel B. The dependent variable is a dummy indicating ownership of stocks outside retirement accounts. Household data is from the PSID for the period 1999-2011. All marginal effects are plotted for various levels of log homestead plus wildcard exemptions and are estimated at the means of the remaining covariates. The vertical dotted lines represent each of the four knots placed at the 5th, 35th, 65th, and 95th percentiles. These are equally spaced percentiles of the exemption's marginal distribution recommended by Harrell (2001) when the number of knots is four. 90% confidence intervals are obtained by clustering the standard errors at the state level.

Table 5: Sample selection: Effect of exemptions from the state of residence in the year that the household joined the sample

	All the sample		Home owners		By home equity level					
					Bottom		Middle		Top	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log exemptions	.013	.019	.006	.030	-.007	-.016	.024*	.008	.035**	.065***
	(.011)	(.015)	(.017)	(.022)	(.011)	(.016)	(.014)	(.022)	(.013)	(.020)
Log exemptions'	-.074	-.189*	-.053	-.245**	.081	.097	-.050	-.115	-.290***	-.504***
	(.074)	(.101)	(.082)	(.106)	(.068)	(.096)	(.090)	(.121)	(.099)	(.133)
Log exemptions"	.164	.506**	.101	.860***	-.233	-.284	.045	.595*	.662**	1.257***
	(.183)	(.236)	(.237)	(.279)	(.186)	(.256)	(.301)	(.350)	(.264)	(.316)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.167	.167	.282	.282	.065	.065	.158	.158	.311	.311
No. of Obs.	44,905	44,905	17,856	17,856	19,972	19,972	10,124	10,124	14,809	14,809
No. of Clusters	51	51	51	51	51	51	51	51	51	51
R-Squared	.01	.01	.02	.02	.01	.02	.02	.03	.02	.02

Notes. This table shows the results of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th, and 95th percentiles of the log exemption distribution. Each household is assigned the state reported at the time of joining the sample. The dependent variable is a dummy indicating ownership of stocks outside retirement accounts. Household data is from the PSID for the period 1999-2011. In columns 3 and 4 the sample is restricted to households that were always home owners. In columns 5 to 10 the sample is split by home equity tercile as in Table 4. Demographic and state-level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 6: Dynamic effects of exemptions on stock ownership

	By home equity level								
	Bottom			Middle			Top		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Low exemptions (t+1)	-.004	-.011*	-.003	.028	.006	.008	-.041*	-.044*	-.015
	(.006)	(.006)	(.010)	(.020)	(.022)	(.039)	(.023)	(.023)	(.022)
Middle exemptions (t+1)	.023*	.018	.032*	-.018	-.032	-.007	.003	-.010	.025
	(.012)	(.015)	(.017)	(.025)	(.030)	(.038)	(.023)	(.022)	(.021)
High exemptions (t+1)	-.019	-.073	-.142**	-.095**	-.084	-.273*	.097	.025	-.009
	(.054)	(.063)	(.071)	(.040)	(.097)	(.160)	(.076)	(.124)	(.149)
Low exemptions (t)	-.005	-.003	.018	-.018	-.009	.014	.051**	.057**	.082**
	(.009)	(.010)	(.016)	(.027)	(.030)	(.059)	(.020)	(.023)	(.035)
Middle exemptions (t)	.002	-.006	-.005	.036	.007	.012	-.056**	-.072**	-.062**
	(.015)	(.016)	(.013)	(.023)	(.027)	(.064)	(.025)	(.030)	(.024)
High exemptions (t)	.035	.031	.073	.159***	.201***	.108	-.003	.053	.146
	(.032)	(.030)	(.066)	(.039)	(.052)	(.151)	(.051)	(.051)	(.106)
Low exemptions (t-1)	.011	.009	-.004	.030	.057	.090	-.031	.004	-.014
	(.012)	(.014)	(.019)	(.023)	(.042)	(.088)	(.025)	(.028)	(.036)
Middle exemptions (t-1)	-.010	-.010	.002	-.036	-.063**	-.063	.013	-.020	-.013
	(.018)	(.019)	(.025)	(.024)	(.026)	(.089)	(.026)	(.033)	(.059)
High exemptions (t-1)	-.021	-.047*	-.005	-.127***	.005	-.043	.004	.031	.060
	(.019)	(.025)	(.023)	(.037)	(.039)	(.081)	(.032)	(.037)	(.050)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Y	Y		Y	Y		Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
No. of Obs.	13,834	13,834	13,834	7,334	7,334	7,334	10,741	10,741	10,741
No. of Clusters	51	51	51	50	50	50	51	51	51
R-Squared	.02	.02	.03	.02	.03	.04	.02	.03	.03

Notes. This table shows the results of estimating panel models using restricted cubic splines with four knots for the lead, the contemporaneous and the lagged value of log exemptions. The dependent variable is a dummy indicating stock ownership. Household data is from the PSID for the period 1999-2009. The sample is split by home equity terciles, defined based on the within-state home equity distribution by marital status. Demographic and state-level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 7: Effects of state background variables on bankruptcy exemption levels

	Homestead + wildcard exemption					
	(1)	(2)	(3)	(4)	(5)	(6)
House price (t)	-.096	1.067**	1.143**	-1.073	.585	.718
	(1.308)	(.460)	(.458)	(1.365)	(.583)	(.659)
House price (t-1)				.010	.009**	.006
				(.007)	(.003)	(.004)
Unemployment rate (t)	-.209	.141**	.125**	-.105	.088	.089**
	(.200)	(.066)	(.056)	(.168)	(.058)	(.043)
Unemployment rate (t-1)				-.092	.051	.000
				(.122)	(.060)	(.079)
Proprietor employment (t)	.487***	-.071	-.023	.710	-.160	-.101
	(.147)	(.067)	(.064)	(.530)	(.103)	(.100)
Proprietor employment (t-1)				-.243	.107	.091
				(.555)	(.107)	(.108)
Per capita personal income (t)	6.575	-.468	-.880	12.848	-5.992	-6.433
	(5.584)	(3.448)	(4.743)	(15.069)	(4.587)	(6.571)
Per capita personal income (t-1)				-6.567	5.858	6.001
				(15.273)	(4.747)	(5.444)
State GDP (t)	-1.128***	.140	.026	-.245	.302	.216
	(.350)	(.163)	(.158)	(.569)	(.205)	(.228)
State GDP (t-1)				-.915	-.194	-.217
				(.685)	(.210)	(.223)
Non-business filings (t)	-.144	.095**	.072**	-.103	.052	.046*
	(.142)	(.037)	(.030)	(.084)	(.034)	(.027)
Non-business filings (t-1)				-.048	.056	.009
				(.103)	(.049)	(.055)
Per capita medical expenses (t)			35.134			3.549
			(33.544)			(61.029)
Per capita medical expenses (t-1)						27.503
						(51.145)
Couples	.133**	.151***	.153***	.132**	.155***	.153***
	(.050)	(.031)	(.031)	(.050)	(.032)	(.032)
Year FE	Y	Y	Y	Y	Y	Y
State FE		Y	Y		Y	Y
No. of Obs.	697	697	596	697	697	596
R-Squared	.15	.94	.95	.16	.94	.95

Notes. The dependent variable is the log of homestead plus wildcard exemptions (set to $550,000 for households in states with unlimited homestead exemptions). The sample period is 1999-2011, except in columns 3 and 6 where 2011 is excluded because medical expenses data are not available. Only years surveyed in the PSID wealth questionnaires are included. All non-categorical regressors are in logs. The house price index is from Freddie Mac, the unemployment rate is from the Bureau of Labor Statistics, and proprietor employment, per capita personal income and real GDP are from the Bureau of Economic Analysis. Per capita medical expenses are from the Centers for Medicare & Medicaid Services. The total per capita number of non-business bankruptcy filings (in 1,000's) is from the Statistics Division of the Administrative Office of the United States Courts. Couples is a dummy taking value one for exemption levels corresponding to couples. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 8: Heterogeneous effects on stock market participation

Panel A. Piecewise-linear splines

	By self-employment status						By health status	
			Incorporated		Unincorporated			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Low exemptions x Self-employed	.080	.085	-.009	-.012	.214	.224*		
	(.067)	(.065)	(.063)	(.063)	(.131)	(.133)		
Middle exemptions x Self-employed	-.143**	-.138**	-.160**	-.155**	-.192**	-.191**		
	(.060)	(.060)	(.063)	(.067)	(.088)	(.087)		
High exemptions x Self-employed	.048	.047	-.005	-.015	.109	.121		
	(.068)	(.068)	(.064)	(.067)	(.094)	(.091)		
Low exemptions x Bad health							.007	.006
							(.021)	(.023)
Middle exemptions x Bad health							.047	.046
							(.029)	(.029)
High exemptions x Bad health							-.057**	-.059**
							(.025)	(.026)
Low exemptions	.019***	.020**	.023***	.021*	.016**	.016	.023***	.024**
	(.006)	(.010)	(.007)	(.011)	(.007)	(.010)	(.007)	(.011)
Middle exemptions	-.006	-.016	-.010	-.018	-.005	-.015	-.011	-.021
	(.010)	(.014)	(.009)	(.013)	(.010)	(.013)	(.010)	(.014)
High exemptions	.017	.043***	.016	.041*	.009	.040***	.015	.047***
	(.017)	(.014)	(.018)	(.021)	(.021)	(.014)	(.020)	(.012)
Self-employed	-.691	-.740	.181	.218	-1.987	-2.090		
	(.642)	(.615)	(.589)	(.589)	(1.257)	(1.279)		
Bad health							-.069	-.059
							(.199)	(.214)
Log income	-.002	-.001	-.000	-.000	-.000	-.000	-.002	-.002
	(.001)	(.001)	(.002)	(.002)	(.001)	(.001)	(.002)	(.002)
Log income'	.001	.001	-.001	-.001	-.001	-.001	.000	.000
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Log income"	1.898***	1.932***	2.235***	2.274***	2.214***	2.257***	1.872***	1.919***
	(.488)	(.498)	(.576)	(.591)	(.510)	(.516)	(.586)	(.592)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.167	.167	.171	.171	.165	.165	.180	.180
No. of Obs.	41,049	41,049	40,557	40,557	42,333	42,333	38,961	38,961
No. of Clusters	51	51	51	51	51	51	51	51
R-Squared	.01	.01	.01	.02	.01	.01	.01	.02

Notes. This table shows the results of estimating panel models using two-knots linear splines. The dependent variable is a dummy indicating stock ownership. Household data is from the PSID for the period 1999-2011. Interaction terms are included for households where the head reports being self-employed (col. 1 and 2), unincorporated self-employed (col. 3 and 4), incorporated self-employed (col. 5 and 6) and for households in bad health (col. 7 and 8). The status is based on reports from the first wave that the household enters into the sample and from the current wave; individuals changing status between waves are excluded. "Bad health" is a dummy taking value one for household's heads that report fair or poor health and zero otherwise. Demographic and state level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 8: Heterogeneous effects on stock market participation

Panel B. Restricted cubic splines

	By self-employment status						By health status	
			Incorporated		Unincorporated			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log exemptions x Self-employed	.104	.108	-.011	-.020	.288*	.302*		
	(.083)	(.080)	(.077)	(.077)	(.170)	(.172)		
Log exemptions' x Self-employed	-.970*	-.966*	-.540	-.480	-1.907**	-1.958**		
	(.516)	(.508)	(.475)	(.495)	(.936)	(.938)		
Log exemptions" x Self-employed	2.281*	2.260*	1.313	1.165	4.387**	4.506**		
	(1.205)	(1.189)	(1.111)	(1.165)	(2.106)	(2.103)		
Log exemptions x Bad health							.001	-.001
							(.028)	(.030)
Log exemptions' x Bad health							.220	.220
							(.226)	(.237)
Log exemptions" x Bad health							-.637	-.637
							(.548)	(.571)
Log exemptions	.022**	.028**	.026**	.027*	.017*	.020	.025***	.031**
	(.008)	(.014)	(.010)	(.015)	(.009)	(.013)	(.009)	(.014)
Log exemptions'	-.102	-.186*	-.128*	-.185*	-.072	-.142	-.127*	-.211**
	(.074)	(.107)	(.074)	(.107)	(.073)	(.098)	(.069)	(.096)
Log exemptions"	.232	.473*	.285	.464*	.153	.369	.283	.535**
	(.179)	(.255)	(.179)	(.255)	(.181)	(.227)	(.169)	(.223)
Self-employed	-.900	-.943	.218	.299	-2.661	-2.800*		
	(.785)	(.755)	(.710)	(.716)	(1.620)	(1.639)		
Bad health							-.012	.005
							(.264)	(.283)
Log income	-.002	-.001	-.000	-.000	-.000	-.000	-.002	-.002
	(.001)	(.001)	(.002)	(.002)	(.001)	(.001)	(.002)	(.002)
Log income'	.001	.001	-.001	-.001	-.001	-.001	.000	.000
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
Log income"	1.893***	1.929***	2.232***	2.272***	2.208***	2.249***	1.869***	1.915***
	(.488)	(.499)	(.574)	(.589)	(.510)	(.516)	(.586)	(.592)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.167	.167	.171	.171	.165	.165	.180	.180
No. of Obs.	41,049	41,049	40,557	40,557	42,333	42,333	38,961	38,961
No. of Clusters	51	51	51	51	51	51	51	51
R-Squared	.01	.01	.01	.02	.01	.01	.01	.02

Notes. This table shows the results of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating stock ownership. Household data is from the PSID for the period 1999-2011. Interaction terms are included for households where the head reports being self-employed (col. 1 and 2), unincorporated self-employed (col. 3 and 4), incorporated self-employed (col. 5 and 6) and for households in bad health (col. 7 and 8). The status is based on reports from the first wave that the household enters into the sample and from the current wave; individuals changing status between waves are excluded. "Bad health" is a dummy taking value one for household's heads that report fair or poor health and zero otherwise. Demographic and state level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 9: Panel regressions of holdings of other unprotected and protected assets

Panel A. Ownership of safe liquid assets

	All the sample		Home owners		By home equity level					
					Bottom		Middle		Top	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log exemptions	-.003	-.021*	-.020	-.020	.010	-.017	.004	.011	-.032***	-.055***
	(.009)	(.010)	(.013)	(.018)	(.020)	(.020)	(.018)	(.021)	(.010)	(.013)
Log exemptions'	.005	.001	.099	-.031	-.132	-.138	-.054	-.151	.211***	.242***
	(.058)	(.066)	(.082)	(.097)	(.092)	(.099)	(.108)	(.173)	(.058)	(.088)
Log exemptions"	-.030	.007	-.258	.115	.310	.441*	.103	.370	-.459***	-.499**
	(.142)	(.157)	(.219)	(.265)	(.237)	(.247)	(.329)	(.538)	(.141)	(.211)
Log income	-.011***	-.011***	.002	.001	-.011**	-.010**	-.010	-.012	-.007*	-.007*
	(.003)	(.003)	(.005)	(.005)	(.004)	(.004)	(.008)	(.008)	(.004)	(.004)
Log income'	.020***	.020***	.004	.004	.021***	.020***	.017**	.018**	.013***	.012**
	(.004)	(.004)	(.006)	(.006)	(.005)	(.005)	(.008)	(.007)	(.005)	(.005)
Log income"	-2.033***	-1.970***	-1.221	-1.270	-.911	-.693	-.592	-.894	-2.095***	-2.064***
	(.538)	(.537)	(1.132)	(1.143)	(.830)	(.832)	(2.364)	(2.329)	(.642)	(.656)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.736	.736	.884	.884	.600	.600	.817	.817	.865	.865
No. of Obs.	44,905	44,905	17,856	17,856	19,972	19,972	10,124	10,124	14,809	14,809
No. of Clusters	51	51	51	51	51	51	50	50	51	51
R-Squared	.01	.02	.01	.02	.02	.02	.02	.03	.01	.02

Notes. This table shows the result of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating ownership of safe liquid assets. Household data is from the PSID for the period 1999-2011. In columns 3 and 4 the sample is restricted to households that were always home owners. In columns 5 to 10 the sample is split by home equity tercile as in Table 4. Demographic and state level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 9: Panel regressions of holdings of other unprotected and protected assets

Panel B. Housing

	Own house		Log of home equity							
			Home owners		Home owners by home equity level					
					Bottom		Middle		Top	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log exemptions	.020*	.027**	.027	-.050	-3.151**	-2.306	.034	.111	.002	-.056
	(.011)	(.011)	(.105)	(.154)	(1.284)	(1.555)	(.131)	(.151)	(.125)	(.148)
Log exemptions'	-.110	-.121	-.474	-.362	14.666**	9.804	-.252	-.840	-.452	-.232
	(.085)	(.079)	(.602)	(.861)	(6.542)	(7.026)	(.561)	(.910)	(.633)	(.856)
Log exemptions"	.215	.217	1.160	1.087	-35.789**	-23.289	.783	2.444	1.185	.684
	(.193)	(.186)	(1.298)	(2.009)	(16.065)	(16.726)	(1.598)	(2.929)	(1.360)	(1.973)
Log income	-.011***	-.011***	-.022	-.027	-.090	-.035	-.066*	-.089**	.012	.012
	(.002)	(.002)	(.020)	(.019)	(.312)	(.325)	(.039)	(.035)	(.022)	(.020)
Log income'	.017***	.017***	.024	.031	.163	.058	.084	.128***	-.016	-.016
	(.003)	(.003)	(.028)	(.027)	(.392)	(.403)	(.055)	(.045)	(.028)	(.027)
Log income"	1.575***	1.587***	3.229	3.183	2.403	38.100	12.471	8.686	6.053*	5.778*
	(.478)	(.480)	(3.082)	(3.215)	(75.328)	(81.285)	(11.663)	(11.532)	(3.409)	(3.306)
Inverse Mills ratio			-.400	.458	2.381	16.060	1.571	5.154*	-5.935*	-5.953*
			(2.822)	(2.859)	(27.366)	(31.885)	(3.799)	(2.749)	(3.331)	(3.506)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
No. of Obs.	44,905	44,905	21,392	21,392	1,594	1,594	7,204	7,204	12,594	12,594
No. of Clusters	51	51	51	51	48	48	50	50	51	51
R-Squared	.07	.08	.07	.07	.07	.13	.06	.08	.11	.12

Notes. This table shows the result of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating home ownership (col. 1 and 2) and the log of home equity (col. 3 to 10). Household data is from the PSID for the period 1999-2011. In columns 3 to 10 the sample is restricted to home owners and I control for sample selection by adding the inverse Mills ratio/non-selection hazard estimated from the participation equation. The exclusion restriction in the participation equation is log wealth in t-1. In columns 5 to 10 the sample is split by home equity tercile as in Table 4. Demographic and state level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 9: Panel regressions of holdings of other unprotected and protected assets

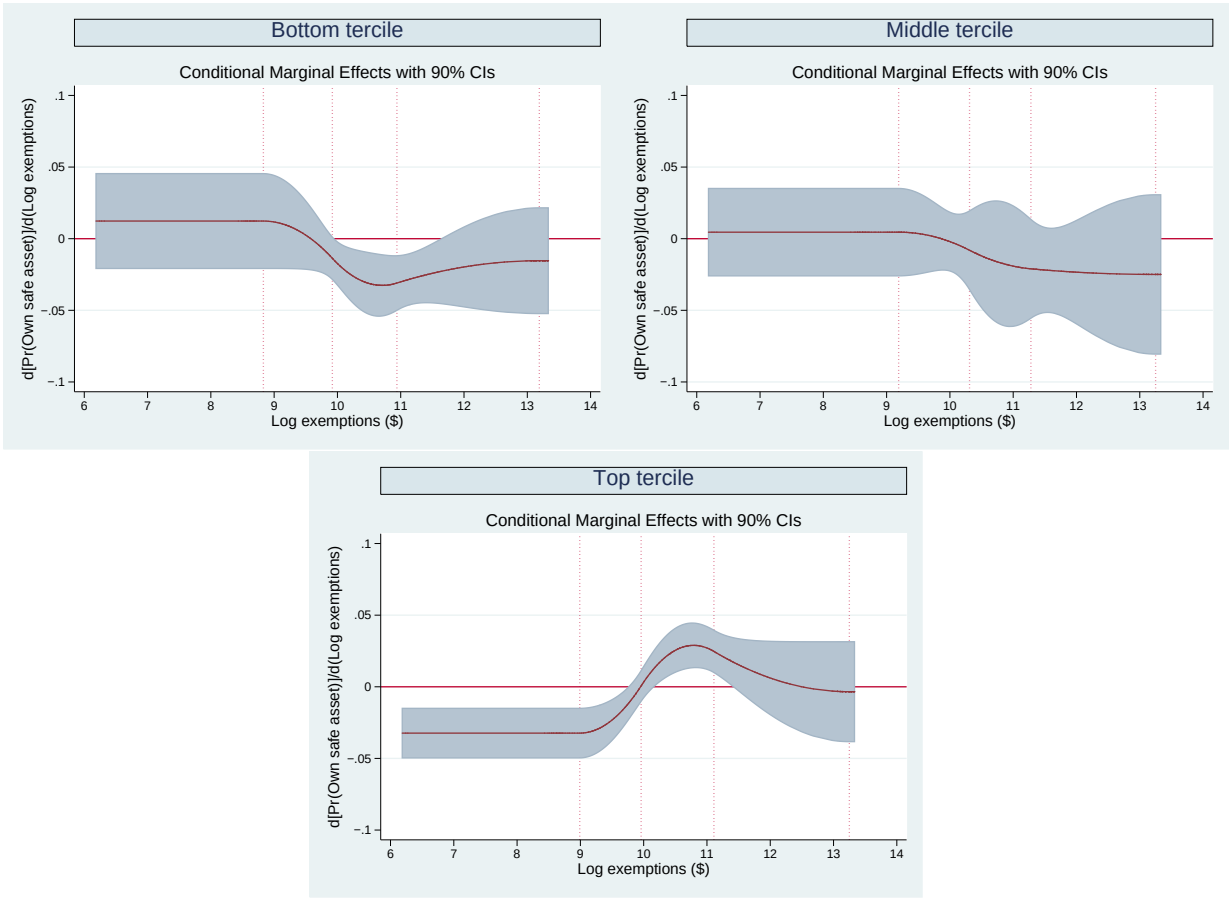
Panel C. Mortgage debt

	All the sample		By home equity level					
			Bottom		Middle		Top	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log exemptions	.031***	.046***	-.000	.022	.035	.085***	.079***	.108***
	(.009)	(.010)	(.017)	(.021)	(.036)	(.025)	(.022)	(.026)
Log exemptions'	-.144*	-.215***	-.115	-.100	-.002	-.354**	-.317**	-.494***
	(.077)	(.074)	(.102)	(.136)	(.203)	(.143)	(.121)	(.148)
Log exemptions"	.238	.432**	.371	.188	-.150	.975**	.499*	1.037***
	(.181)	(.171)	(.291)	(.368)	(.587)	(.445)	(.279)	(.350)
Log income	-.010***	-.010***	.000	-.000	-.024***	-.024***	-.008**	-.008**
	(.002)	(.002)	(.002)	(.002)	(.007)	(.007)	(.004)	(.004)
Log income'	.019***	.019***	.001	.002	.041***	.041***	.015**	.014**
	(.003)	(.003)	(.002)	(.002)	(.008)	(.008)	(.006)	(.006)
Log income"	1.816***	1.822***	3.347***	3.209***	-2.468	-2.264	-.204	-.269
	(.600)	(.610)	(.621)	(.624)	(2.863)	(2.940)	(1.052)	(1.042)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.434	.434	.124	.124	.716	.716	.661	.661
No. of Obs.	44,905	44,905	19,972	19,972	10,124	10,124	14,809	14,809
No. of Clusters	51	51	51	51	50	50	51	51
R-Squared	.06	.06	.07	.09	.06	.08	.03	.04

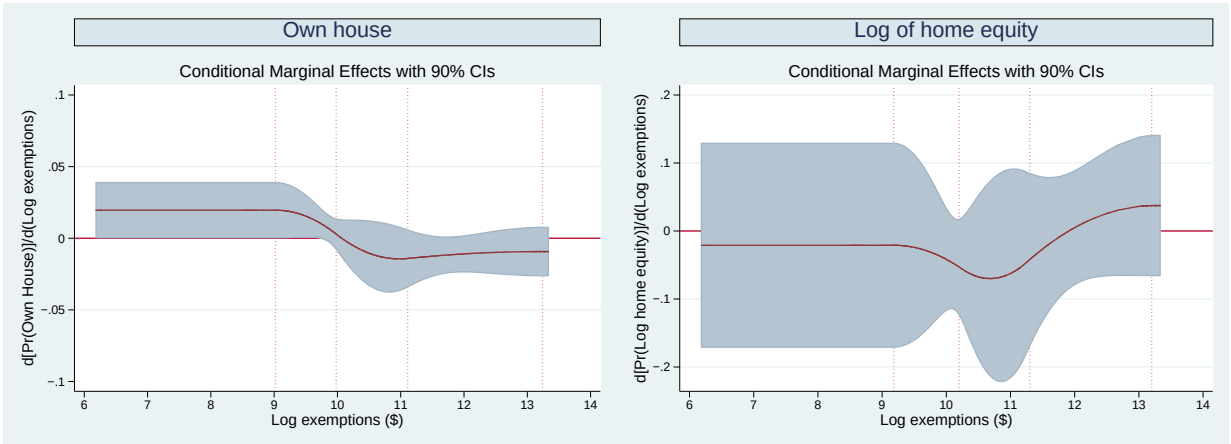
Notes. This table shows the result of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating ownership of mortgage debt. Household data is from the PSID for the period 1999-2011. In columns 3 to 8 the sample is split by home equity tercile as in Table 4. Demographic and state level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Figure 4: Regressions of holdings of other unprotected and protected assets using restricted cubic splines: Marginal effects at various exemption levels

Panel A. Ownership of safe liquid assets by home equity level



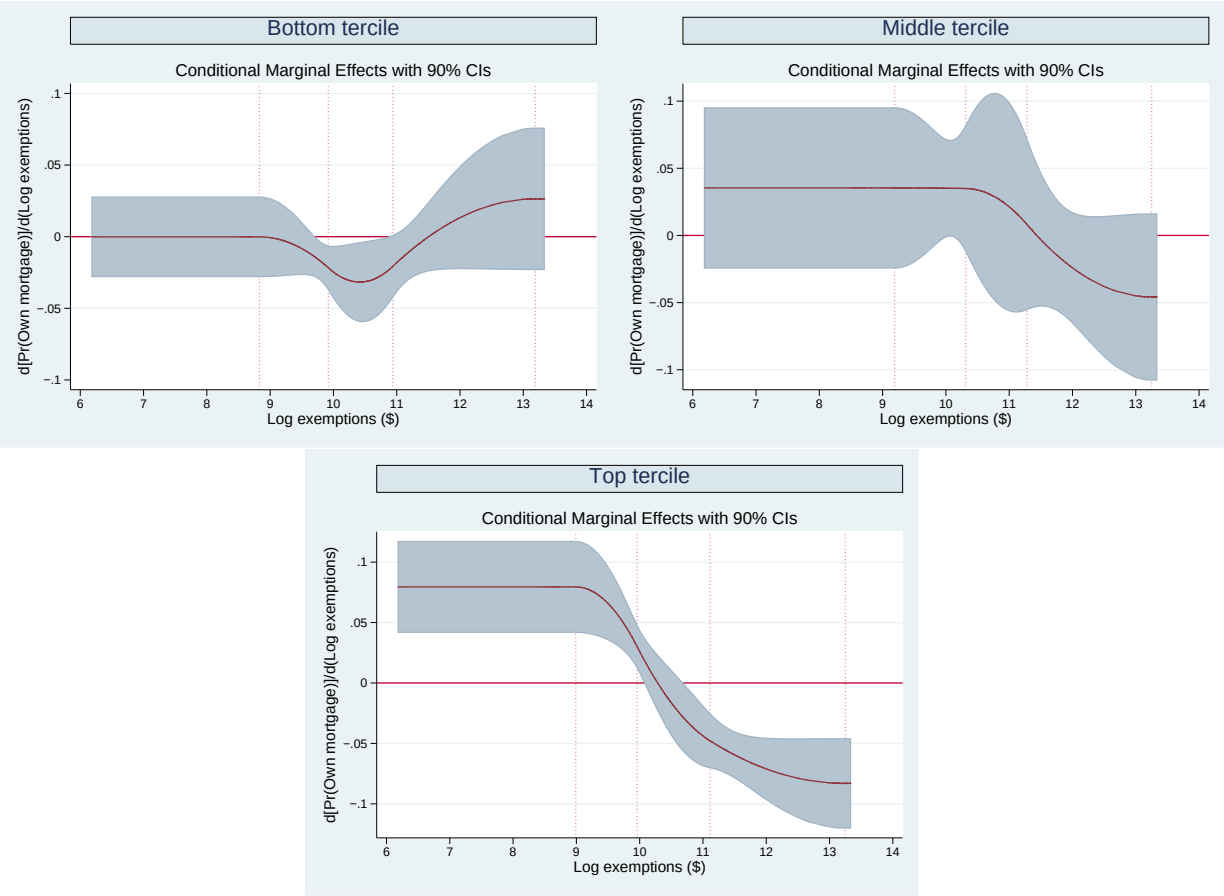
Panel B. Housing



Notes. The figures show the marginal effects of exemptions estimated using the same specification as in columns 5, 7 and 9 of Table 9, Panel A, and in columns 1 and 3 of Panel B. The dependent variables are ownership of safe liquid assets (Panel A) and home ownership and the log of home equity (Panel B). Household data is from the PSID for the period 1999-2011. All marginal effects are plotted for various levels of log homestead plus wildcard exemptions and are estimated at the means of the remaining covariates. The vertical dotted lines represent each of the four knots placed at the 5th, 35th, 65th, and 95th percentiles. These are equally spaced percentiles of the exemption's marginal distribution recommended by Harrell (2001) when the number of knots is four. 90% confidence intervals are obtained by clustering the standard errors at the state level.

Figure 5: Regressions of holdings of other unprotected and protected assets using restricted cubic splines: Marginal effects at various exemption levels (cont.)

Panel C. Ownership of mortgage debt by home equity level



Notes. The figures show the marginal effects of exemptions estimated using the same specification as in columns 3, 5 and 7 of Table 9, Panel C. The dependent variables are ownership of mortgage debt. Household data is from the PSID for the period 1999-2011. All marginal effects are plotted for various levels of log homestead plus wildcard exemptions and are estimated at the means of the remaining covariates. The vertical dotted lines represent each of the four knots placed at the 5th, 35th, 65th, and 95th percentiles. These are equally spaced percentiles of the exemption's marginal distribution recommended by Harrell (2001) when the number of knots is four. 90% confidence intervals are obtained by clustering the standard errors at the state level.

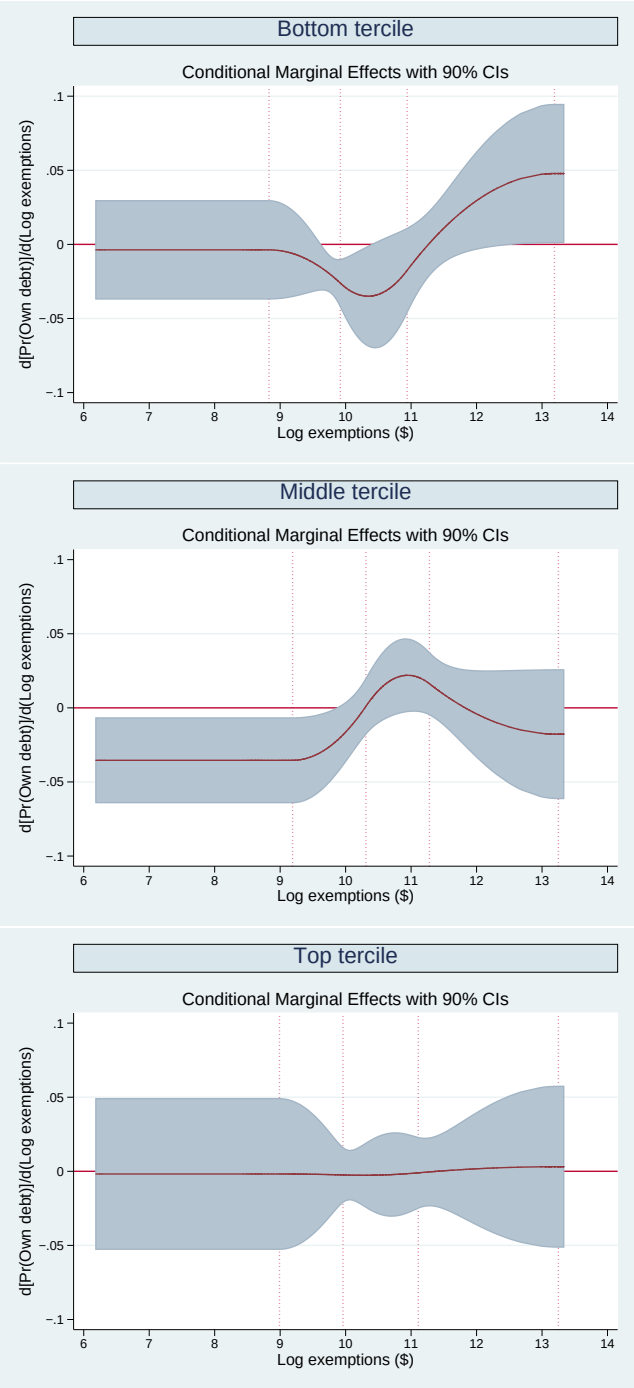
Table 10: Effect of bankruptcy exemptions on debt holdings

	All the sample		Home owners		By home equity level					
					Bottom		Middle		Top	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log exemptions	-.013	-.017	-.023	-.027	-.004	-.030	-.035**	-.024	-.002	.001
	(.013)	(.019)	(.017)	(.030)	(.020)	(.022)	(.017)	(.018)	(.030)	(.036)
Log exemptions'	-.015	-.020	.133	.043	-.120	.041	.160**	.041	-.004	-.110
	(.081)	(.109)	(.088)	(.131)	(.131)	(.140)	(.070)	(.106)	(.154)	(.188)
Log exemptions"	.104	.101	-.360	-.019	.431	-.048	-.441**	.016	.018	.301
	(.188)	(.258)	(.234)	(.370)	(.362)	(.397)	(.207)	(.344)	(.350)	(.485)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.561	.561	.583	.583	.543	.543	.655	.655	.522	.522
No. of Obs.	44,905	44,905	17,856	17,856	19,972	19,972	10,124	10,124	14,809	14,809
No. of Clusters	51	51	51	51	51	51	50	50	51	51
R-Squared	.01	.01	.01	.02	.01	.01	.01	.02	.02	.02

Notes. The table shows the results of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating ownership of non-mortgage debt. Household data is from the PSID for the period 1999-2011. In columns 3 and 4 the sample is restricted to households that were always home owners. In columns 5 to 10 the sample is split by home equity tercile as in Table 4. Demographic and state level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Figure 6: Regressions of debt ownership using restricted cubic splines: Marginal effects at various exemption levels

By home equity level



Notes. The figures show the marginal effects of exemptions estimated using the same specifications as in columns 5, 7 and 9 of Table 10. The dependent variable is a dummy indicating ownership of non-mortgage debt. Household data is from the PSID for the period 1999-2011. All marginal effects are plotted for various levels of log homestead plus wildcard exemptions and are estimated at the means of the remaining covariates. The vertical dotted lines represent each of the four knots placed at the 5th, 35th, 65th, and 95th percentiles. These are equally spaced percentiles of the exemption's marginal distribution recommended by Harrell (2001) when the number of knots is four. 90% confidence intervals are obtained by clustering the standard errors at the state level.

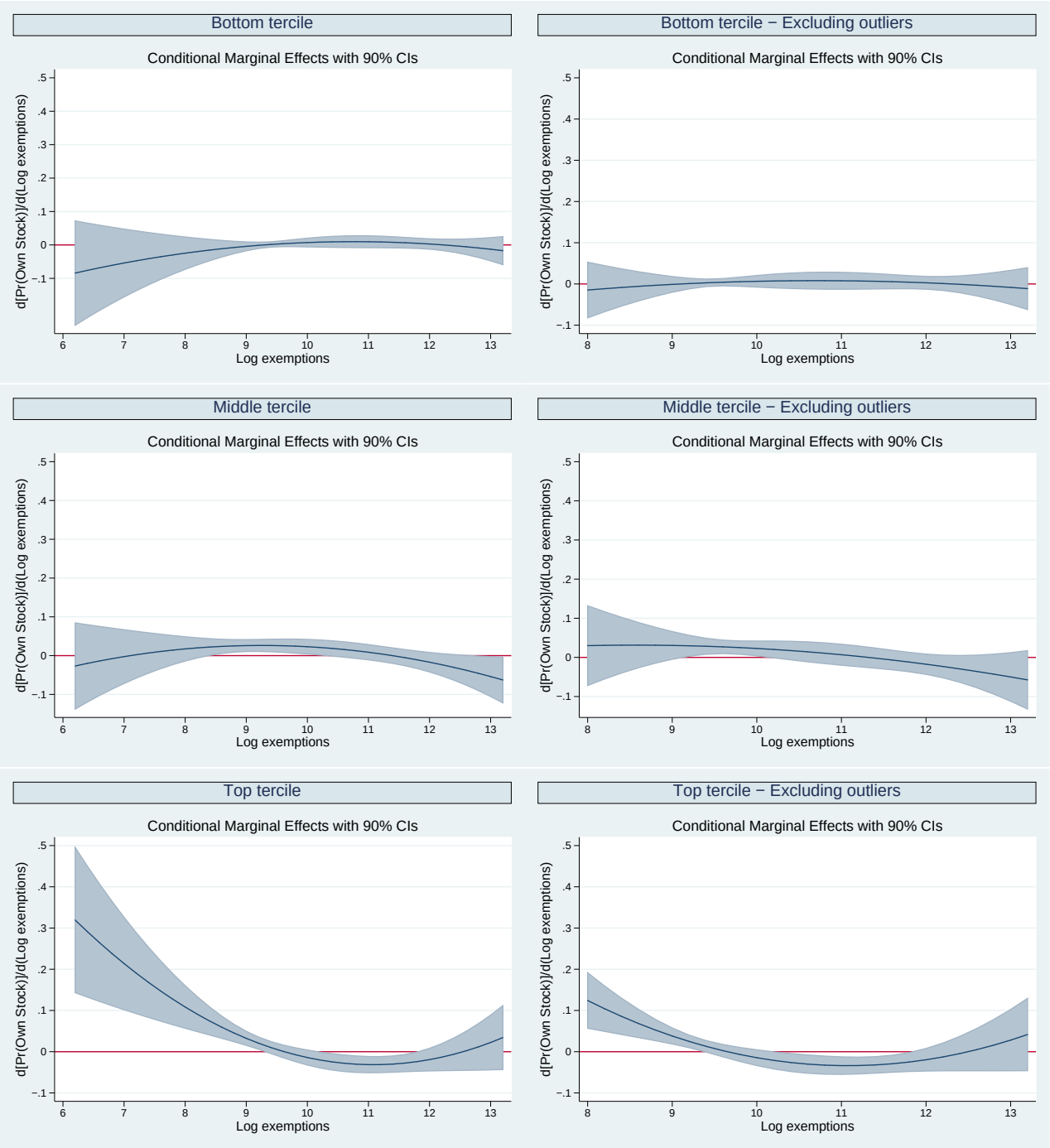
Table 11: Regressions of stock ownership using linear, quadratic and cubic polynomial regressions

	All the sample		Home owners		By home equity level					
					Bottom		Middle		Top	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log exemptions	.487	1.403**	.720	2.984***	-.513	-.202	-.461	1.135**	1.774**	4.425***
	(.366)	(.603)	(.554)	(.610)	(.569)	(.823)	(.457)	(.539)	(.690)	(1.099)
Log exemptions squared	-.043	-.133**	-.061	-.283***	.049	.019	.053	-.124**	-.163**	-.411***
	(.035)	(.058)	(.053)	(.059)	(.054)	(.077)	(.045)	(.052)	(.067)	(.105)
Log exemptions cubed	.001	.004**	.002	.009***	-.002	-.001	-.002	.004**	.005**	.013***
	(.001)	(.002)	(.002)	(.002)	(.002)	(.002)	(.001)	(.002)	(.002)	(.003)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Akaike's information criterion	-7,970	-8,104	3,444	3,348	-20,297	-20,440	-304	-402	3,528	3,439
Mean dependent variable	.167	.167	.282	.282	.065	.065	.158	.158	.311	.311
No. of Obs.	44,905	44,905	17,856	17,856	19,972	19,972	10,124	10,124	14,809	14,809
No. of Clusters	51	51	51	51	51	51	50	50	51	51
R-Squared	.01	.01	.02	.02	.01	.02	.02	.03	.02	.03

Notes. This table shows the results of estimating panel models using polynomial transformations of "Log exemptions", defined as the log of the dollar value of the state homestead plus wildcard exemption, divided by 10,000. The dependent variable is a dummy indicating stock ownership. Household data is from the PSID for the period 1999-2011. In columns 3 and 4 the sample is restricted to households that were always home owners. In columns 5 to 10 the sample is split by home equity tercile as in Table 4. Demographic and state-level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Figure 7: Regressions of stock market participation using cubic polynomials: Marginal effects at various exemption levels

By home equity level



Notes. The figures show the marginal effects on stock ownership from cubic polynomial regressions as estimated in columns 5, 7 and 9 of Table 11. I also plot the marginal effects for the same models excluding 19 observations from Delaware with log exemptions smaller than 8. The dependent variable is a dummy indicating ownership of stocks outside retirement accounts. Household data is from the PSID for the period 1999-2011. All marginal effects are plotted for various levels of log homestead plus wildcard exemptions and are estimated at the means of the remaining covariates. 90% confidence intervals are obtained by clustering the standard errors at the state level.

Table 12: Effects of exemptions on stock ownership before and after the 2005 bankruptcy reform

	All the sample		Home owners		By home equity level					
					Bottom		Middle		Top	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1999-2005										
Log exemptions	.021	.033	-.029	-.030	.000	-.001	.016	.036	.029	.101
	(.021)	(.032)	(.027)	(.056)	(.020)	(.023)	(.046)	(.082)	(.049)	(.093)
Log exemptions'	-.209*	-.304**	-.042	-.634	-.027	-.026	.079	.145	-.155	-.685
	(.113)	(.148)	(.286)	(.394)	(.122)	(.170)	(.377)	(.456)	(.339)	(.568)
Log exemptions"	.617*	.913**	.154	1.576*	.081	.133	-.052	-.133	.337	1.725
	(.308)	(.416)	(.590)	(.837)	(.372)	(.538)	(.758)	(.877)	(.916)	(1.553)
Mean dependent variable	.191	.191	.301	.301	.082	.082	.178	.178	.347	.347
No. of Obs.	23,637	23,637	10,160	10,160	10,415	10,415	5,470	5,470	7,752	7,752
No. of Clusters	51	51	51	51	51	51	51	51	50	50
R-Squared	.01	.01	.01	.02	.02	.03	.03	.05	.01	.02
2005-2011										
Log exemptions	.024**	.031**	.068***	.096***	-.011	-.013	.025	.031	.069***	.095***
	(.010)	(.014)	(.018)	(.030)	(.009)	(.016)	(.021)	(.024)	(.016)	(.023)
Log exemptions'	-.142**	-.164**	-.355***	-.458***	.145**	.115	-.111	-.114	-.500***	-.521***
	(.060)	(.067)	(.077)	(.114)	(.070)	(.108)	(.113)	(.104)	(.093)	(.133)
Log exemptions"	.497**	.599**	1.257***	1.823***	-.416**	-.257	.588	.992	1.566***	1.559***
	(.203)	(.266)	(.268)	(.445)	(.179)	(.279)	(.372)	(.625)	(.308)	(.519)
Mean dependent variable	.147	.147	.261	.261	.058	.058	.151	.151	.276	.276
No. of Obs.	27,572	27,572	10,272	10,272	13,221	13,221	5,435	5,435	8,916	8,916
No. of Clusters	51	51	50	50	51	51	49	49	50	50
R-Squared	.01	.02	.03	.03	.02	.03	.03	.04	.03	.03
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Notes. This table shows the results of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th, and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating ownership of stocks outside retirement accounts. Household data is from the PSID for the period 1999-2005 in the top panel and for 2005-2011 in the bottom panel. In columns 3 and 4 the sample is restricted to households that were always home owners. In columns 5 to 10 the sample is split by home equity tercile as in Table 4. Demographic and state-level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Table 13: Effects of exemptions on stock ownership excluding Arizona, California, Florida and Nevada

	All the sample		Home owners		By home equity level					
					Bottom		Middle		Top	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log exemptions	.016	.026	.018	.053**	-.003	-.005	.019	.016	.046***	.095***
	(.012)	(.018)	(.014)	(.022)	(.014)	(.022)	(.020)	(.025)	(.017)	(.032)
Log exemptions'	-.061	-.186	-.083	-.463**	.042	.006	.081	-.223	-.280**	-.530***
	(.079)	(.122)	(.128)	(.176)	(.088)	(.119)	(.173)	(.190)	(.118)	(.195)
Log exemptions"	.112	.573	.114	1.276***	-.150	-.031	-.373	.929*	.797*	1.697**
	(.234)	(.376)	(.343)	(.460)	(.280)	(.363)	(.463)	(.517)	(.412)	(.679)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
State x time trend		Linear		Linear		Linear		Linear		Linear
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mean dependent variable	.164	.164	.276	.276	.063	.063	.161	.161	.300	.300
No. of Obs.	38,210	38,210	15,418	15,418	16,930	16,930	8,649	8,649	12,631	12,631
No. of Clusters	47	47	47	47	47	47	46	46	47	47
R-Squared	.01	.01	.02	.02	.01	.02	.02	.03	.02	.03

Notes. This table shows the results of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th, and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating ownership of stocks outside retirement accounts. Household data is from the PSID for the period 1999-2011 and excludes the states of Arizona, California, Florida and Nevada. In columns 3 and 4 the sample is restricted to households that were always home owners. In columns 5 to 10 the sample is split by home equity tercile as in Table 4. Demographic and state-level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

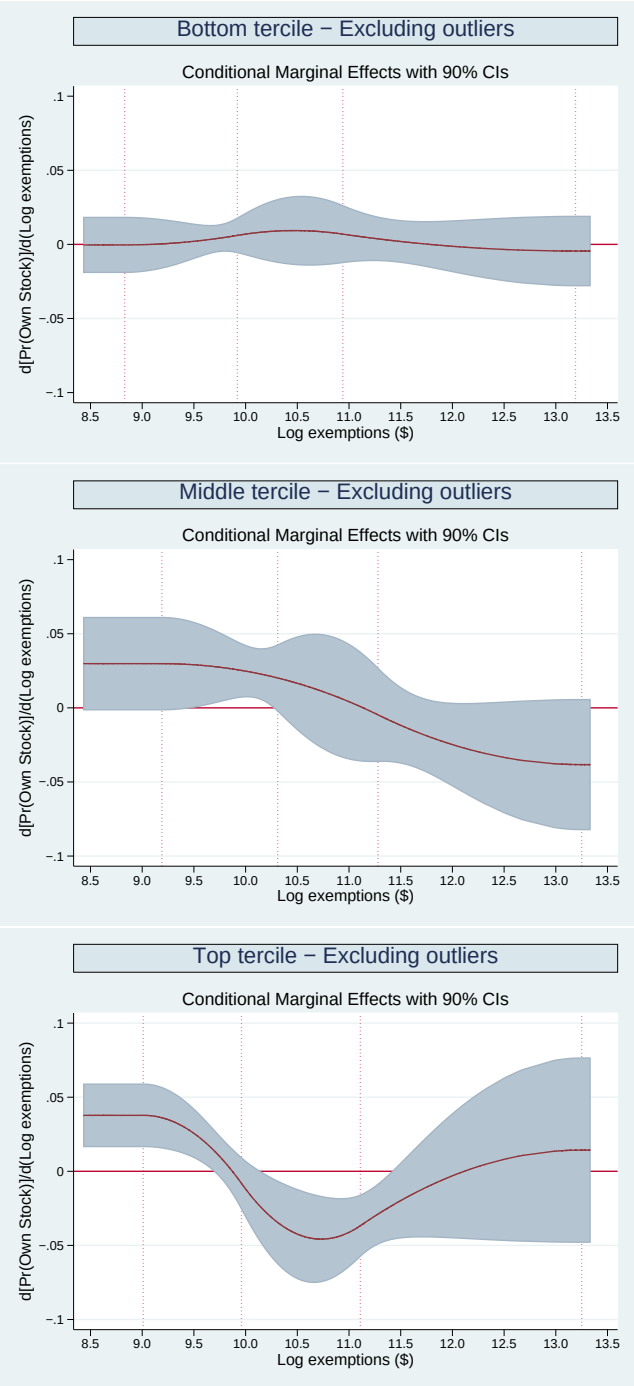
Table 14: Additional robustness checks: Effects of total asset exemptions, use of sample weights and exclusion of outliers

	Total asset exemptions			Weighted regressions			Log exemptions > 8		
	By home equity level			By home equity level			By home equity level		
	Bottom	Middle	Top	Bottom	Middle	Top	Bottom	Middle	Top
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log total exemptions	-.002	.033*	.054***						
	(.011)	(.017)	(.014)						
Log total exemptions'	.044	-.053	-.355***						
	(.080)	(.100)	(.105)						
Log total exemptions"	-.125	.016	.865***						
	(.212)	(.326)	(.305)						
Log exemptions				-.009	.031	.032	-.000	.030	.038***
				(.021)	(.023)	(.020)	(.011)	(.019)	(.013)
Log exemptions'				.092	-.042	-.246*	.034	-.042	-.305***
				(.106)	(.133)	(.128)	(.075)	(.108)	(.106)
Log exemptions"				-.255	.016	.570	-.103	-.005	.683**
				(.268)	(.390)	(.340)	(.204)	(.316)	(.280)
Demographic controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State-level controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Individual FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
No. of Obs.	19,972	10,124	14,809	17,605	9,106	13,394	19,965	10,117	14,804
No. of Clusters	51	50	51	51	49	51	51	50	51
R-Squared	.01	.02	.02	.02	.02	.02	.01	.02	.02

Notes. This table shows the result of estimating panel models using restricted cubic splines with four knots placed at the 5th, 35th, 65th, and 95th percentiles of the log exemption distribution. The dependent variable is a dummy indicating stock ownership. Household data is from the PSID for the period 1999-2011. The measure of total exemptions used in columns 1 to 3 include homestead, wildcard, vehicle and bank deposit exemptions. In columns 4 to 6 the regressions are weighted using the PSID core/immigrant family longitudinal weights from the first wave that the individual enters into the sample. In columns 7 to 9 I drop from the sample observations with log exemptions smaller than 8. In all cases the sample is split by home equity tercile as in Table 4. Demographic and state-level controls are the same as in Table 3. Robust standard errors (clustered at the state level) are in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

Figure 8: Regressions of stock market participation excluding outliers: Marginal effects at various exemption levels

By home equity level



Notes. The figures show the marginal effects on stock ownership estimated using restricted cubic splines and the same specifications as in columns 7, 8 and 9 of Table 14. The dependent variable is a dummy indicating ownership of stocks outside retirement accounts. Household data is from the PSID for the period 1999-2011. All marginal effects are plotted for various levels of log homestead plus wildcard exemptions and are estimated at the means of the remaining covariates. 90% confidence intervals are obtained by clustering the standard errors at the state level.

Appendix

Appendix A. Definitions and sources

Table A.1: Definitions of Household and State Variables

This table summarizes the main household and state variables used in the paper. Except where indicated, all variables are extracted from the Panel Study of Income Dynamics.

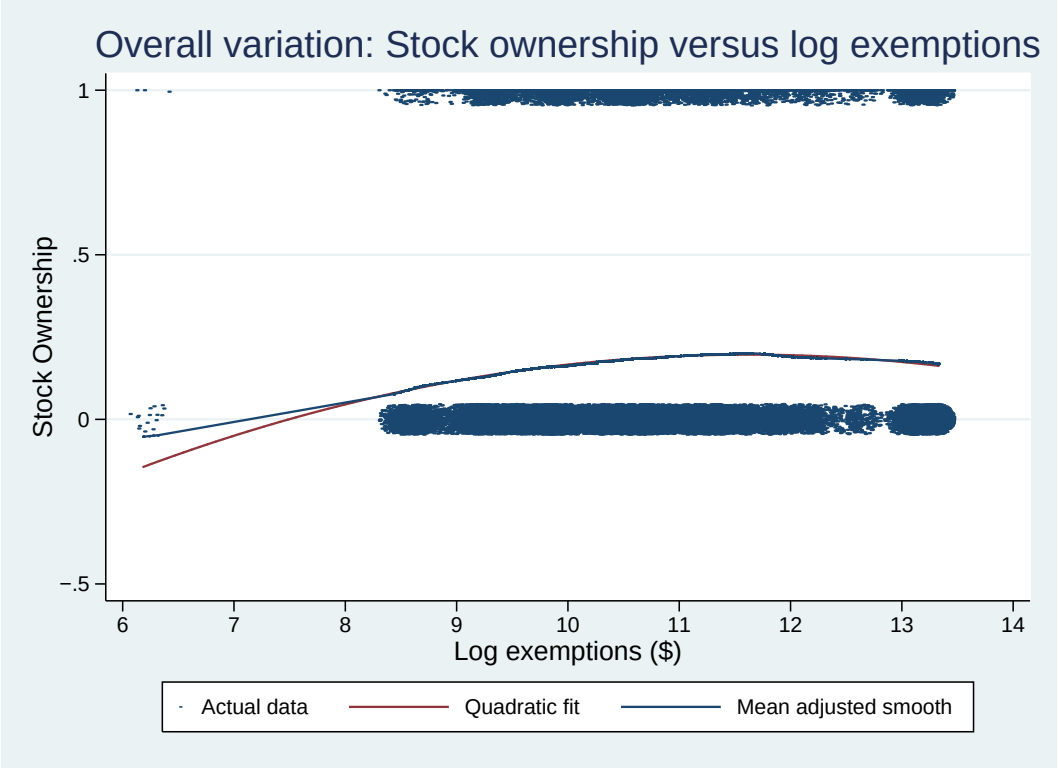
Variable	Description
Stocks	Dollar value of the shares of stock in publicly held corporations, mutual funds, or investment trusts, not including stocks in employer-based pensions or IRAs over liquid assets.
Stock market participation	Dummy variable equal to one if the head or anyone in the family have any stocks.
Stock market entry	Dummy variable equal to one if the household does not hold stocks at year t-1 and enters the risky asset market at year t.
Stock market exit	Dummy variable equal to one if the household holds stocks at time t-1 and exits the risky asset market at year t.
Safe liquid assets ($)	Dollar value of money in checking or savings accounts, money market funds, certificates of deposit, government savings bonds or treasury bills, and other assets (bond funds, cash value in a life insurance policy, a valuable collection for investment purposes, or rights in a trust or estate).
Total liquid assets ($)	Dollar value of stocks plus safe liquid assets.
Income ($)	Dollar value of the head's labor income, plus farm income and the labor portion of business income from unincorporated business, corresponding to the last calendar year.
Home equity ($)	Imputed dollar value of home equity, constructed as value of the home minus mortgage debt.
Retirement account ($)	Imputed dollar value of private annuities and Individual Retirement Accounts (IRAs).
Non-mortgage debt ($)	Dollar value of other debts different than mortgages on the main home and vehicle loans, such as credit card charges, student loans, medical or legal bills, or loans from relatives.
Mortgage debt ($)	Dollar value of the remaining principal currently owed from all mortgages or land contracts on the home.
Self-employed	Dummy variable equal to one if the head of the household is "self-employed only" (excludes those self-employed that also work for someone else).
Unincorporated firm	Dummy variable equal to one if the head of the household is self-employed and owns an unincorporated business. When a firm is unincorporated, its debts are personal liabilities of the firm's owner.

Variable	Description
Incorporated firm	Dummy variable equal to one if the head of the household is self-employed and owns a corporation. Corporate firms are legally separate from their owners, who are not personally responsible for the debts of their corporations.
Bad health	Dummy variable equal to one if the head reports having fair or poor health.
Age of the head	Actual age of the head of the family unit.
Male	Dummy variable equal to one if the head is male.
Years of education	Highest grade or year of school completed by the household head.
Number of children	Number of persons in the family unit under 18 years of age, whether or not they are actually children of the head or wife.
Unemployment	Dummy variable equal to one if the head in the household is currently unemployed.
Married	Dummy variable equal to one if the head in the household is married or has a first-year cohabitor in the family unit.
Retired	Dummy variable equal to one if the head in the household is currently retired.
Size of the family unit	Number of persons in the family unit at the time of the interview.
House price	State-level house price index from Freddie Mac.
Unemployment rate	State-level unemployment rate from the Bureau of Labor Statistics.
Proprietor employment	State-level estimates of nonfarm self-employment, consisting of the number of sole proprietorships and the number of individual business partners not assumed to be limited partners (Bureau of Economic Analysis).
Per capita personal income	Total personal income divided by total midyear population (Bureau of Economic Analysis). I deflate this measure by the NIPA implicit price deflator for personal consumption expentidures (2004 q1 = 100).
State GDP	Real GDP by state in millions of chained 2009 dollars (Bureau of Economic Analysis).
Per capita medical expenses	Personal health care expenditures from the Centers for Medicare & Medicaid Services divided by the total state population.
Non-business bankruptcy filings (per 1,000 inhabitants)	Total number of non-business bankruptcy cases commenced (includes Chapters 7, 11 and 13) from the Statistics Division of the Administrative Office of the United States Courts, divided by the total state population (in 1,000s).

Appendix B. Tests of nonlinearity and choice of the functional form

First, I check graphically whether the relationship between stock ownership and exemptions is nonlinear. Given the size of the dataset, it is hard to visualize it using scatterplots or residual-versus-fitted plots. Thus, I create a scatterplot that shows the relationship between stock ownership and exemptions using data from all panel observations. I add fitted quadratic regression and locally weighted regression curves to the scatterplot. I use a logarithmic transformation of the exemption level since its distribution is positively skewed. Indeed, 75% of the pooled sample corresponds to states with exemptions below $105,000 and the remaining 25% to states with exemptions that vary from $105,000 to $550,000 (or unlimited).

Figure B.1: Overall scatterplot of stock ownership on log exemptions using all observations

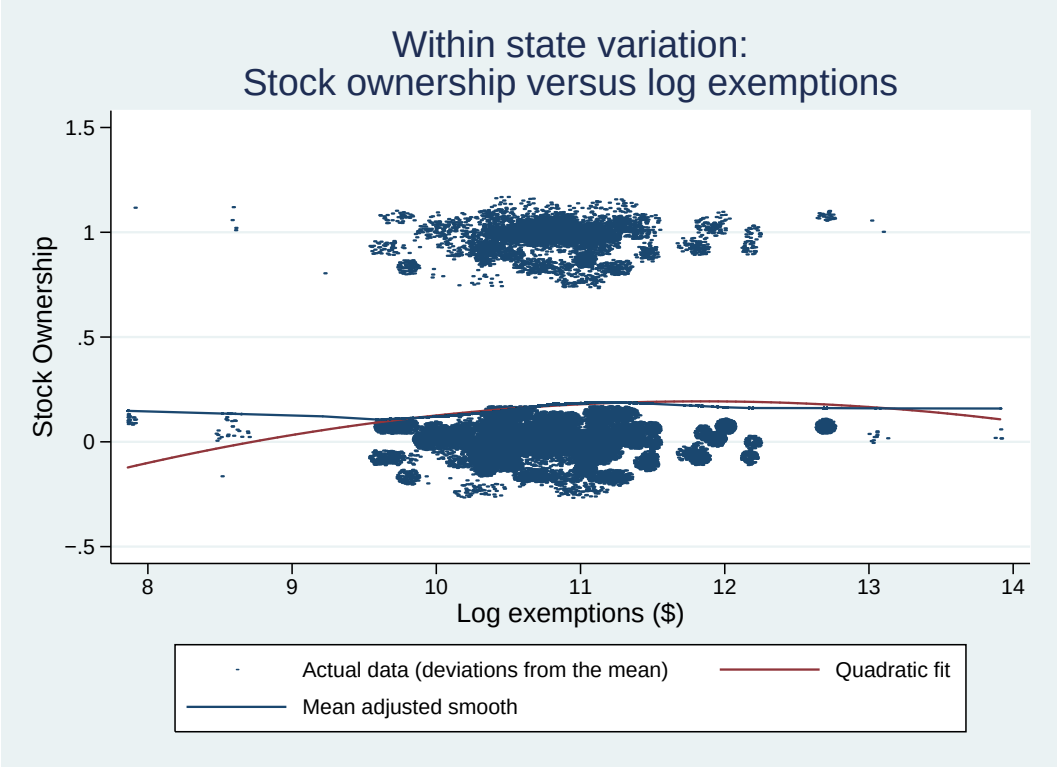


Notes. Each point of the scatterplot represents an individual-year pair. Some noise was added to the data to shift the points around for the visualization of the scatterplot. The red line is fitted by OLS of stock ownership on a quadratic in log exemptions. The line for the mean adjusted smooth is fitted by nonparametric regression using a locally weighted scatterplot smoothing (Cleveland's scatterplot smoother) of stock ownership on log exemptions. The resulting curve is adjusted (by multiplication) so that the mean of the smoothed values equals the mean of the unsmoothed values.

Figure Figure B.1 suggests the presence of moderate nonlinearity, since stock ownership increases with log exemptions until they reach 11-12 ($60,000-160,000) approximately, at which point it becomes flat.

Since my empirical strategy rests on within-state variation, I also plot a within-state scatterplot of stock ownership on log exemptions, expressed in terms of deviations from the means. Figure Figure B.2 shows the values of stock ownership centered on $\overline{Y} = 0.17$ and the values of log exemptions centered on $\overline{X} = 10.8$, which are the unweighted sample means. The graph using within-state variation in the data shows a weaker relationship between stockholdings and exemptions.

Figure B.2: Within-state scatterplot of stock ownership on log exemptions (deviations from the means)



Notes. Each point of the scatterplot represents an individual-year pair expressed in deviations from state means, i.e. $Y_{ist} - \overline{Y_s} + \overline{Y}$ versus $X_{ist} - \overline{X}_s + \overline{X}$. See note in Table A.1 for description of the fitting curves.

Notice that these graphs are only exploratory; the unconditional relationship between exemptions and stock ownership can be misleading if it is capturing heterogeneity across states. To identify the relationship of interest it is necessary to use a multivariate and multivariable framework to control for the influence of other determinants of stock holdings. In particular, in the regression framework I can also control for individual-level, time-invariant heterogeneity.

Next, I use a factor variable approach to detect analytically the presence of nonlinearity. I formulate a logit regression model of stock ownership on exemption treated as a continuous variable and as a factor variable. The latter is feasible since I will use the dollar amounts specified by the bankruptcy law, which take a finite number of integer values. This allows to divide the relationship

between stock ownership and exemptions into two components: the linear relationship and any nonlinear terms. The test of the indicator variables is significant at the 1% level ($\chi^2(130) = 1,668$, $p = 0.000$). This suggests that overall there is a significant contribution of the nonlinear components in the relationship between exemptions and stock ownership.

Polynomial specifications

A common approach to deal with the nonlinearities is the use of a polynomial specification, where exemptions would enter not only linearly but also through a squared term and possibly cubic or of higher power. There are several reasons for why this is not a desirable strategy in this context. First, the polynomial curve has unwanted peaks and valleys. Second, it does not adequately fit "threshold effects", that is, sudden changes in the relationship of interest that occur after certain limit. Third, it is non-local, meaning that the fitted values at one segment of the curve depend strongly on the regressors some distance away. These elements imply that the fitted values at low exemption levels might be influenced by the fitted values at high exemption levels, even when the latter are relatively infrequent in this dataset.

Restricted cubic splines

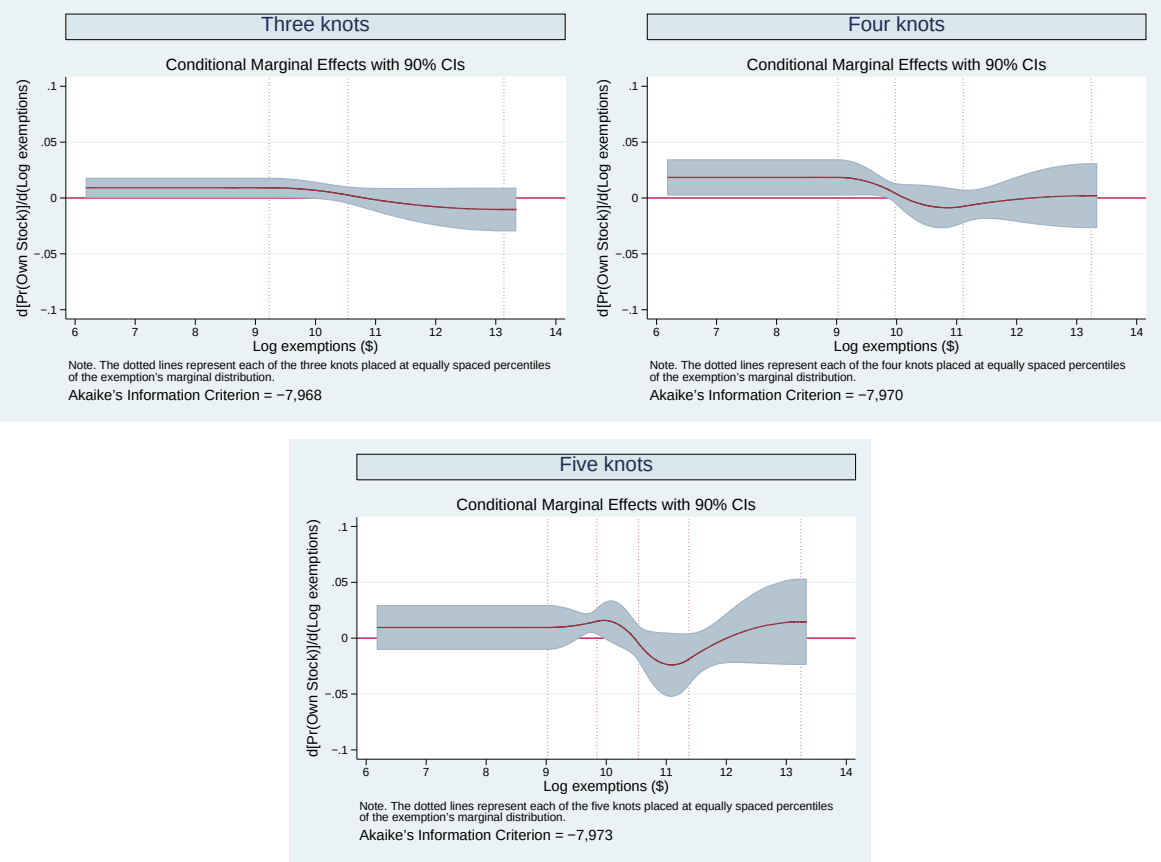
For those reasons, I adopt in my preferred specifications a more flexible approach and estimate a restricted cubic spline regression, which does not present the same drawbacks. In fact, polynomials can be considered a special case of splines without knots. Stone (1986) has noted that the placement of the knots is not as crucial in the case of cubic splines as it is in linear splines. Since in this context there is not a strong a priori basis for the knots' placement, I use the one recommended by Harrell (2001). Thus, I place the knots at equally spaced percentiles of the log exemption's distribution, which ensures that enough observations fall within each interval and prevents outliers having an excessive influence in the knot's location. The fit of the restricted cubic splines depends much more on the number of knots than on their placement. Thus, following Harrell's (2001) advice, I estimate the model with 3 to 5 knots, as represented in Figure B.3.[27] This figure shows that the overall shape of the fitting does not change substantially as we increase the number of knots. Thus, I restrict the number of knots to 4, which seems to provide a good compromise between flexibility and parsimony.

Linear splines

One of the drawbacks of the restricted cubic spline is that the flexibility of the curve comes at the cost of a more difficult interpretation of the results. To obtain point estimates that can be interpreted as regular regression coefficients, I also estimate linear splines.

[27]Farrell (2001) notes that usually the number of knots varies between 3 to 5; often it is 4, for large samples the preferred number is 5 and for small samples is 3.

Figure B.3: Restricted cubic spline regression: Marginal effects with three, four and five knots



They provide a less smooth fitting but preserve other desirable features of the restricted cubic splines and do not suffer from the same drawbacks as the polynomial regression. Since I want a summary measure of the overall effects, I consider only one and two knots for the linear splines. By visual inspection of the cubic splines these numbers seems reasonable to model the relationship between exemptions and stock ownership. The main issue that needs to be addressed in linear splines is that they are very sensitive to where the knots are placed, which is not the case with cubic splines. Thus, I define the optimal knot location by selecting the one that minimizes the residual sum of squares.[28] I start with a guess for the knot placement of 10, based on the inspection of the cubic spline curves, and the automated process yields 10.5. Thus, I set at 10.5 the reference point for the model with one knot. Next, I replicate the same algorithm with initial plausible values of 10 and 11.5, and I get 10 and 11.5 as the values that minimize the residual sum of squares in a two-knot model.

[28]The exact algorithm is based on the one proposed by Mitchell (2012), pp. 109.

In Table B.1 I summarize the coefficients estimated using one and two-knots linear splines. Then I compare them using the Akaike's information criterion (AIC) to choose which of the two models maximizes the model likelihood ratio and therefore fits the data better. I find that the model with two knots performs better (AIC of -7,972 versus -7,969 in the one knot model) and, therefore, this becomes the preferred specification.

Table B.1: Linear piecewise regression model with one and two knots

	One knot	Two knots
	(1)	(2)
	Coefficients	Coefficients
Log exemption < 10.5	.010**	
	(.005)	
Log exemption > 10.5	-.008	
	(.009)	
Log exemption < 10		.017**
		(.007)
Log exemption 10-11.5		-.010
		(.009)
Log exemption > 11.5		.007
		(.017)
Demographic controls	Y	Y
State-level controls	Y	Y
State FE	Y	Y
Year FE	Y	Y
AIC	-7,969	-7,972
No. of Obs.	44,905	44,905
No. of Clusters	51	51
R-Squared	.01	.01

Appendix C. A model of portfolio choice with bankruptcy

Following Gormley et al. (2010), I first present a baseline model that shows how exposure to a large, negative wealth shock affects household savings and investment in risky assets. Then I depart from those authors, who focus on the role of insurance purchased by the household, to study the effects of introducing an implicit insurance as the one from Chapter 7 bankruptcy. For simplicity, I restrict the model to the demand-side without incorporating the general equilibrium effects that would arise when accounting for the response of the lending sector. Thus, the model illustrates the risk and the protection channel that are the most plausible mechanisms in the light of the empirical evidence.

Saving and investment without bankruptcy

I consider a two-period model of household savings and portfolio choice. The household starts the first period with initial wealth W_0. Consumption today and consumption in the next period are denoted by C_0 and C_1 respectively. In the second period the household receives a wealth endowment $\widetilde{W}_1$. This endowment equals the present value of future income, $W_1 \geq 0$, with probability $1-\epsilon$ and the negative wealth shock, $-D < 0$, with probability ϵ. In the first period, the household can consume, save (for example, in home equity) or invest in a risky asset such as a stock. The risky asset has a random gross return given by $\widetilde{R}_1$ that equals $u > 1$ with probability $p > 0$ and $d < 1$ with probability $1-p$. For simplicity, I assume that the stock returns and the income process are uncorrelated and that the interest rate on savings equals zero.

The household's problem in the first period is to choose consumption C_0, savings H, and stock investment α to solve:

$$\max_{C_0,H,\alpha} U(C_0) + \delta E[U(C_1)] \tag{A.1}$$

subject to:

$$H = W_0 - C_0 - \alpha \tag{A.2}$$

$$C_1 = H + \alpha\widetilde{R}_1 + \widetilde{W}_1 \tag{A.3}$$

where:

$$U(C) = \begin{cases} u(C) & \text{if } C \geq \underline{C} \\ -\infty & \text{otherwise} \end{cases} \tag{A.4}$$

and $u(C)$ is strictly increasing and strictly concave for $C \geq \underline{C}$, δ is the subjective time discount rate and $\underline{C}$ is the subsistence level of consumption.

Without loss of generality, as in Gormley et al. (2010) I make the assumption that the magnitude of the negative wealth shock is given by $D = W_0 - 2\underline{C} > 0$. Such a large negative wealth shock can occur if there is an unexpected illness that implies a substantial increase in medical expenses and a large loss of future income. It can also occur if there is a prolonged period of unemployment

leading to a reduction in income that exceeds current wealth.

Proposition 1. *Given a negative wealth shock of size D that has a positive probability of occurrence, the household does not participate in the stock market, i.e. $\alpha^* = 0$. In addition, household consumption is set at the minimum, $C_0^* = \underline{C}$, and the remaining wealth is allocated to savings, $H^* = W_0 - \underline{C}$.*

Proof of Proposition 1:

The household's problem can be written as:

$$\begin{aligned}\max_{C_0,\alpha} U(C_0) + \delta [p(1-\epsilon) U(W_0 - C_0 - \alpha + \alpha u + W_1) + \\ + (1-p)(1-\epsilon) U(W_0 - C_0 - \alpha + \alpha d + W_1) + \\ + p\epsilon U(W_0 - C_0 - \alpha + \alpha u - D) + (1-p)\epsilon U(W_0 - C_0 - \alpha + \alpha d - D)] \quad \text{(A.5)}\end{aligned}$$

Suppose $\alpha > 0$, then it can be shown that if $C_0 \geq \underline{C}$:

$$\begin{aligned} W_0 - C_0 - \alpha + \alpha d - D &= W_0 - C_0 - \alpha + \alpha d - (W_0 - 2\underline{C}) \\ &\leq \underline{C} + \alpha(d-1) \\ &< \underline{C} \end{aligned}$$

Thus, $C_1 < \underline{C}$ in the fifth term in equation (A.5), which as a result equals $-\infty$. Since the other terms are less than $+\infty$, at the optimum it must be $\alpha^* \leq 0$. The same reasoning in the fourth term implies that whenever $\alpha^* \leq 0$, $C_1 < \underline{C}$ and therefore we must have $\alpha^* \geq 0$ to avoid an infinite utility loss. This implies that at the optimum $\alpha^* = 0$.

Given $\alpha^* = 0$, let's suppose that $C_0 > \underline{C}$. Then C_1 in the presence of a wealth shock will be:

$$\begin{aligned} W_0 - C_0 - D &= W_0 - C_0 - (W_0 - 2\underline{C}) \\ &< \underline{C} \end{aligned}$$

Since $U(C) = -\infty$ for any $C < \underline{C}$, we must have $C_0^* = \underline{C}$. Given that $\alpha^* = 0$, from period-zero budget constraint this implies that $H^* = W_0 - \underline{C}$. $\otimes$

Proposition 1 says that if a large wealth shock is expected with a positive probability, the optimal strategy for the household is not participate in the stock market. This result holds even if the probability of the shock is very small and independently of how high are the expected stock return and household's wealth in good states. Any loss in the stock investment would lead to an infinite utility loss if the wealth shock is bad enough. In addition, the household consumes only at the subsistence level and saves as much as possible.

Bankruptcy insurance

I now study how the possibility of declaring bankruptcy affects investment, consumption and saving decisions. To that end I modify the baseline specification and assume that in the bad states of the world it is possible for households not to repay their loans - so that second-period wealth is zero rather than $-D < 0$. In exchange they lose all the investment in risky assets, whereas their savings are protected up to a certain amount. In particular, under the bankruptcy law the individual can guarantee a minimum level of consumption given by H, up to a maximum of X. I will further assume that the bankruptcy protection at least equals the subsistence level of consumption, $X \geq \underline{C}$.

Since the household only lives two periods, I ignore the option value of bankruptcy that needs to be studied in a dynamic setting.[29] Thus, the problem of the household remains the same as in (A.1):

$$\max_{C_0,H,\alpha} U(C_0) + \delta E[U(C_1)] \tag{A.6}$$

whereas the budget constraints become:

$$\begin{aligned} H &= W_0 - C_0 - \alpha && \text{(A.7)} \\ C_1 &= \max\left(C_1^{NB}, C_1^B\right) && \text{(A.8)} \\ C_1^{NB} &= H + \alpha\widetilde{R}_1 + \widetilde{W}_1 && \text{(A.9)} \\ C_1^B &= \min(H, X) && \text{(A.10)} \\ & X \geq \underline{C} && \text{(A.11)} \end{aligned}$$

where C_1^{NB} and C_1^B denote consumption in the non-bankruptcy and bankruptcy states. Equation (A.8) captures the fact that when the stock return and second-period wealth are sufficiently low the optimal strategy is to file for bankruptcy. There is no need to impose a borrowing constraint $H \geq 0$ because the household will optimally never want to have negative consumption in bankruptcy.

In Proposition 2 I state the implications of the model given by (A.6) to (A.11) in terms of participation, savings and consumption. It predicts that the household optimally participates in the stock market in the presence of a consumption floor in bankruptcy. It also shows that consumption is higher and savings are lower than in Proposition 1. However, as exemptions increase, the household is more likely to find bankruptcy optimal and to have their assets fully protected. As a result, it faces less incentives to keep stocks either because of their lower marginal benefit (they are lost in bankruptcy) or their higher marginal cost (investment in stocks crowd-outs savings in protected assets).

[29] In this two period model the only cost of bankruptcy is the loss of seizable assets. Thus, it does not account for the fact that households value the option to declare bankruptcy at some future time and the uninterrupted access to unsecured credit. This needs to be studied in a multi-period model, in which households are willing to trade the immediate benefit of filing in exchange for keeping their option (Lehnert and Maki, 2002).

Proposition 2. *There are four cases to consider. (i) If $H^* \geq X$ and $C_1^{NB*} \geq C_1^{B*}$ in the presence of a wealth shock and high returns, the household optimally participates in the stock market, $\alpha^* > 0$, as long as the risk premium is not negative. In addition, there exists $\overline{W}_1$ and $\underline{\epsilon}$ such that, $\forall W_1 > \overline{W}_1$ and $\epsilon < \underline{\epsilon}$, the optimal time 0 consumption is strictly greater than the subsistence level, $C_o^* > \underline{C}$. (ii) If $H^* \geq X$, consider an increase in the exemption level from X to X' that leads to $C_1^{NB*} < C_1^{B*}$ in the presence of a wealth shock and high returns. For any $\epsilon > 0$, investment in the risky asset is lower and consumption is higher than in (i). (iii) If $C_1^{NB*} \geq C_1^{B*}$ in the presence of a wealth shock* and high returns, *consider an increase in the exemption level from X to X'' that leads to $H^* < X''$. For any $\epsilon > 0$, investment in the risky asset and consumption are lower than in (i). (iv) If $C_1^{NB*} < C_1^{B*}$ in the presence of a wealth shock and high returns, consider an increase in the exemption level from X' to X''' that leads to $H^* < X'''$. For any $\epsilon > 0$, investment in the risky asset and consumption are lower than in (ii).*

Proof of Proposition 2.

In the presence of bankruptcy protection, the household problem can be written as:

$$\begin{aligned}\max_{C_0,\alpha} U(C_0) + \delta \{ & p(1-\epsilon) U(W_0 - C_0 - \alpha + \alpha u + W_1) + \\ & + (1-p)(1-\epsilon) U(W_0 - C_0 - \alpha + \alpha d + W_1) + \\ & + p\epsilon U(\max[W_0 - C_0 - \alpha + \alpha u - D, \min(W_0 - C_0 - \alpha, X)]) + \\ & + (1-p)\epsilon U(\min(W_0 - C_0 - \alpha, X))\} \quad \text{(A.12)}\end{aligned}$$

At the optimum, the household chooses $C_0^* \geq \underline{C}$ and $H^* \geq \underline{C}$ so that the utility floor in every period is given by $U(\underline{C})$. The last term in expression (A.12) captures the fact that the household has to file for bankruptcy if it experiences the negative wealth shock and faces low stock returns. Instead, in the fourth term where the stock return is high, it does not file for bankruptcy if the total stock investment including its return, $\alpha^* u$, is larger than the wealth shock, D. Thus, C_1^{NB*} can be above or below than C_1^{B*} in the fourth term. This, and the fact that savings can be above and below X in the last two terms, implies that there are four cases to consider.

i) When $H^* \geq X$ and $C_1^{NB*} \geq C_1^{B*}$ in the fourth term, the first derivative of the objective function in (A.12) with respect to α, evaluated at $\alpha = 0$, is given by:

$$[pu + (1-p)d - 1](1-\epsilon) U'(W_0 - C_0 + W_1) + \epsilon p(u-1) U'(W_0 - C_0 - D) \quad \text{(A.13)}$$

If the risk premium $(pu + (1-p)d - 1) \geq 0$, the expression in (A.13) is positive for any $C_0 = C_0^*$ given that the utility function is strictly increasing. Therefore, $\alpha^* > 0$ when the risk premium is not negative. Moreover, since $[pu + (1-p)d - 1] U'\left(C_1^{NB}\right) < p(u-1) U'\left(C_1^{B}\right)$, the optimal value of α^* is increasing in ϵ.

The first derivative of the objective function in (A.12) with respect to C_0 is given by:

$$U'(C_0) - \delta\{p(1-\epsilon)U'(W_0 - C_0 - \alpha + \alpha u + W_1) + \\ + (1-p)(1-\epsilon)U'(W_0 - C_0 - \alpha + \alpha d + W_1) + \\ + p\epsilon U'(W_0 - C_0 - \alpha + \alpha u - D)\} \quad \text{(A.14)}$$

As W_1 grows to infinity and ϵ approaches 0, the expression in (A.14) approaches $U'(C_0) > 0$. This implies that C_0^* must be greater than any $C_0 = \underline{C}$.

ii) When $H^* \geq X$ and $C_1^{NB*} < C_1^{B*}$ in the fourth term of the objective function, the last term in (A.13) drops. Since that term is positive, the optimal decision is $\alpha^* > 0$ when $(pu + (1-p)d - 1) > 0$, but $\alpha^* = 0$ if the risk premium is zero. In addition, α^* will be smaller than in part (i) because now the marginal benefit of holding stocks in bankruptcy is zero rather than positive. But if ϵ approaches 0, then the value of α^* does not change.

In turn, the last term from the first-derivative in (A.14) also drops. Thus, as W_1 grows to infinity, the expression in (A.14) approaches $U'(C_0) > 0$ for any ϵ and C_0^* must be greater than any $C_0 = \underline{C}$. Since now the marginal cost of time 0 consumption declines to 0, C_0^* is larger than in case (i). However, if ϵ approaches 0, C_0^* remains the same.

iii) When $H^* < X$ and $C_1^{NB*} \geq C_1^{B*}$ in the fourth term of the objective function, the optimal decision must be $\alpha^* > 0$, otherwise $C_1^{NB*} < C_1^{B*}$. In particular, the condition $C_1^{NB*} \geq C_1^{B*}$ implies that $\alpha^* \geq D/u$. The first derivative of (A.12) with respect to α, evaluated at $\alpha = 0$, is given by:

$$[pu + (1-p)d - 1](1-\epsilon)U'(W_0 - C_0 + W_1) + p\epsilon(u-1)U'(W_0 - C_0 - D) \\ - (1-p)\epsilon U'(W_0 - C_0) \quad \text{(A.15)}$$

If $(pu + (1-p)d - 1) \geq 0$ and p is sufficiently large, the condition (A.15) is positive since $U'(W_0 - C_0 - D) > U'(W_0 - C_0)$. Given that the last term in (A.15) is negative, α^* will be smaller than in part (i) except when ϵ approaches 0.

In turn, the first derivative of the objective function in (A.12) with respect to C_0 is given by:

$$U'(C_0) - \delta\{p(1-\epsilon)U'(W_0 - C_0 - \alpha + \alpha u + W_1) + \\ + (1-p)(1-\epsilon)U'(W_0 - C_0 - \alpha + \alpha d + W_1) + \\ + p\epsilon U'(W_0 - C_0 - \alpha + \alpha u - D) + (1-p)\epsilon U'(W_0 - C_0 - \alpha)\} \quad \text{(A.16)}$$

Unless ϵ approaches 0, now the marginal cost of time 0 consumption is larger and therefore C_0^* is smaller than in part (i).

iv) When $H^* < X$ and $C_1^{NB*} < C_1^{B*}$ in the fourth term of the objective function, the first derivative of (A.12) with respect to α, evaluated at $\alpha = 0$, is given by:

$$[pu + (1-p)\,d - 1]\,(1-\epsilon)\,U'\,(W_0 - C_0 + W_1) - \epsilon U'\,(W_0 - C_0) \tag{A.17}$$

As ϵ approaches 0, if the risk premium $(pu + (1-p)\,d - 1) > 0$, the expression in (A.17) is positive for any $C_0 = C_0^*$, which implies that $\alpha^* > 0$. More generally, that result holds for any ϵ whenever the risk premium is larger than the ratio of the expected marginal utilities in bankruptcy to non-bankruptcy, $\epsilon U'\,(W_0 - C_0)\,/\,(1-\epsilon)\,U'\,(W_0 - C_0 + W_1)$. In particular, as W_1 grows sufficiently large, this condition is less likely to be met for a given $\epsilon > 0$. The optimal value of α is smaller than in part (ii) because, even if the stock return is high, all the stock investment is lost in bankruptcy. But if ϵ approaches 0, then the value of α^* does not change.

The first derivative of the objective function in (A.12) with respect to C_0 is given by:

$$\begin{aligned} U'\,(C_0) - \delta\,\{&p\,(1-\epsilon)\,U'\,(W_0 - C_0 - \alpha + \alpha u + W_1) + \\ &+ (1-p)\,(1-\epsilon)\,U'\,(W_0 - C_0 - \alpha + \alpha d + W_1) + \\ &+ \epsilon U'\,(W_0 - C_0 - \alpha)\} \end{aligned} \tag{A.18}$$

Unless ϵ approaches 0, now the marginal cost of time 0 consumption is larger and therefore C_0^* is smaller than in part (ii).$\otimes$

The exemption level identifies four regions in the solution space. Part (i) of Proposition 2 corresponds to low exemption levels, which do not fully protect savings and are not sufficient to trigger bankruptcy in case of a negative wealth shock and high stock returns. It anticipates that the solution will be in the region where $\alpha^* > 0$ if the risk premium is not negative. Given the consumption floor in the bad states of the world, the household is now willing to participate in the stock market. Even if there is a low stock realization combined with a large negative wealth shock, by declaring bankruptcy it can avoid an infinitely negative utility loss. Moreover, conditional on participation, the optimal level of stockholdings is increasing in the probability of the wealth shock. This is because stocks provide a large marginal benefit by helping to avoid bankruptcy if the shock occurs. The proposition also states that consumption can be higher than in the absence of bankruptcy. For example, if the wealth endowment is high and the probability of a negative wealth shock is low, the household consumes more than the subsistence level. As a result of higher investment and higher consumption, savings are lower

than in Proposition 1, however, by assumption they will be at least equal to the exemption level. Thus, the presence of bankruptcy protection implies a positive investment in the risky asset, higher consumption and lower savings relative to the predictions of Proposition 1.

Parts (ii) to (iv) in Proposition 2 state that an increase in exemptions will discourage investment in the risky asset when the probability of a negative wealth shock is nonzero. If such probability approaches 0, then increases in the exemption level do not have effects on investment and consumption decisions. In part (ii) savings are still not fully protected, but the increase in exemptions makes bankruptcy optimal in the face of a negative wealth shock and high stock returns. As a result, the household invests less in risky assets than in part (i) because the marginal benefit of holdings such assets, which are lost in bankruptcy, declines. In turn, time 0 consumption increases because it does not reduce time 1 utility in bankruptcy and therefore its marginal cost is lower. Lower investment in stocks and higher consumption have ambiguous implications for savings.

Part (iii) corresponds to an increase in exemptions that results in fully protected savings, but the household still does not file for bankruptcy if stock returns are high. This leads to an increase in the marginal cost of holding stocks. Stocks imply lower savings and therefore lower consumption in bankruptcy. As a result, in this scenario investment in the risky asset is lower than in part (i). Time 0 consumption is also lower because its marginal cost increases. It reduces utility in bankruptcy not only when stock returns are high, but also when they are low. Since investment in stocks and consumption are smaller than in part (i), savings should be larger.

In part (iv) the increase in exemption results in fully protected assets relative to scenario (ii), i.e. when the household files for bankruptcy if stock returns are high. This implies lower stock holdings than in (ii) because by reducing consumption in bankruptcy their marginal cost increases. Time 0 consumption is also smaller than in part (ii) because its effect on savings implies a higher marginal cost in bankruptcy. Given the lower stock holdings and lower consumption, savings should be higher than in part (ii).

Finally, note that under the conditions of scenario (iv), that is, when savings are fully protected and it is optimal to file for bankruptcy even if stock returns are high, additional increases in exemptions do not affect investment and consumption decisions. This is because exemptions are not binding at sufficiently high levels.

References

Alan, S., 2006. Entry costs and stock market participation over the life cycle. Review of Economic Dynamics 9 (4), 5888–611.

Armour, J., Cumming, D., 2008. Bankruptcy law and entrepreneurship. American Law and Economics Review 10 (2), 303–350.

Atella, V., Brunetti, M., Maestas, N., 2012. Household portfolio choices, health status and health care systems: A cross-country analysis based on share. Journal of Banking and Finance 36 (5), 1320–1335.

Becker, T. A., Shabani, R., 2010. Outstanding debt and the household portfolio. The Review of Financial Studies 23 (7), 2900–2934.

Berger, A. N., Cerqueiro, G., Penas, M. F., 2011. Does debtor protection really protect debtors? evidence from the small business credit market. Journal of Banking and Finance 35 (7), 1843–1857.

Berkowitz, M. K., White, M. J., 2004. Bankruptcy and small firms' access to credit. RAND Journal of Economics 35 (1), 69–84.

Calvet, L. E., Campbell, J. Y., Sodini, P., 2009. Fight or flight? portfolio rebalancing by individual investors. The Quarterly Journal of Economics 124 (1), 301–348.

Campbell, J. Y., 2006. Household finance. The Journal of Finance 61 (4), 1553–1604.

Cerqueiro, G., Penas, M. F., March 2016. How does personal bankruptcy law affect start-ups? Discussion paper, Tilburg University, Center for Economic Research.

Chen, B., Stafford, F., 2016. Stock market participation: Family responses to housing consumption commitments. Journal of Money, Credit and Banking 8 (4), 635–659.

Christelis, D., Ehrmann, M., Georgarakos, D., May 2015. Exploring differences in household debt across euro area countries and united states. Staff working papers, Bank of Canada.

Christelis, D., Georgarakos, D., Haliassos, M., 2013. Differences in portfolios across countries: Economic environment versus household characteristics. The Review of Economics and Statistics 95 (1), 220–236.

Christelis, D., Georgarakos, D., Sanz-de-Galdeano, A., 2014. The impact of health insurance on stockholding: A regression discontinuity approach. CSEF Working Papers 382, Centre for Studies in Economics and Finance (CSEF).

Corradin, S., Gropp, R., Huizinga, H., Laeven, L., May 2013. Who invests in home equity to exempt wealth from bankruptcy? SAFE Working Paper 21, Goethe University.

Elmendorf, D. W., Kimball, M. S., 2000. Taxation of labor income and the demand for risky assets. International Economic Review 41 (3), 801–834.

Fagereng, A., Gottlieb, C., Guiso, L., 2016. Asset market participation and portfolio choice over the life-cycle. Journal of Finance Forthcoming.

Fan, W., White, M. J., 2003. Personal bankruptcy and the level of entrepreneurial activity. Journal of Law and Economics 46 (2), 545–567.

Fossen, F. M., 2014. Personal bankruptcy law, wealth, and entrepreneurship -evidence from the introduction of a "fresh start" policy. American Law and Economics Review 16 (1), 269–312.

Ganong, P., Jager, S., 2014. A permutation test and estimation alternatives for the regression kink design. Discussion paper no. 8282, IZA.

Gelman, A., Imbens, G., August 2014. Why high-order polynomials should not be used in regression discontinuity designs. Working Paper 20405, National Bureau of Economic Research.

Gelman, A., Zelizer, A., 2015. Evidence on the deleterious impact of sustained use of polynomial regression on causal inference. Research and Politics 2 (1), 1–7.

Georgellis, Y., Wall, H. J., 2006. Entrepreneurship and the policy environment. Federal Reserve Bank of St. Louis Review 88 (2), 95–111.

Goldman, D., Maestas, N., 2013. Medical expenditure risk and household portfolio choice. Journal of Applied Econometrics 28 (4), 527–550.

Gollier, C., Koehl, P.-F., Rochet, J.-C., 1997. Risk-taking behavior with limited liability and risk averison. The Journal of Risk and Insurance 64 (2), 347–370.

Gollier, C., Pratt, J. W., 1996. Risk vulnerability and the tempering effect of background risk. Econometrica 64 (5), 1109–1123.

Gomes, F., Michaelides, A., 2005. Optimal life-cycle asset allocation: Understanding the empirical evidence. The Journal of Finance 60 (2), 869–904.

Gormley, T., Liu, H., Zhou, G., 2010. Limited participation and consumption-saving puzzles: A simple explanation and the role of insurance. Journal of Financial Economics 96 (2), 331–344.

Greenhalgh-Stanley, N., Rohlin, S., 2013. How does bankruptcy law impact the elderly's business and housing decisions? Journal of Law and Economics 56 (2), 417–451.

Gropp, R., Scholz, J. K., White, M. J., 1997. Personal bankruptcy and credit supply and demand. The Quarterly Journal of Economics 112 (1), 217–251.

Gross, T., Notowidigdo, M. J., 2011. Health insurance and the consumer bankruptcy decision: Evidence from expansions of medicaid. Journal of Public Economics 95 (7-8), 767–778.

Guiso, L., Jappelli, T., Terlizzese, D., 1996. Income risk, borrowing constraints and portfolio choice. American Economic Review 86 (1), 158–172.

Haliassos, M., Bertaut, C., 1995. Why do so few households hold stocks? Economic Journal 105 (432), 1110–1129.

Haliassos, M., Michaelides, A., 2003. Portfolio choice and liquidity constraints. International Economic Review 44 (1), 143–177.

Harrell, F. E., 2001. Regression Modeling Strategies. With Applications to Linear Models, Logistic Regression and Survival Analysis. Springer, New York.

Heaton, J., Lucas, D., 2000. Portfolio choice and asset prices: The importance of entrepreneurial risk. Journal of Finance 55 (3), 1163–1198.

Himmelstein, D. U., Warren, E., Thorne, D., Woolhandler, S., 2005. Illness and injury as contributors to bankruptcy. Health Affairs, W5–63–W5–73.

Kimball, M. S., 1993. Standard risk aversion. Econometrica 61 (3), 589–611.

Lehnert, A., Maki, D. M., February 2002. Consumption, debt and portfolio choice. testing the effect of bankruptcy law. Working paper.

Lin, E. Y., White, M. J., 2001. Bankruptcy and the market for mortgage and home improvement loans. Journal of Urban Economics 50, 138–162.

Loken, K. V., Mogstad, M., Wiswall, M., 2012. What linear estimator miss: Re-examining the effects of family income on child outcomes. American Economic Journal: Applied Economics 4 (2), 1–35.

Mahoney, N., 2015. Bankruptcy as implicit health insurance. American Economic Review 105 (2), 710–746.

Mankart, J., Rodano, G., 2015. Personal bankruptcy law, debt portfolios and entrepreneurship. Discussion Paper 28/2015, Deutsche Bundesbank.

Mitchell, M. N., 2012. Interpreting and Visualizing Regression Models Using Stata. Stata Press.

Neumark, D., Salas, J. M. I., Wascher, W., 2014. Revisiting the minimum wage-employment debate: Throwing out the baby with the bathwater? Industrial and Labor Relations Review 67, 608–648.

Pavan, M., 2008. Consumer durables and risky borrowing: The effects of bankruptcy protection. Journal of Monetary Economics 55, 1441–1456.

Persad, S., February 2005. Does availability of consumption insurance influence portfolio allocation? A real options approach to bankruptcy exemptions. Working paper, Columbia University.

Pottow, J. A. E., 2012. The rise in elder bankruptcy filings and failure of U.S. bankruptcy law. The Elder Law Journal 19 (1), 119–158.

Pratt, J. W., Zeckhauser, R. J., 1987. Proper risk aversion. Econometrica 55 (1), 143–154.

Rau, T., 2011. Bayesian inference in the regression discontinuity model. Working paper, Pontificia Universidad Catolica de Chile.

Repetto, A., 1998. Personal bankruptcies and individual wealth accumulation, M.I.T. Ph.D. dissertation.

Rosen, H. S., Wu, S., 2004. Portfolio choice and health status. Journal of Financial Economics 72 (3), 457–484.

Severino, F., Brown, M., Coates, A., 2014. Personal bankruptcy protection and household debt, M.I.T. Ph.D. dissertation.

Stone, C. J., 1986. Comment: Generalized additive models. Statistical Science 1 (3), 312–314.

United States Government Accountability Office, Washington DC, June 2008. Bankruptcy reform: Dollar costs associated with the bankruptcy abuse prevention and consumer protection act of 2005, GAO-08-697.

Vissing-Jorgensen, A., April 2002. Towards an explanation of household portfolio choice heterogeneity: Nonfinancial income and participation cost structures, NBER Working Paper.

von Lilienfeld-Toal, U., Mookherjee, D., 2016. A general equilibrium analysis of personal bankruptcy law. Economica 83, 31–58.

White, M. J., 2007a. Bankruptcy Law. Vol. 2. Elsevier, pp. 1013–1072.

White, M. J., 2007b. Bankruptcy reform and credit cards. Journal of Economic Perspectives 21 (4), 175–199.

White, M. J., December 2008. Bankruptcy: Past puzzles, recent reforms, and the mortgage crisis. NBER Working Papers 14549, National Bureau of Economic Research, Inc.