

# **The Impact of Bankruptcy Exemptions for Retirement Assets**

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## **ABSTRACT**

When filing for personal bankruptcy, an individual can, in almost all cases, claim an exemption for retirement assets. Using the Survey of Consumer Finances from 2007 and 2010, we test the theory that highly educated or financially sophisticated households allocate more resources to retirement assets under conditions of higher probability of filing for personal bankruptcy. This hypothesis stems from the concept of asset sheltering, in which an individual will demonstrate a preference for assets that are exempt from a particular risk.

To address our hypothesis, we run a Heckman model on the Survey of Consumer Finances data. Our results provide evidence to match our theory for only highly educated or financially sophisticated individuals, conditional on owning retirement assets. That is, we observe highly educated and financially sophisticated households allocate more resources to retirement accounts when they are at higher risk for bankruptcy. Other characteristic groups do not demonstrate a similarly strong relationship between the probability of filing for bankruptcy and the level of retirement assets.

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## **Chapter 1: Introduction**

According to the United States Courts, the average number of non-business bankruptcy filings in the US from 2000 to 2005 reached 1.57 million annually before seeing a sharp decline to 598 thousand filings in 2006 after the passing of the Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) of 2005. However, after 2006, the number spiked upward, reaching a mid-recession high of 1.54 million in 2010, or 1.4 percent of all US households (US Courts 2013). These high filing rates elevate the importance of bankruptcy in the United States and its impact on consumers and suppliers of credit.

A large determinant of a household's post-bankruptcy welfare, as well as its decision to file, is the level and type of assets that he is allowed to own after filing. This situation is governed by bankruptcy law with respect to exemptions, which designate those assets that cannot be claimed by a creditor during bankruptcy. In particular, special legal attention has been given to the exempt status of retirement assets, especially amid the uncertainty surrounding the recent economic downturn. The BAPCPA extended exemption protection on the federal level to most retirement accounts that were not previously covered. However, current research has left many questions unanswered about the impact of such protections on investment behavior and the impact of the policy on different population segments. This thesis attempts to answer those questions by measuring the effect of exemptions for retirement assets on investment in retirement accounts.

We begin the discussion with background information in Chapter 2 on bankruptcy in the United States as well as the legal status of retirement accounts to provide context for the current environment in which investment decisions are made. The literature review, Chapter 3, will inform the discussion by shedding light on similar policy decisions and their disparate impacts on certain population groups. Previous documentation of disaggregate responses to a similar tax

policy will be important for identifying mechanisms by which individuals optimize their portfolio choice.

This thesis will contribute to the literature by focusing on bankruptcy exemptions for retirement assets and its impact on portfolio choice and welfare. Chapter 4, our theoretical framework, will define our predictions regarding behavior, which we will test with data from the Survey of Consumer Finances, described in Chapter 5. In Chapters 6 and 7, we construct a model to measure behavior and welfare gains and report the results. Chapter 8 concludes with a discussion of the results and their implications.



## **Chapter 2: Background**

The following sections describe the process of filing for bankruptcy and some of the primary factors that contribute to an individual decision to file. Next, we discuss the evolution of retirement assets and the current tradeoffs faced by an individual considering contributions to a retirement plan.

### **2.1 The Bankruptcy Process**

The bankruptcy process is governed by Title 11 of the United States Code, adopted by the Bankruptcy Reform Act of 1978 as a way to allow debtors an opportunity to regain financial stability without being burdened by previous debt (Government Printing Office). An individual who does not have the financial ability to repay creditors can use current bankruptcy protection in the United States in various forms to discharge or reorganize debt in exchange for the repayment of some debts to the extent of his ability to pay without being unduly burdened. Thus, all United States citizens will have an effective partial insurance against unfortunate or unpreventable financial events, such as medical debt.

In almost all cases, a bankruptcy case is filed by the individual debtor, rather than the creditor, to initiate the process. The individual has several choices about which form of bankruptcy he will pursue, usually Chapter 7 or Chapter 13. Chapter 7 allows greater protection for the individual's assets by extending protection to a specified list of exempt assets, and otherwise discharging unsecured debt. However, Chapter 7 also requires that nonexempt assets be surrendered to the courts for redistribution to creditors. On the other hand, Chapter 13 keeps debts intact but initiates a court-supervised reorganization of financial assets. The Chapter 13 debtor is required to have current income to meet the repayment goals set by the debt consolidation plan, unsecured debt, and must also have secured debt levels below specified amounts. For 2013, that amount is \$1,149,525. Other chapter choices, not examined by the

present study, are available in infrequent circumstances; for example, farmers and fisherman are eligible to file for Chapter 12.

The proceedings occur at the local level in a bankruptcy court, but bankruptcy rules are governed by federal and state law. The trustee, who liquidates the debtor's assets, sets aside those assets that are ruled to be exempt. In some cases, state law allows specific exemptions for a type of asset. In other instances, federal law universally mandates certain exemptions. Of interest to the research here, the exemptions for retirement assets, are in the latter category. For those assets that are covered by either type of bankruptcy exemptions, the debtor is allowed to keep those assets. Any uncertainty surrounding an asset is judged by the bankruptcy courts.

In recent years, new legislation has incrementally increased the amount of exemptions that can be claimed by a debtor in bankruptcy court as a means to allow ample opportunity for a fresh financial start. One such asset type that underwent legislative evaluation for exemption eligibility is retirement assets. Each type of retirement plan was evaluated separately and almost all were granted exempt status. The legislative decisions surrounding exemptions for retirement assets and the controversies surrounding the court's judgment are discussed in Section 2.3 for each type of retirement asset.

## **2.2 Determinants of Bankruptcy Choice**

The decision to file for bankruptcy is not simple. Standard economic theory suggests that people will file for bankruptcy when it is financially beneficial to do so. Filing after a negative income shock will serve as an insurance mechanism for smoothing consumption (Blundell 2008). In these cases, bankruptcy law successfully protects consumers against events that are not their fault, while expecting debt repayment to the extent that the debtor is able to pay (Grochulski 2010).

Several behavioral factors complicate this ideal objective. In some cases, social factors prevent individuals from filing, even amid financial hardship. A study by Fay, Hurst, and White suggests that many people who do not file for bankruptcy would benefit from doing so. They suggest that social stigma may play a significant role (Fay, Hurst, and White 1998). If social stigma serves as an incentive to refrain from filing, then it may prevent debtors from taking advantage of the benefits of filing. In other words, debtors treat social stigma as an additional cost to filing for bankruptcy above the traditional financial costs.

Other incentive problems permeate bankruptcy decisions. For example, an individual might decide to file because of a financial gain, regardless of his latent or overt ability to pay his current debts. One study suggests that people have the ability to pay more than their bankruptcy choice requires (Neubig, Jaggi, and Ernst 1999). Furthermore, research shows that the level of exemptions that can be claimed by an individual in bankruptcy has an enormous effect on his chapter choice (Domowitz 1993). The adverse effects of bankruptcy exemptions are discussed in the literature review in the context of retirement plans. First, we present background information on retirement assets and the legal environment surrounding retirement accounts.

## **2.3 Retirement Assets**

### **2.3.1 Background on Retirement Assets**

The decision to contribute to a retirement account is complex and multifaceted. An individual's cost-benefit analysis includes many desirable and undesirable outcomes, which must be weighed against one another. We begin with a discussion of the benefits and drawbacks of retirement accounts to explore the tradeoff faced by an individual, and continue in the Theoretical Framework section, we present a model that explains the tradeoff between saving in a taxable liquid account or contributing to a retirement account that would be exempt from

creditors during bankruptcy. Finally, we will discuss individual characteristics that influence retirement account contributions, as predicted by our cost-benefit analysis.

There are many types of retirement plans that are characterized by the investor's ability to choose his contribution levels. For the purposes of this research, we are interested in these plans because of their discretionary feature. The ability to have control over contribution levels is an essential component for our analysis of the impact of bankruptcy exemptions on personal retirement planning choice. The two primary types of plans that comprise discretionary retirement contributions are tax-deferred retirement plans (TDRPs) and Individual Retirement Accounts (IRAs). Each of these types of retirement plans, as well as their respective subgroups, have several characteristic differences. For example, a TDRP exists through one's employer, while IRAs are privately funded (with the exception of SEP IRAs and SIMPLE IRAs). These differences are less important for our analytical framework than the similarities among retirement plans, which are discussed below.

These retirement accounts were created and defined by the US Congress in the 1970s and the 1980s to govern contributions to retirement plans from employee income. The explicit purpose was to establish investment vehicles that would encourage greater levels of retirement savings. Congress stated that it "was concerned that a large number of the country's workers ... face the prospect of retiring without the resources needed to provide adequate retirement income levels" (Congress 2003, 88). Thus, retirement contribution plans were created with special treatment and features that would make them more attractive to individuals who are determining their level of retirement savings. One example is that some retirement assets are not included in calculations of assets for financial aid purposes for one's household. The following characteristics are relevant toward understanding our theoretical model.

### **2.3.2 Loss of Liquidity**

The purpose of retirement plans as an investment tool is to encourage savings that will be later used for income after retirement. Because of this intended goal, retirement plans were equipped with a mechanism by which funds would be partially committed to the account until retirement: a withdrawal penalty. Any individual under the age of 59½ must pay a 10 percent tax penalty on all withdrawals from an IRA or TDRP, with several exceptions for special circumstances. The purpose of the penalty is to remove the temptation to withdraw funds prior to retirement and to ensure that prior contributions will indeed be used for retirement purposes. Using the account for any other purpose would be expensive to the individual.

However, individuals are not fully committed to using those funds for retirement purposes. Although there is a significant tax penalty, an account holder can withdraw funds early if doing so is worth the expense. This feature allows the individual to opt out of using the retirement savings in the event of extreme or emergency situations. This is comparable to other assets which are not fully liquid, such as Certificates of Deposit, for which penalties exist for early withdrawal.

The choice between placing one's assets in an IRA or TDRP and choosing some other type of account weighs the cost of this commitment. When one chooses an IRA or TDRP, he is losing liquidity, thus diminishing the ability to use those funds for outside loans, income smoothing, emergency situations, or any unforeseen circumstance.

### **2.3.3 Excess Contribution Penalty**

Another important feature of IRAs and TDRPs is the limit on annual contributions. For IRAs, as of 2013, individuals can contribute no more than \$5,500 for those under age 50, and

\$6,500 for those age 50 and over. For TDRPs, the limit is \$17,500 for those under age 50 and \$23,000 for those age 50 and over. Other limits to employer contributions apply.

The exception to the contribution limit for IRAs is those with especially low income: one cannot contribute more than 100% of his taxable compensation for the year. For IRAs, any amount over this limit is taxed at an annual rate of 6 percent of the amount of excess, if it is not withdrawn before the end of the year. For TDRPs, excess contributions are not allowed. Furthermore, high-income individuals are not able to contribute to IRAs and TDRPs after certain phase-out limits, which depend on filing status.

Placing a limit on the amount that one can contribute to a retirement plan leaves low-income individuals generally unaffected, while high-income earners cannot take full advantage of the benefits of an IRA or TDRP. This leaves retirement plan benefits to target those people who have lowest incomes, intended to benefit the savings of those who need it most. Limiting contributions to 100 percent of income ensures that individuals are truly intending contributions for retirement planning.

However, similar to the withdrawal limit, the contribution limit can be bypassed after paying a tax penalty for IRAs. This means that in certain situations, an individual might choose to contribute a greater amount if the benefits of contribution more than offset this cost. Our theoretical model treats the annual excess contribution limit as a cost for the IRA portion, but the excess contribution limit is not binding in that case.

### **2.3.4 Tax Deferment**

The negative features of retirement plans are balanced against those beneficial features which were intended to encourage retirement savings. The most prominent feature is the ability for an individual to reduce taxable income by contributing to tax-deferred retirement plans (with

the exceptions for contributions to Roth accounts). For those tax-deductible plans, one's taxable income is lessened by any amount that he adds to his account in the same year. Furthermore, interest, capital gains, and dividends on investments are tax-sheltered until withdrawal. Only when an account holder makes a withdrawal from his account, he must then claim the amount of withdrawal as income. Thus, taxes are not required to be paid on those assets until they are withdrawn, which is usually after retirement. This benefit is diminished by the fact that gains are taxed at withdrawal as well, where they are taxed as ordinary income and not at the lower capital gains tax rate.

The tax deductibility and tax-sheltered status of retirement plans are intended to encourage higher levels of retirement planning. The burden of paying current taxes weighs into an individual's decision to contribute. Additionally, those with higher marginal tax rates will find this benefit to be especially helpful. First, upon withdrawal, they might have lower taxable income during retirement years than they did mid-career. Also, for years that the account experienced dividends or interest, an account holder might have high marginal tax rates as well. In that case, deferring this income to post-retirement years will in many instances diminish the rate at which those gains will be taxed.

The size of the benefit of the tax treatment of retirement plans depends on several factors. Namely, the benefit depends on the relative value of one's current marginal tax rate, one's future marginal tax rate during capital gains and interest, and the marginal tax rate post-retirement. This feature is treated as a benefit in our theoretical model, measured by the values listed above, and weighed against the opportunity costs of contributing.

### **2.3.5 Bankruptcy Exemption**

The characteristic of retirement plans that is of greatest interest to this study is their exempt status during personal bankruptcy. All assets in an IRA or a Roth IRA up to \$1,000,000, indexed for inflation from 2005, are exempt from the claims of creditors during bankruptcy proceedings. A bankruptcy judge is allowed to increase this limit if he deems the credit Keoghs, 401(k)s, 403(b)s, and are all exempt with no limitation on the dollar amount. Prior to 2005, individual state governments and courts made judgments about bankruptcy exemptions for IRA and 403(b) plans. The exempt status of 403(b)s and IRAs was federally mandated in 2005 with the BAPCPA. Prior to 2005, state legislature was allowed to decide policy for those assets. Other retirement plans were mandated to be exempt by the Employee Retirement and Income Security Act of 1974 (ERISA).

The purpose of this exemption for retirement assets was to insure those assets; that is, to protect future income security from current income shocks. No matter how deeply in debt an individual is, the option of filing for bankruptcy can help to keep his future savings intact. This adds security to retirement plans, making them more attractive to investors, which is expected to increase savings for retirement. It also serves to extend the insurance benefits of filing for bankruptcy. Because of this goal, certain transfers from a nonexempt asset type to an exempt asset type are considered fraudulent. If the debtor contributes a large amount to an exempt asset type very close to the date of filing, the exchange is invalidated and the transferred assets are considered to be nonexempt. This places a limitation on large, time-specific shifts in debtor behavior in anticipation of bankruptcy, but does not explicitly limit less extreme transfers.

Individuals who file for Chapter 7 bankruptcy benefit from the exemption by the amount in their exempt account. Measured by opportunity cost, the exempt status of retirement assets saves bankrupt individuals the amount that they have previously contributed. On the other hand,



those individuals who never file for bankruptcy receive no benefit from the exemption. The exemption, then, leaves an uneven distribution of benefit across people.

We include the exemption as a benefit in our theoretical model as an expectation of benefit. This benefit depends on whether the individual will ever file for bankruptcy. We theorize that individuals have some information prior to bankruptcy about themselves by which they evaluate the probability of eventually filing for bankruptcy. This information will lead to an expected probability of whether they will be in the group of those that use the benefit (bankrupt individuals) or of those who do not (individuals who never file for bankruptcy). In turn, this expectation will determine the magnitude of the expected benefit of the exempt status of their retirement assets. Similar to other beneficial properties of retirement plans, the exempt status will be weighed against costs of contributing to the plan.

## **Chapter 3: Literature Review**

The current literature is extensive with respect to bankruptcy and the impact of bankruptcy exemptions on microeconomic behavior. First, we discuss the justification for the existence of bankruptcy exemptions and their insurance benefits to debtors. Counterbalancing these benefits are several negative collateral consequences that have the potential to harm certain types of households. Here, we document the effects that previous research has discovered, and then examine bankruptcy exemptions through the lens of asset sheltering by drawing parallels with other types of asset sheltering.

### **3.1 Efficiency Losses from Bankruptcy Exemptions**

A great deal of the literature emphasizes and measures the positive moderating effect of bankruptcy on negative income shocks. Some research indicates that bankruptcy exemptions can be an alternative to other forms of wealth redistribution in public policy (Grant and Koeniger 2009). However, the collateral effect of bankruptcy exemptions extends across various types of behaviors – primarily filing rates, credit supply, and interest rates.

One negative aspect of bankruptcy exemptions is the moral hazard problem. Individuals may choose to undertake riskier behavior as a result of being protected by insurance. One study by Grant (2010) exploits state-level exemption policy differences and examines the impact of higher exemption levels on the amount of unsecured debt as well as life cycle consumption patterns. Grant (2010) found that individuals with higher exemptions tended to prefer greater unsecured debt, but also had smoother consumption levels across one's life. Similarly, Athreya (2006) found that higher levels of exemptions causes some individuals to be more likely to declare bankruptcy in the first instance. This research demonstrates the tendency for individuals to use bankruptcy laws as exemptions increase.

Athreya (2006) highlighted another negative consequence of bankruptcy exemptions – credit availability. The insurance benefits of bankruptcy are mitigated by the loss in credit availability to those that are at most risk for filing and discharging debt. According to the WEFA Group (1998), creditors lose \$40 billion annually from personal bankruptcy exemptions as a result of their inability to collect certain assets against loans they have issued. Economic theory predicts that creditors respond to decreased prospects of profitability for risky individuals by charging higher interest rates and restricting credit availability. In other words, as the cost of providing credit increases, supply diminishes, resulting in a higher price and lower quantity supplied of credit. In agreement with standard economic supply and demand theory, the Congressional Budget Office shows that demanders of credit (debtors) undertake some of the costs of bankruptcy exemptions to creditors (Kowalewski 2000). However, in this case, additional costs emerge from bankruptcy exemptions. The report points out that some of the losses are borne by taxpayers as a result of the tax-deductibility of losses for businesses. That is, if a debtor fails to pay a loan, the creditor can deduct the amount of the loss from the taxable income of his business or his personal tax return. Furthermore, bankruptcy courts are subsidized by the government, incurring further taxpayer losses (Kowalewski 2000).

### **3.2 Participation in Tax Shelters**

For this study, we will examine investment in exempt assets to determine a disparate effect of bankruptcy exemptions on different groups. The primary problem is participation in investment in exempt assets. Participation has come under scrutiny in recent policy research because of its importance in measuring the effectiveness of a particular law, especially tax law. If a policy intends to benefit a specific subset of Americans, for example low-income households, then participation by that group is crucial to ensuring the success of the policy. If,

on the other hand, there are financial or informational barriers to participation that impact the targeted group disproportionately, then participation problems will be expected to undermine the effectiveness of that policy for benefitting that group (Boylan and Frischmann 2006).

Examples of the participation problem abound throughout the literature across a wide variety of policies. One such example examines the complexity surrounding financial aid forms in higher education and whether such complexity impedes the intended benefactor, students from low-income households. The study concludes that the distributional goals of the policy are offset by the unnecessary complexity in financial aid rules because complexity disproportionately harms low-income households (Babiarz and Yilmazer 2009).

Another study by Dynarski and Scott-Clayton (2006) demonstrates a mechanism by which privileged households are able to benefit from such a policy. The answer lies in the fact that those assets that are exempted from financial aid calculations hold greater financial benefit to those intending to attend a college or university under financial aid. However, those with the greatest ability to pay are more likely to recognize those benefits and favor those assets. The result is that those who need aid the least possess the greatest share of those exempt assets and can pull more financial aid away from those who need it more (Dynarski and Scott-Clayton 2006). This is in line with other research that demonstrates that financial sophistication impacts the extent to which an individual uses the advantages of a particular tax policy. For example, one study uses tax benefits for IRAs to demonstrate the positive impact of sophistication on the receipt of tax benefits (Smith et. al, 2012).

The emphasis of current literature addressing policy effects upon those asset types that are advantaged by tax rules demonstrate collateral effects that may be counterproductive to redistributive or equity goals. The current body of research, however, leaves unanswered several

relevant considerations about retirement asset bankruptcy policy and whether exemptions are received differently by various characteristic groups. Are some individuals more likely than others to have portfolios that accurately price the expected financial benefit of bankruptcy exemptions for certain assets? Who has a greater share of the exempt assets in the first instance?

### **3.3 Bankruptcy Exemptions as an Implicit Tax Shelter**

Before we can answer these retirement asset bankruptcy policy questions with our models, we must first examine the impact of exemptions on different groups.

One study by White (2006) found, in agreement with other literature (Grant 2010, Ellis 1998, Pavan 2008), that bankruptcy exemptions cause individuals to increase risky portfolio allocation, file for bankruptcy more often, and work fewer hours after filing for bankruptcy. It also examined redistributive effects across those who can take advantage of bankruptcy exemptions and those who cannot. In conclusion, the study found that exemptions cause redistribution of wealth from low-asset borrowers to high-asset borrowers and from states with low exemptions to states with high exemptions (White 2006). This redistributive effect, emerging from a problem of asymmetric participation, is a barrier to some individuals in receiving intended benefits of greater exemption policies. Thus, participation and the receipt of benefits will be a major focus of our econometric model.

Furthermore, research has shown that the availability of credit is not equivalently impacted across demographics. A study by Gropp, Scholz, and White (1997) found that low-asset households in high-exemption states had lower debt and higher interest rates for auto loans than did households in low-exemption states. The authors find that exemptions redistribute credit to households with many assets because they benefit to a greater extent from exemptions (Gropp, Scholz, and White 1997).

Even more problematically, some have suggested that the riskier borrowing and lesser credit leaves debtors hardly better off at all (Pavan 2008). If households with high levels of certain assets are benefitting from exemptions, but the net welfare gains are negligible, it follows that certain households may be worse off due to high levels of bankruptcy exemptions at the expense of those with high asset levels. Our question of interest, then, narrows in on the consequences of a neglected subset of bankruptcy exemptions: exemptions for retirement assets.

The above research demonstrates some of the negative aspects of bankruptcy protection and exemptions. By comparison, other policies that help an individual avoid an implicit tax are often affected by asymmetric participation, which helps certain demographics benefit from the policy to a greater extent than others. Our research will complement the current body of work on bankruptcy exemptions and participation in implicit tax shelters by investigating whether the investment and savings of different types of households are affected disproportionately by the exemptions for retirement assets. Specifically, we will test two things. First, whether financially sophisticated or highly educated individuals are more likely to recognize and take advantage of the expected benefits of the exemptions, and second, what characteristics are related to having high levels of asset protection from the exemptions. Our theoretical framework examines these savings decisions in more detail and theorizes how retirement asset exemptions can impact a portfolio decision.

## Chapter 4: Theoretical Framework

An individual will contribute to a retirement account if he expects that the marginal benefits of contributing are greater than the marginal costs. Our theoretical framework builds off this concept by weighing the key costs against the benefits of contributing. We assume that the individual has already optimized his budget for investments and saving and has a certain after-tax income available to save.

### 4.1 Utility Model

The costs of contributing to a retirement account are twofold: 1) the loss of liquidity and excess contribution penalties, and 2) the opportunity cost of contributing to some other investment. Thus, we can examine the net benefit of contributing to a retirement plan (accounting for costs) and weigh them against contributing to some other liquid asset. These benefits, expressed in terms of relative expected utility, must incorporate the investor's risk aversion into the distribution of returns. We begin with the following necessary condition for an individual's contribution to a retirement plan:

$$E(U(W_{RET})) > E(U(W_{LIQ})) \quad (1)$$

where the following representations apply:

$E(U)$  = the expected utility

$W_{RET}$  = the wealth in one's retirement account

$W_{LIQ}$  = the wealth in one's liquid savings account

This relative utility measure represents the individual's preferences for one portfolio choice against another. This differs from an expected wealth model in that expected utility incorporates risk preferences in addition to expected return. Many risk preference models could accommodate this choice, but we will use the constant relative risk aversion model as an example. The model was developed by Pratt (1964) and Arrow (1965) and states the following:

$$U(W) = \frac{W^{1-Z}}{1-Z} \quad (2)$$

where  $Z = -\frac{\% \text{ change in marginal utility}}{\% \text{ change in wealth}}$ ,  $W$  is wealth, and  $U$  is utility as a function of wealth.

Using this model, Equations 1 and 2 expand according to the relative values of the retirement plan contributions and the liquid assets. The following representations apply:

$P_B$  = expected probability of filing for bankruptcy  
 $W_{RET_B}$  = wealth in a retirement account after bankruptcy  
 $W_{RET_{NB}}$  = wealth in a retirement account with no bankruptcy  
 $W_{LIQ_B}$  = wealth in a liquid savings account after bankruptcy  
 $W_{LIQ_{NB}}$  = wealth in a liquid savings account with no bankruptcy

In order to define the expected benefit of contributing a dollar to a retirement plan, we use the estimated probability of filing for bankruptcy. If the account holder does file for bankruptcy, then the benefit to wealth is the exempted amount of his retirement plan balance. If he does not, then those retirement assets are distributed to creditors. The probability of bankruptcy serves as weights for the expected wealth.

Another important factor that contributes to a person's decision to contribute to an investment is the amount of risk that he is willing to accept. Because different investors have variable preferences for risk acceptance, we use a coefficient,  $Z$ , to represent the distribution of utility across quantity of risk. Although the model below cannot define  $Z$ , we can assume it is constant within individuals but varying across individuals.

The result is the following formula for the expected utility of a retirement plan, substituting into Equation 2:

$$U(W_{RET}) = \frac{W_{RET}^{1-Z}}{1-Z} \quad (3)$$

This expectation is weighted according to the probability of filing for bankruptcy:



$$E(U(W_{RET})) = P_B \left( U(W_{RET_B}) \right) + (1 - P_B) \left( U(W_{RET_{NB}}) \right) \quad (4)$$

$$E(U(W_{RET})) = P_B \left( \frac{(W_{RET_B})^{1-Z}}{1-Z} \right) + (1 - P_B) \left( \frac{(W_{RET_{NB}})^{1-Z}}{1-Z} \right) \quad (5)$$

For a liquid asset, we can define their value to the investor below. Note that we are only interested in the portion of the account that would be at risk during bankruptcy (ie the extent of his debt obligations).

$$U(W_{LIQ}) = \frac{W_{LIQ}^{1-Z}}{1-Z} \quad (6)$$

$$E \left( U(W_{LIQ}) \right) = P_B \left( U(W_{LIQ_B}) \right) + (1 - P_B) \left( U(W_{LIQ_{NB}}) \right) \quad (7)$$

$$E \left( U(W_{LIQ}) \right) = P_B \left( \frac{(W_{LIQ_B})^{1-Z}}{1-Z} \right) + (1 - P_B) \left( \frac{(W_{LIQ_{NB}})^{1-Z}}{1-Z} \right) \quad (8)$$

Since we are examining only the portion of the account that would be at risk during bankruptcy, the value of the liquid savings account during bankruptcy would be much lower.

This value depends on chapter choice within bankruptcy. The following representation applies:

$P_B$  = the probability of filing for any type of bankruptcy

$P_7$  = the probability of filing for Chapter 7

$P_{13}$  = the probability of filing for Chapter 13

$W_{LIQ_7}$  = the wealth in a liquid account if one files for Chapter 7

$W_{LIQ_{13}}$  = the wealth in a liquid account if one files for Chapter 13

By definition,

$$P_B = P_7 + P_{13} \quad (9)$$

Thus, Equation 8 expands to

$$\begin{aligned} E \left( U(W_{LIQ}) \right) &= P_7 \left( \frac{(W_{LIQ_7})^{1-Z}}{1-Z} \right) + P_{13} \left( \frac{(W_{LIQ_{13}})^{1-Z}}{1-Z} \right) \\ &+ (1 - P_B) \left( \frac{(W_{LIQ_{NB}})^{1-Z}}{1-Z} \right) \end{aligned} \quad (10)$$

For Chapter 7, the entirety of the at-risk portion of one's liquid savings account will be distributed to creditors. Thus,  $W_{LIQ_7}$  reduces to 0. For Chapter 13, the value of the liquid

savings account is simply  $W_{LIQ_{NB}}$  discounted by the obligation to creditors. We designate this value some constant proportion  $\delta$  and reduce the above equation:

$$E(U(W_{LIQ})) = P_{13} \left( \frac{(\delta W_{LIQ_{NB}})^{1-Z}}{1-Z} \right) + (1 - P_B) \left( \frac{(W_{LIQ_{NB}})^{1-Z}}{1-Z} \right) \quad (11)$$

Thus, an individual will contribute to a retirement plan if, by Equation 1,

$$\begin{aligned} & \left[ P_B \left( \frac{(W_{RET_B})^{1-Z}}{1-Z} \right) + (1 - P_B) \left( \frac{(W_{RET_{NB}})^{1-Z}}{1-Z} \right) \right] \\ & > \left[ P_{13} \left( \frac{(\delta W_{LIQ_{NB}})^{1-Z}}{1-Z} \right) + (1 - P_B) \left( \frac{(W_{LIQ_{NB}})^{1-Z}}{1-Z} \right) \right] \end{aligned} \quad (12)$$

These values depend on the contribution limit for the account and the value of the annual returns, the time periods until withdrawal, and the marginal tax rates.

#### 4.2 The Decision between Retirement Plans and Liquid Savings Accounts

We establish the following definitions:

$R$  = annual return within the retirement account

$T$  = time period in years until withdrawal

$\tau_w$  = marginal tax rate in the year of withdrawal (plus 10% penalty if withdrawn before age 59 $\frac{1}{2}$  and no exemption met)

$\tau_0$  = marginal tax rate in year of contribution

$r$  = after-tax return in a taxable liquid savings account

$C_L$  = Pre tax contribution up to annual limit \$5,500 (\$6,500 for age 50 or older)

$C_E$  = Additional excess contribution to above limit (must be 0 for TDRPs but can be greater than 0 for IRAs)

The expected value of the retirement account is represented below, derived from Equation 5. Note that probabilities of filing for bankruptcy no longer apply, since the expected utility of wealth in a retirement account does not vary according to whether the individual files.

$$E(U(W_{RET})) = \left( \frac{([C_L(1-\tau_w)(1+R)^T] + [C_E((1+R)^T - 1)(1-\tau_w) + C_E - \sum_{i=1}^{n-T-1} C_E(0.06)(1+r)^n])^{1-Z}}{1-Z} \right) \quad (13)$$

The value of the at-risk portion of the liquid account is represented in terms of its returns, derived from Equation 11.

$$E(U(W_{LIQ})) = \left[ P_{13} \left( \frac{(\delta(C_L(1-\tau_0)+C_E)(1+r)^T)^{1-Z}}{1-Z} \right) + (1 - P_B) \left( \frac{((C_L(1-\tau_0)+C_E)(1+r)^T)^{1-Z}}{1-Z} \right) \right] \quad (14)$$

Substituting into Equation 12, an individual will contribute to an IRA if the following conditions are true:

$$\left( \frac{([C_L(1-\tau_w)(1+R)^T] + [C_E((1+R)^T - 1)(1-\tau_w) + C_E - \sum_{i=1}^{n-T-1} C_E(0.06)(1+r)^n])^{1-Z}}{1-Z} \right) > \left[ P_{13} \left( \frac{(\delta(C_L(1-\tau_0)+C_E)(1+r)^T)^{1-Z}}{1-Z} \right) + (1 - P_B) \left( \frac{((C_L(1-\tau_0)+C_E)(1+r)^T)^{1-Z}}{1-Z} \right) \right] \quad (15)$$

Our hypothesis can be demonstrated by deriving the change in the expected utilities as a result of changes in the probability of filing for bankruptcy.

$$\frac{\partial E(U(W_{RET}))}{\partial P_B} = 0 \quad (16)$$

$$\frac{\partial E(U(W_{LIQ}))}{\partial P_B} = \left( \frac{(\delta(C_L(1-\tau_0)+C_E)(1+r)^T)^{1-Z}}{1-Z} \right) - \left( \frac{((C_L(1-\tau_0)+C_E)(1+r)^T)^{1-Z}}{1-Z} \right) < 0 \quad (17)$$

Thus, the probability of filing for bankruptcy increases, the left-hand side of our decision rule, Equation 15, stays constant, while the right-hand side decreases. This will tilt the portfolio decision in favor of retirement assets.

The following numerical examples serve to demonstrate the mechanics of this model. The examples account for the various factors that influence an individual's decision to contribute to a retirement plan, based on the net benefit of both options. The examples are evaluated in scenarios where retirement accounts are exempt from creditors in bankruptcy and in scenarios where retirement accounts are not exempt. The differences between the scenarios illustrates the impact of exemptions on the decision between portfolio options.

### 4.3 Numerical Examples

#### 4.3.1 Example 1: High Probability of Filing for Bankruptcy

Assume the following for a household that is considering contributing to an IRA.

$$P_B = 0.30$$

$$P_{13} = 0.10$$

$$C_L = \$5,500 \text{ (individual is 40 years old)}$$

$$R = 4.5\% \text{ (invested in corporate bonds)}$$

$$T = 2$$

$$\tau_w = .35 \text{ (25\% marginal tax rate in year of withdrawal + 10\% penalty (before age } 59\frac{1}{2}\text{))}$$

$$\tau_0 = .28$$

$$r = 4\% \text{ (invested in corporate bonds, return after taxes)}$$

$$C_E = \$10,000$$

$$Z = .5$$

$$\delta = .5$$

*Solution.* Based on the mathematical tradeoff presented, the household should contribute to an

IRA versus maintaining liquidity in savings account based on the following calculation:

$$\left( \frac{([5,500(1-.35)(1+.045)^2] + [10,000((1+.045)^2 - 1)(1-.35) + 10,000 - 10,000(.06)(1.04)])^{1-.5}}{1-.5} \right)$$

$$> .1 \left( \frac{(.5(5,500(1-.28) + 10,000)(1+.04)^2)^{1-.5}}{1-.5} \right) + .7 \left( \frac{((.5(5,500(1-.28) + 10,000)(1+.04)^2)^{1-.5}}{1-.5} \right)$$

The computation results in the following relative utility measure:

$$235.61 > .1(173.78) + .7(245.76)$$

$$235.61 > 189.41$$

This example demonstrates the relative benefit of contributing to a retirement asset instead of a liquid asset, using the case of IRAs. When the percentage probability of filing for bankruptcy is high at 30 percent, the individual sees a high relative benefit of contributing to an IRA. In the next example, we change the exempt status of IRAs, and we can see the isolated effect of bankruptcy exemptions on this portfolio decision.

### 4.3.2 Example 2: Low Probability of Filing for Bankruptcy

Assume the parameters from Section 4.3.1 except the estimated probability of filing for bankruptcy being  $P_B = .005$  and  $P_{13} = .002$  in this example. The decision is made post-BAPCPA where the individual will be eligible to claim IRA exemptions if he does file for bankruptcy.

*Solution:*

$$\left( \frac{([5,500(1-.35)(1+.045)^2] + [10,000((1+.045)^2 - 1)(1-.35) + 10,000 - 10,000(.06)(1.04)])^{1-.5}}{1-.5} \right) < .002 \left( \frac{(.5(5,500(1-.28) + 10,000)(1+.04)^2)^{1-.5}}{1-.5} \right) + .995 \left( \frac{((5,500(1-.28) + 10,000)(1+.04)^2)^{1-.5}}{1-.5} \right)$$

The computation results in the following relative utility measure:

$$235.61 < .002(173.78) + .995(245.76)$$

$$235.61 < 244.88$$

In this example, the individual should prefer investing in a liquid asset instead of investing in an IRA. This contrasts from Example 1, where the optimal decision was to invest in an IRA. This example demonstrates that portfolio choice can be a function of the probability of filing for bankruptcy. We would expect individuals with higher probabilities of filing for bankruptcy to be more inclined to invest in IRAs when they are exempt. That is, the marginal impact of IRA exemptions given these parameters is to shift personal preferences in favor of IRAs away from liquid assets.

Several parameters within the model can vary either in favor of one type of contributions or another. For example, with a different risk variable  $Z$ , the outcome could have changed in any of the above examples. A less risk-averse individual (with a lower  $Z$  coefficient) will more highly favor the liquid asset. Other endogenous factors, such as current marginal tax rates, may

impact the level of contribution, but also external factors play a large role. Both types of determinants are discussed below.

#### **4.4 Factors Related to Retirement Plan Contributions**

We expect retirement plan balances to be positively related to the probability of filing for personal bankruptcy, among other variables. Our models will accommodate this theoretical framework by including variables that measure the probability of filing for bankruptcy. Amid these variables of interest, our model will include several control variables to explain as much variation in retirement assets as possible.

The following sections outline which variables will be used in the econometric model and the rationale for their inclusion.

##### **4.4.1 Income**

Maintaining a comfortable standard of living depends on the amount of investment that an individual undertook prior to leaving the workforce for retirement. The reason designated retirement plans were established by the US government has always been to encourage savings that will later be used for consumption during retirement. The inherent commitment mechanism through the withdrawal penalty is intended to ensure that the benefits of the plan are used for retirement. Thus, the level of investment in one's retirement plan is a partial indication of the future level of consumption post-retirement.

Based on life-cycle theory, we expect that low-income individuals will be unlikely to expect a sharp increase in standard of living after retirement, and that high-income individuals will be unlikely to expect a sharp decrease in standard of living after retirement. The life cycle theory was developed by Modigliani as a way to explain savings and consumption during various years over a lifetime (Modigliani 1966). According to the theory, individuals have a strong

preference for smoother consumption, and take steps to diminish the variation in his own consumption across time. The theory predicts that during relatively high-income periods, the individual will save a greater portion of his income, and in relatively low-income periods, the individual will consume more than his income. During those low-income years, the individual can facilitate higher consumption by two means: borrowing against future income, or withdrawing from savings from previous periods. During retirement, where income drops off, in an effort to smooth consumption, the individual consumes saving from previous periods.

According to the life cycle theory, variations in income across time can partially predict which years an individual will prefer to save for future, post-retirement years. That is, high income in a given year might predict savings whether the individual is typically a high-income earner or not. Furthermore, it also predicts that individuals who typically have high income will prefer to consume high levels during retirement, to smooth consumption against high pre-retirement consumption. Thus, an application of the life cycle theory demonstrates that we should expect a positive relationship between income and saving for retirement. Additionally, high incomes are related to higher levels of liquidity, which will help the individual to contribute to savings at his discretion. Low-income households tend to spend a higher percentage of income on necessities and have less available to save (Gutter et al. 2012). We expect that these households also have lower access to credit and less wealth from which to draw.

We also hypothesize that the loss in liquidity associated with contributions, which is usually a significant cost of contributing, affects the finances of high-income individuals less than low-income individuals. High-income individuals are better able to absorb negative income shocks that might require liquidity. This means that high-income individuals are less affected by one of the costs of contributing to a retirement plan.

To a greater extent, high-income individuals can take advantage of one of the benefits of contributing to a retirement plan: tax deferral. High income is taxed at a higher marginal tax rate than low income. Therefore, the benefit of deferring taxes to retirement might be greater for high-income individuals, as he can avoid paying a high marginal tax rate that he might not experience post-retirement when he withdraws. This is consistent with current literature, which indicates that income is indeed a determinant of retirement plan contribution rates (Huberman, Iyengar, and Jiang 2007).

#### **4.4.2 Education and Financial Sophistication**

When ERISA established new retirement plans, Congress expressed concern that individuals were not investing enough in retirement assets and that many individuals would not have enough funds to finance a comfortable level of consumption throughout retirement (Congress 2003, 88). The express intent of retirement plans was to encourage individuals to invest more so that the nation could avoid a problem at retirement of not having enough in savings. Research and polling on individuals retirement planning lends support to the idea that individuals are choosing a level of saving that is not based on optimal information. That is, informational costs are greater than 0. For example, a recent poll showed that 56 percent of households have not tried to calculate how much money they will need in retirement to live comfortably (Helman, Copeland, and VanDerhei 2012). Although the barriers to making optimal financial decisions are complex and not fully identified, it is apparent that understanding finance is crucial to correctly estimating the benefits of a particular choice and to making decisions in the long-term interests of the individual (Van Rooij, Lusardi, and Alessie 2012).

Understanding the complexities of finance and the laws it entails comes at a separate cost. For example, knowledge about IRAs would drastically affect the examples given based on



our theoretical model. If an individual is unaware of the status of bankruptcy exemptions for IRAs, then he will underestimate the benefit of contributing to his IRA. Although the IRA may have a higher expected utility, the individual may choose to invest in a liquid asset instead, without realizing the risk he is taking. In other words, while our model is valid, there is an additional cost that is not modeled to represent the costs of implicitly computing the model in the first instance.

As outlined in the literature review, individuals face varied barriers, or informational costs, to optimally allocating financial resources. For some individuals, access to financial literacy or wherewithal to develop a dependable expertise is not uniformly distributed. For those with higher financial education, knowing and understanding the interplay of all financial instruments and laws can highlight the benefits of a portfolio choice (Lusardi, Mitchell, and Curto 2010). Modeling this problem as variable informational costs helps explain the disproportionate impact of tax policies on different demographic groups.

To proxy for the benefits of education in reducing informational costs, we will use level of education as a dependent variable in our econometric model. We expect that those with higher education will more accurately estimate the benefits of retirement plans in the long term. Therefore, total retirement assets are expected to be positively related to education levels. Another measure, financial sophistication, which is explained in detail in the Data section, will be included as well to determine its effect on retirement planning.

#### **4.4.3 Age**

As an individual ages, retirement nears his current time horizon. The closer to retirement one approaches, the more apparent it becomes the precise level of wealth needed post-retirement, as one gains new information on current salary, health and expected work years, and about how

much will be needed to consume after retirement to stay comfortable. Some individuals have limits to the amount of time in advance that they will plan for their future. That is, in the present, one is more likely to choose to disregard the needs of one's future self if the time horizon is distant. For this type of person, age will play a significant role in motivating retirement planning. As one ages, the prospect of retirement comes into view, and one is more likely to realize the urgency of proper planning.

The tendency to focus on the present is documented in literature and in the present bias theory or time inconsistency (Laibson 1997). The theory states that an individual's decisions are made in such a way that they are at odds with future decisions. By focusing on one's present self, the decision maker can have devastating consequences to his own future self. This is often viewed as a behavioral bias which justifies the existence of tax-advantaged retirement plans.

For those with this particular behavioral tendency, age will be a determinant of retirement assets. This effect is combined with increased and improved information about one's own retirement and current income over time, which can motivate contributions as well. Finally, for those age 50 and above, the contribution limit increases in all types of qualified plans. We view this as a decrease in the cost of contributing additional funds after age 50, making retirement assets more attractive relative to other investments. Thus, our model expects age pre-retirement to be positively related to retirement assets, consistent with literature on retirement contributions (Hira, Rock, and Loibl 2009).

#### **4.4.4 Marginal Tax Rate**

As mentioned in above in the discussion of income, individuals with high marginal tax rates (MTRs) have an extra incentive to contribute. Because retirement plans are a tax-deferred vehicle, the benefits of contributing depend on the current MTR that one is forgoing. If this

MTR is high, then deducting contributions saves the individual from paying a high MTR on the amount of his contribution. Furthermore, earnings and growth in the account are tax-sheltered until withdrawn. If the assets in an retirement account were instead originally placed in a more liquid account, the earnings would be taxed at the MTR each year. In a retirement account, those earnings avoid this high marginal tax up front and generates the possibility of overall tax savings if an individual's tax rate is lower in the future at withdrawal.

Avoiding this tax is an extra incentive or reduction in cost of contributing to a retirement plan. We can assume that an individual will respond to this incentive by investing more heavily in a retirement plan if his MTR is higher. One can see this in the theoretical model: the  $\tau_0$  variable reduces the after-tax amount that may be contributed to a taxable liquid savings account and therefore is directly related to being more likely to benefit from a tax-deferred retirement plan. Thus, the impact of higher marginal tax rates on total retirement assets should be positive (Long 1990).

#### **4.4.5 Liquidity and Savings Preferences**

The section on income explained that high-income individuals might be better able to handle one of the costs of contributing to a retirement plan, the loss of liquidity. Having one's assets committed to an account with a steep withdrawal penalty might impose a bigger burden on those who do not have a high level of wealth or income. However, income is not the only factor that determines preferences for liquidity. Other factors, such as risk aversion, discount rate, or characteristics of one's overall portfolio might determine one's optimal level of liquidity. Liquidity preferences, in turn, will influence the relative value of a retirement account. If an individual prefers high levels of liquidity, then the lost liquidity from contributing is an additional cost that is weighed in the decision to contribute (Long 1990).

Similarly, the life cycle theory is not the only determinant of savings preferences. As discussed in the overview of time inconsistency theory, individuals may have a stronger preference for savings if they are more future-oriented. Other factors that may contribute to savings preferences include investment options, educational costs, or income shocks. If an individual has stronger preferences for saving for future consumption, regardless of the reason, then we would expect higher retirement account balances. Since retirement plans are a form of savings, total retirement assets should be related to overall preferences for saving.

Stronger preferences for liquidity and for savings are expected to be negatively and positively related to retirement account assets, respectively. These exogenously-determined variables should partially explain retirement account balances in our econometric model. As such, it is necessary to control for these variables.

#### **4.4.6 Family**

The size and timing of a family greatly affects the level of income and consumption of the household. It is expected that families with greater number of children will have greater demands on their income to support current consumption for a larger number of household residents. This places additional constraints on liquidity and ability to save, resulting in an expected negative effect on retirement assets.

Furthermore, some evidence exists that children serve as an implicit partial insurance mechanism for their parent's future consumption and income (Pörtner 2001). This insurance effect will, for some individuals, partially alleviate some of the need to save for future income. We expect, then, that having children could negatively impact retirement savings for this reason as well. Combined with the additional demand on current income, the overall marginal effect of

having children should be negative on retirement assets, consistent with Yang and DeVaney (2012)

Having a spouse, on the other hand, may not have a negative effect on retirement planning. Although additional household members will place additional demands on income, a spouse may increase the household's ability to contribute to a retirement plan. In spite of the fact that a spouse may serve as future income insurance, we theorize that a spouse may increase ability to pay or decrease informational costs. Furthermore, there are economies of scale associated with a marginal household member. A married couple will have less than twice the expected expenses of living separately.

Additionally, having a spouse increases the need for retirement plans in the future. If the head of household expects to operate as one economic unit with his future spouse after retirement, then the household's retirement assets will need to be high enough to support both individuals. Thus, there is a greater current need to build a high retirement account balance. Thus, we expect that overall, the impact of a spouse to be positive on the chosen level of retirement balances. Note that the effect of increased income has already been captured and controlled for by the income variable.

## **Chapter 5: Data**

### **5.1 The Survey of Consumer Finances**

The data for our models draws from the Survey of Consumer Finances (SCF). The SCF is a triennial study conducted by the Federal Reserve Board of thousands of households to provide a comprehensive view of American finances. The household-level data covers a broad range of topics including demographics, liabilities, debt, retirement assets, and income.

#### **5.1.1 Survey Design**

For our analysis, the 2007 and 2010 versions of the survey are included, along with a panel from 2009 which resampled those households which were surveyed in 2007. The 2007 survey sampled 4,418 individuals, and the panel in 2009 was able to resurvey 3,857 of those individuals. The 2010 survey increased the number of households to 6,482. For the analyses here, the 2007 and 2010 surveys are combined into a pool of 10,900 households. These two survey years give a detailed description of American finances after the BAPCPA came into effect. These two surveys are the only two full surveys that occurred when all individuals are certain to have bankruptcy protection for retirement assets post-BAPCPA.

Each variable included in the SCF is numerically coded based on survey responses. The responses are all in number form, and sometimes represent dollar values. In other cases, specific numbers correspond to a yes or no response, an item on a provided list, or a reference to a specific household person. This coding method necessitates reclassification of all variables into a form that can be analyzed or regressed.

In some cases, the variables used in the model were derivatives of a collection of survey variables, discussed later. In addition to the financial variables, the SCF also includes attitudinal and demographic variables which are useful as control variables in a regression model. The

variables in the survey used for the empirical analysis are described below, as well as a description of the creation of new variables.

### **5.1.2 Weighting and Implicates**

In an effort to convey the most information about US finances, the SCF intentionally over-samples wealthy and high-income households, resulting in a non-representative sample. We describe in brief the methods that are detailed by the FRB (Kennickell 1998). For descriptive statistics or t-tests, the SCF includes a variable for the weight of each household according to how many households (out of the total 116 million) that are represented by this observation. Those households with higher incomes or assets are given lower weights, since they are relatively atypical among American households. Where descriptive statistics and t-tests are used, the variables are properly weighted first.

The SCF also attempts to correct for another problem with its data: missing values. As outlined by Kennickell (1998), the Federal Reserve Board uses multivariate analysis to predict an expected value for the data where missing data exists in the survey results. In order to accomplish this, each household is imputed, or replicated, five times, resulting in five separate implicates for each variable per household. These five implicates provide a better estimate than just one because multiple values can more accurately capture the likely range of values that are expected from that respondent. This method provides the best possible estimate for the household's missing value given other known characteristics.

When using regression analysis, such imputations can bias the standard error of the results, and necessary adjustments must be made to correct for this tendency. An article published by the Ohio State University explains the procedure for correcting regression results

(Montalto and Sung 1996). These adjustments to standard errors are made in any regression analysis in our empirical analysis, discussed in Chapter 6.

### **5.1.3 Creation of Pooled Data**

For these models, the 2010 survey and the 2007 survey were pooled into a total sample with 10,900 households and 54500 total imputations. Dollar values reported in the 2010 survey were deflated to 2007 dollars according to the Consumer Price Index. The 2009 survey, which uses the same individuals from the 2007 survey, excluded many typical variables included in other survey years in order to make the panel more practical and manageable. Because of this, there was not enough information to appropriately estimate the probability of filing for bankruptcy. Later on, the panel is used here to test the validity of our probability estimate by determining who the profile of those who did file for bankruptcy between the 2007 and 2009 surveys.

## **5.2 Variable Definitions**

The variables used in the models range across demographic, attitudinal, and financial variables, all derived from the Survey of Consumer Finances. All these variables were reclassified to logically apply to a statistical modeling framework instead of reflecting survey codes. In some cases, new variables needed to be created from a combination of other measures. These processes are explained below.

### **5.2.1 Independent Variables**

The first model, which will estimate each household's probability of filing for bankruptcy (PB), is explained in the Model section. The variables that contributed our first model were primarily financial in nature. The main contributor to bankruptcy, debt, takes several forms that have distinct relationships with bankruptcy. Because of these distinguishing characteristics, it



was necessary to specify the amount of debt held by each household in several categories based on ownership of the loan, type of loan, and whether the loan was secured (collateralized with property). The six categories of debt that were created were 1) credit card debt, 2) unsecured debt owed to a bank or financial institution (other than credit card debt), 3) all other unsecured debt, 4) secured debt owed to a bank or financial institution, and 5) all other secured debt and 6) medical debt. The justification for these categories is discussed in the Model section.

To classify debt as secured or unsecured, we first observed the type of debt. Some types of debt, such as credit card debt, is assumed to be unsecured, while others, such as house loans, are assumed to be secured, unless otherwise specified. In those cases where the type of debt does not imply secured or unsecured status, such as business loans, the SCF asks whether the loan is secured by property. If the loan is either a type of loan that is typically unsecured, or specified to be unsecured by the survey respondent, then we classified that debt as unsecured. For most loans, this question preceded a question about to whom this loan was owed. In a minority of instances, this question was not included. We assumed those loans were “other,” that is, not owed to a bank or financial institution. Medical debt, which overlapped with other categories of debt, is defined as any debt that is owed to a doctor, hospital, dentist, or veterinarian.

Other variables contribute to the estimation of the probability of filing for bankruptcy, some of which are used in our other models as well. The variable for married is a dummy variable that includes both those individuals who are legally married as well as those who are unmarried but living with a partner or spouse. House ownership is a dummy variable as well that includes ownership of all types of houses – ranches, farms, mobile homes, houses, condos, etc.

The variable for debt includes all types of debt, and the variable for assets includes all types of assets.

The variable for income was used in the estimation of the probability of filing for bankruptcy in a unique way. Because the specification of the model used income to normalize debt variables, those with incomes of 0 led to computationally impossible values for normalized debt categories. In order to treat those individuals with no income as having low incomes and high normalized debt values, we censored the income data from below at \$500. For our other models, the income variable simply measures the dollar values of income, bound from below by 0.

In explaining retirement assets, we use a wide array of variable types. First, we compute the age of the head of household, and his or her age squared, as well as natural log of household income. We also constructed dummy variables for whether the household has 0 children, 1 child, 2 children, or more than 2 children, as well as whether the household head has a bachelor's degree, to proxy for education. Another variable from the SCF for being married was constructed by including households with either a couple that is legally married or domestic partners. Race variables were also included to capture demographic variation – a dummy variable for whether the individual is white and a dummy variable for whether the individual is black. If the individual is neither black nor white, then both dummy variables will be 0.

Another dummy variable captures whether the individual is currently constrained for liquidity. The household was classified as constrained for liquidity if he met two conditions: 1) they were turned down for credit in the previous five years, and 2) they either were unable to obtain credit by reapplying or decided not to reapply because they believed they would be turned

down. This variable proxies for the household's opportunity cost for liquidity loss as a result of holding assets in savings.

Some of our variables related to retirement plans directly. We constructed a variable for whether the household head has access to a retirement plan through his employer in which both parties can participate. Another variable measures whether the individual plans to retire in the next five years. Aside from age, we expect that an individual will plan his retirement assets based on how soon he will need them. Furthermore, to control for the expected returns on an individual's retirement assets, we calculate the percent of an individual's retirement assets that consist of "risky" assets with a high expected return, such as stocks.

To create a measure of financial sophistication, we duplicate previous measures from Huston, Finke, and Smith. First, four factors are selected from the SCF: 1) an attitudinal variable about the level of risk the individual is willing to take, 2) whether the individual currently utilizes greater than 50 percent of his credit availability, 3) whether the individual owns stock equity, and 4) a rank from 1 to 4 for the level of understanding of the SCF questions. The latter variable is reported by the person who conducts the survey based how well the respondent showed an understanding of the complex financial questions in the survey. Next, the four factors are combined via factor analysis using the standard deviation from the mean for each factor. Those who are more risk averse, are not utilizing high amounts of credit, own stock equity, and have greater understanding of the survey are ranked higher. Finally, the individuals are split into quintiles, where 1 represents the (weighted) 20% of individuals who ranked highest in the factor analysis, and where 5 represents lower levels of financial sophistication (Huston, Finke, and Smith 2007).

### **5.2.2 Interaction terms**

We also created interaction terms to be used in the model. The first interaction variables measured the impact of the probability of filing for bankruptcy and financial sophistication jointly. The estimated probability of filing for bankruptcy was multiplied by each of the five dummy variables for financial sophistication, one for each quintile. The other interaction variable measured the impact of the probability of filing for bankruptcy and education jointly. It was created by multiplying the estimated probability of filing for bankruptcy by the dummy variable for whether the individual has completed a bachelor's degree.

### 5.2.3 Dependent variable

Finally, we used a variable for the level of retirement assets owned by the household. This variable uses the log total dollar amount of quasi-liquid retirement accounts, including pensions, IRAs, and Keoghs. That is, it measures the percentage of a household's total assets that have been invested in a designated retirement account with a withdraw penalty.

### 5.3 Descriptive Statistics

The following descriptive statistics give us a clearer picture of the mean and the dispersion of the data. All data from 2007 and 2010 are pooled.

TABLE 1: Descriptive Statistics for Total Population

<b>Variable</b>	<b>Frequency (Percent)</b>	<b>Mean (Std Dev)</b>
<b>Income (000s)</b>		79.51 (142.01)
<b>Quasi-Liquid Retirement Assets (000s)</b>		84.38 (139.95)
<b>Age</b>		50.32 (7.68)
<b>Access to Employee Retirement Plan</b>	31.66	
<b>Plans to Retire within 5 Years</b>	4.17	
<b>Bachelor's Degree</b>	36.46	
<b>No Kids</b>	56.30	
<b>1 Kid</b>	18.29	
<b>2 Kids</b>	15.59	

<b>3 or More Kids</b>	9.81
<b>Married</b>	58.38
<b>Black</b>	13.32
<b>White</b>	72.06
<b>Liquidity Constrained</b>	27.22

By comparison, we include here a descriptive statistics table for the five quintile classifications of financial sophistication and for the two levels of education. These descriptive data demonstrate the characteristic difference of individuals with different levels of financial sophistication and education. Each value represents the mean for the disaggregated groups, with Quintile 5 representing those with lowest levels of financial sophistication, and Quintile 1 representing those with highest levels of financial sophistication. Dummy variables represent percentages within the quintile with the relevant characteristic.

TABLE 2: Descriptive Statistics by Financial Sophistication and Education

Variable	Financial Sophistication					Education	
	Quintile 5	Quintile 4	Quintile 3	Quintile 2	Quintile 1	No Bachelor's Degree	Bachelor's Degree
<b>Income (000s)</b>	27.42	38.54	61.64	99.38	169.98	49.15	132.42
<b>Quasi-Liquid Retirement Assets (000s)</b>	1.45	6.74	35.57	120.56	256.43	30.30	178.63
<b>Probability of Filing for Bankruptcy</b>	4.33	4.97	7.25	6.44	4.17	7.82	4.04
<b>Bachelor's Degree</b>	11.41	20.55	31.86	49.92	68.48	0.00	1.00
<b>Married</b>	41.84	50.64	59.94	63.83	75.57	0.56	0.57
<b>No Kids</b>	54.16	58.73	56.11	56.51	55.98	0.19	0.17
<b>1 Kid</b>	18.21	17.83	19.08	18.14	18.21	0.15	0.17
<b>2 Kids</b>	15.53	13.09	14.66	16.70	17.99	0.11	0.08
<b>3 or More Kids</b>	12.11	10.35	10.15	8.66	7.81	0.56	0.63
<b>Black</b>	22.76	17.03	14.29	8.87	3.69	0.15	0.10
<b>White</b>	54.45	66.37	70.17	81.09	88.19	0.69	0.78

## Chapter 6: Models

### 6.1 The Probability of Filing for Bankruptcy

In order to determine the effect of bankruptcy on portfolio choice, we must first estimate the probability of filing for bankruptcy for each household in the SCF. The probability of filing for bankruptcy, while not observable, can be estimated via its relationship with other variables, especially debt variables. Domowitz and Sartain used multiple nested logit models from the SCF and interviews with bankrupt individuals to create a model that specified the magnitude of these relationships (Domowitz and Sartain 1999). Using this model, we can quantify each explanatory variable for households in the SCF and compute the probability of either Chapter 7 or Chapter 13 bankruptcy. Their model is defined as:

$$\begin{aligned} PB = & -5.103 + 3.208(\textit{Medical}) - 2.62(\textit{Homeowner}) & (18) \\ & + .604(\textit{Married}) + .002(\textit{Debt}) + 29.92(\textit{Credit Card}) \\ & + 82.65(\textit{Unsecured Bank}) + 7.1995(\textit{Unsecured Other}) \\ & + 2.663(\textit{Secured Bank}) + .966(\textit{Secured Other}) \end{aligned}$$

The variable “PB” is the probability of filing for bankruptcy. “Medical” is the amount of medical debt divided by assets. “Homeowner” is a dummy variable for whether the individual owns their home. “Married” is a dummy variable for whether the household consists of a married couple or a couple living together. “Debt” is the debt-asset ratio in the household. “Credit Card” is the amount of credit card debt divided by total assets. “Unsecured Bank” is the amount of unsecured debt owed to a bank or financial institution, divided by total assets. “Unsecured Other” is the amount of unsecured debt, divided by total assets, that is not on a credit card and not owed to a bank or financial institution. As described in Chapter 5, the coefficient on “Unsecured Other” has been averaged across two of Domowitz’s variables, the variables for

unsecured other debt and for unsecured individual debt. “Secured Bank” is the amount of secured debt that is owed to a bank or financial institution. “Secured Other” is the amount of secured debt, divided by total assets, that is not owed to a bank or financial institution.

The methods for creating and computing these variables are defined in detail in the Data chapter. Our variable of interest is the PB variable, the probability of filing for bankruptcy, bound from 0 to 100 percent. This variable will be used in the other models below.

The following table gives some information about the mean and dispersion of the probability of filing for bankruptcy variable created in this model. There is a distinct difference between the profiles in 2007 and 2010, with 2010 demonstrating a higher probability of filing on average amid the economic downturn.

TABLE 3: Descriptive Statistics for PB Variable

Year	Mean Probability (%)	25 <sup>th</sup> Percentile Probability (%)	75 <sup>th</sup> Percentile Probability (%)
2007	4.275	0	0.033
2010	6.205	0	1.502
Aggregate	5.423	0	0.831

To lend validity to the measure of PB as a predictor of bankruptcy, we demonstrate the following descriptive statistics from the 2007 SCF, disaggregated by those who reported filing for bankruptcy in the 2009 panel survey. This will allow us to follow a panel of individuals to determine the characteristics of those who actually did file in time period  $t$  based on their probability of filing in time period  $t - 1$ . The 2009 survey resampled the individuals from the 2007 survey with an 89% re-response rate. Using only those individuals resampled in 2009, the table below disaggregates the PB variable by those who did report filing for bankruptcy between surveys and those who did not.

TABLE 4: Descriptive Statistics for Filers and Non-Filers in the 2009 SCF Panel

<b>2009 Panel</b>	<b>Frequency (% of Total)</b>	<b>Mean Probability (%)</b>
Filed between 2007 and 2009	1.57	9.71
Did not file between 2007 and 2009	98.43	4.33

## 6.2 Evidence of Sheltering

In order to determine whether individuals with a higher probability of filing for bankruptcy favor retirement assets, which are protected against bankruptcy, we first seek to determine the effect of an increase in the probability of bankruptcy on the level of retirement assets by different groups.

### 6.2.1 The Heckman Model

Hypothesizing that the selection of whether someone has greater than \$0 in retirement assets differs from the determinants of the level of retirement assets, we will use a Heckman model to estimate the marginal effect of our PB variable at different levels of financial sophistication (Heckman 1979). We first begin with a description of the Heckman model, and establish the following:

$$D = 0 \text{ if } Y = 0 \text{ and } D = 1 \text{ if } Y > 0 \quad (19)$$

D indicates whether the person has any retirement assets, and Y represents the level of retirement assets in dollars. We then continue with the first of two parts of the Heckman model.

In the first part,

$$\Pr(D = 1 | Z) = \Phi(Z\gamma) \quad (20)$$

$$\Pr(D = 0 | Z) = 1 - \Phi(Z\gamma) \quad (21)$$



$Z$  is a vector of all our explanatory variables,  $\gamma$  is a vector of unknown coefficients solved by the first part, and  $\Phi$  is the cumulative distribution function of the standard normal distribution, and  $\phi$  is the density function.

The second stage is a least squares regression on the sample, censored to those individuals where  $D = 1$ . However, the distribution of  $Y$  is bound on the left-hand side to 0. The Heckman model treats our variable  $Y$  as if there is an underlying distribution not bound by 0. This distribution cannot be fully specified in the same way that an OLS can be, and requires that we include the Inverse Mills Ratio (IMR) to correct for this omitted variable problem.

We then compute the IMR as

$$\lambda(Z\gamma) = \frac{\phi(Z\gamma)}{\Phi(Z\gamma)} \quad (22)$$

This allows us to construct the second part of the model, where we specify the conditional expectation of retirement assets on our censored sample, given a positive value for our retirement assets variable. To measure retirement assets, we use the natural log of total dollars in the household's quasi-liquid retirement accounts,  $\ln Y$ . Our model is described as follows:

$$E(\ln Y | X, D = 1) = X\beta + \alpha\lambda(Z\gamma) \quad (23)$$

$X$  is a vector of our explanatory variables,  $\alpha$  is an unknown parameter establishing a relationship between the two steps of the model, and we solve for the vector of coefficients  $\beta$ . The  $X$  vector contains many of the same variables as the  $Z$  vector, which are both discussed in Section 6.4.

The unconditional expectation of the entire sample, however, differs because the unconditional expectation depends on both the probability that  $D = 1$  and the expectation of  $Y$  given that  $D = 1$ . Thus, our unconditional expectation of  $Y$  is the following:

$$E(\ln Y|X) = \Pr(D = 1)(E(Y|D = 1)) \quad (24)$$

$$E(\ln Y|X) = \Phi(Z\gamma)(X\beta + \alpha\lambda(Z\gamma)) \quad (25)$$

### 6.2.2 Marginal Effects

This model allows us to derive our value of interest, the marginal effect of an explanatory variable on the level of retirement assets. The explanatory variable can impact one's retirement assets in two ways: 1) by changing the probability that an individual holds retirement assets, and 2) by increasing the expected value of an individual's retirement assets provided that his asset level is greater than 0. We refer to the first effect as the probability marginal effect and the latter as the conditional marginal effect. The combined result of these two effects are called the unconditional marginal effect.

The probability marginal effects are defined as

$$\frac{\partial(\Pr(D = 1))}{\partial X_k} \quad (26)$$

where  $X_k$  is one explanatory variable. The conditional marginal effect is defined as

$$\frac{\partial E(\ln Y|X, D = 1)}{\partial X_k} \quad (27)$$

Typically, the equation above reduces to  $\beta_k + \alpha \left( \frac{\partial \lambda}{\partial X_k} \right)$ , where  $\beta_k$  is the coefficient on our variable  $X_k$  in the second stage of the Heckman procedure. However, for our interaction terms, the derivation is more complex. For this example, we use  $X_k$  and  $X_m$ , where  $X_m$  is the discrete interaction variable. In our case,  $X_m$  is either financial sophistication or education and PB is  $X_k$ . We will be primarily interested in the marginal effect of  $X_k$  evaluated at each level of the discrete variable  $X_m$ .

$$E(\ln Y|X, D = 1) = B_k X_k + B_m X_m + B_{km} X_m X_k + \sum_{i=1}^n B_i X_i + \alpha \lambda(Z\gamma) \quad (28)$$

$$\left. \frac{\partial E(\ln Y|X, D = 1)}{\partial X_k} \right|_{X_m=c} = B_k + B_{km} X_m + \alpha \left( \frac{\partial \lambda}{\partial X_k} \right) \Big|_{X_m=c} \quad (29)$$

This equation is instrumental for calculating our value of interest, the unconditional marginal effects of PB evaluated at various levels of  $X_m$ . The general case is defined as

$$\begin{aligned} \frac{\partial E(\ln Y|X)}{\partial X_k} &= \frac{\partial (\Pr(D = 1)(E(\ln Y|D = 1))}{\partial X_k} \quad (30) \\ &= \left( (\Pr(D = 1)) \left( \frac{\partial E(\ln Y|X, D = 1)}{\partial X_k} \right) \right) + \left( (E(\ln Y|D = 1)) \left( \frac{\partial (\Pr(D = 1))}{\partial X_k} \right) \right) \end{aligned}$$

For interaction effects, we will compute

$$\left. \frac{\partial E(\ln Y)}{\partial X_k} \right|_{X_m=c} \quad (31)$$

This value will give us a picture of how the portfolio allocation of different population groups changes with the probability of filing for bankruptcy increases.

### 6.3 Model for the Expected Benefit of Retirement Asset Exemptions

Portfolio reallocation in response to a policy reveals how an individual may alter his behavior to benefit from the policy. These behavioral effects impact the distribution of benefits of some policy. Here, we are interested in how portfolio sheltering impacts the distribution of financial gain derived from bankruptcy exemptions for retirement assets.

The distribution of benefits from bankruptcy exemptions is important not only for its policy implications, but also to provide a relative measure of the sheltering effect. Thus, we are

interested in calculating the distribution of these benefits themselves, and compute how much of those benefits are due to asset reallocation.

To measure the benefit of retirement asset exemptions, we consider the two conditions that are necessary for benefitting from the exemption: 1) filing for bankruptcy, and 2) possessing retirement assets that are covered by the exemption. If either of these conditions are not met, then no benefits of the exemption are realized. The level of benefit, if both conditions are met, depends on two factors: 1) the chapter choice in bankruptcy, Chapter 7 or Chapter 13, and 2) the level of retirement assets. If an individual files for Chapter 13 bankruptcy, retirement assets are excluded from the calculation of total assets, which determines the repayment plan. The bankruptcy exclusion therefore benefits Chapter 13 filers to the extent that it relieves repayment obligations. If, instead an individual files for Chapter 7 bankruptcy, his retirement assets are protected from creditors and he is relieved of those debt obligations.

Since our measure of the probability of filing for bankruptcy does not distinguish between chapter choice, we assume that the expected dollar benefit of a marginal dollar in one's retirement plan is the average benefit of filing for each chapter, conditional on filing, and weighted by the relative frequency of each chapter choice. The following representation applies, where  $PB$  represents the percent probability of filing for any type of bankruptcy,  $PB_7$  is the percent probability of filing for Chapter 7,  $PB_{13}$  is the percent probability of filing for Chapter 13,  $E(B)$  is the total expected financial benefit of the bankruptcy exemption for retirement assets,  $E(B_7)$  is the expected financial benefits of the exemption conditional on filing for Chapter 7 bankruptcy,  $E(B_{13})$  is the expected benefit of the exemption conditional on filing for Chapter 13 bankruptcy, and  $Y$  is retirement assets:

$$PB = PB_7 + PB_{13} \tag{32}$$

$$E(B) = .01PB_7(E(B_7)) + .01PB_{13}(E(B_{13})) \quad (33)$$

We scale PB, which is measured in percentage terms, by .01. With a few exceptions for exemption limits, we expect  $E(B_7)$  should be equal to the total amount of retirement assets, Y. The expected benefit of the exemption for Chapter 13 filers is the amount by which exempt assets relieves debt obligations relative to nonexempt assets. We expect this value to be some constant factor of the total amount of exempt assets in one's retirement account. We designate this total value  $\theta Y$  (where  $\theta < 1$ ) to reduce  $E(B)$ :

$$E(B) = .01PB_7Y + .01PB_{13}\theta Y \quad (34)$$

We assume minimal fluctuation in the relative probability of Chapter 13 versus Chapter 7 choice conditional on filing for bankruptcy. That is, we assume  $\frac{PB_7}{PB}$  and  $\frac{PB_{13}}{PB}$  are constant, designated  $\rho$  and  $1 - \rho$  respectively.

$$E(B) = .01Y\rho PB + .01Y\theta(1 - \rho)PB \quad (35)$$

$$.01Y * PB * \mu = E(B) \quad (36)$$

where  $\rho - \rho\theta + \theta = \mu$ , and  $\mu$  is some constant, then we can reduce Equation 35 to a form that is useful for specifying in our final model.

$$.01Y * PB = \frac{E(B)}{\mu} \quad (37)$$

Our value of interest is the impact of retirement asset bankruptcy exemptions on some characteristic or variable. Hypothesizing a log-linear relationship, we are interested in the change in the percent  $E(B)$  as a result of some variable. That is, we will solve for  $\frac{\partial(\ln E(B))}{\partial X_k}$  for some variable  $X_k$  from our previous model. This value is a function of Y and PB.

$$\ln(E(B)) = \ln(.01Y * PB * \mu) \quad (38)$$

$$\frac{\partial \ln(E(B))}{\partial X_k} = \frac{\partial \ln(.01Y * PB * \mu)}{\partial X_k} = \frac{\partial \ln Y}{\partial X_k} + \frac{\partial \ln PB}{\partial X_k} + \frac{\partial \ln(.01\mu)}{\partial X_k} = \frac{\partial \ln Y}{\partial X_k} \quad (39)$$

This holds true for all  $X_k$  with the exception of PB itself, which is an explanatory variable in our Heckman model. For all other variables, the value  $\frac{\partial \ln Y}{\partial X_k}$  was solved in the previous model. Therefore, the unconditional marginal effects of our Heckman model can also be interpreted as percent changes in the expected benefit derived from the exempt status of retirement assets.

For PB, we expect a linear relationship between the benefit and the probability of filing, s defined by equation 33, so we solve using the product rule:

$$\begin{aligned} \frac{\partial(E(B))}{\partial PB} &= \frac{\partial(.01Y * PB * \mu)}{\partial PB} = .01\mu \left( \frac{\partial PB}{\partial PB} Y + \frac{\partial Y}{\partial PB} PB \right) = \\ &.01\mu \left( Y + \frac{\partial \ln Y}{\partial PB} Y * PB \right) = .01Y\mu \left( 1 + \frac{\partial \ln Y}{\partial PB} PB \right) \end{aligned} \quad (40)$$

This approximates the change in benefits a change of 1 in the percent probability of filing for bankruptcy. Since we solve for the unconditional marginal effect  $\frac{\partial \ln Y}{\partial PB}$  from our Heckman model, we will be able to solve for  $\frac{\partial(E(B))}{\partial PB}$  and determine what portion of the full effect of PB on the expected protection is attributable to sheltering. This portion will be evaluated at various levels of our discrete variables for financial sophistication and education to conclude whether individuals with higher levels of financial sophistication or education receive a greater portion of the expected exemption benefit from sheltering.

#### 6.4 Model Specification and Variable Selection

The variables chosen for this model were based in both our theoretical framework and the literature. For each of the variables described below, how they were created and the underlying data are discussed in Chapter 5. All data is derived from the SCF surveys from 2007 and 2010 from 10,900 households.

### 6.4.1 The Heckman Model Part 1

The first part of the Heckman model is specified as a probit model in Equations 19 and 20. Our dependent variable  $D$  is whether or not the individual has retirement assets, which has an mean probability of 51.4%. The vector  $Z$  is composed of our explanatory variables, listed here. First, we include the age of the household head, which we expect to be positively related to  $D=1$ . Once an individual opens a retirement account, he will hold assets in the account until he withdraws all of them. Very few individuals withdraw the entirety of their retirement assets before retirement, and only a minority of retirees have depleted their retirement accounts completely. The only other group with no retirement assets are those who have never opened an account. This leads to our expectation that more individuals join the group who owns retirement assets than those who deplete their assets, meaning a positive relationship between age and owning a retirement asset.

Income, closely correlated to the ability to pay into an account, should be positively related to owning a retirement asset. We include the natural log of income in the  $Z$  vector. Similarly, our dummy variable for whether the individual is liquidity constrained should also display a positive coefficient. Other dummy variables, including one for having access to an employee-sponsored retirement plan and one variable for planning to retire soon are expected to be positively related to  $D=1$ .

Demographic variables such as whether the household head is black, white, married, has no children, one child, two children, or three or more children is included as well. Those households with fewer children and those that contain a married couple should have a greater probability of having a retirement plan.

The probability of filing for bankruptcy is included along with our dummy variables for financial sophistication quintiles and whether the person has a bachelor's degree, which measures education. Financial sophistication and education measure the price of informational barriers, and are hypothesized to be negatively related to price. Therefore, we expect that they are positively related to holding retirement assets. We do not hypothesize any interaction effect between PB and financial sophistication or education for the selection model. We expect that the interaction effect between PB and those household measures will have a measurable effect on those households who regularly consider retirement assets in their portfolio allocation decisions.

#### **6.4.2 The Heckman Model Part 2**

The second part of the Heckman model is specified as in Equation 22. Our variable  $Y$  measures retirement assets in dollars, which are wildly and unevenly distributed in the upper few percentiles of households. Because of the distribution of  $Y$ , we avoid hypothesizing a linear relationship between  $Y$  and our independent variables, which are contained in the vector  $X$ . Therefore, we use the natural log of total dollars,  $\ln Y$ , as our dependent variable.

The vector  $X$  contains many of the same variables as the vector  $Z$  in the first part of the model. However, we include age squared along with age in the second part of this model because the relationship between age and the level of retirement assets is complex. Based on the life cycle theory discussed in Chapter 4, we expect that retirement assets steadily increase throughout life until retirement, at which point they will decline. The variables for age and age squared such capture this hyperbolic relationship.

The natural log of income, access to an employee retirement plan, planning to retire soon, liquidity constrained status, and all our demographic variables are included in the second part of the model, including variables for being black, white, married, having no children, one child, two



children, and three or more children. The coefficients on all the variables listed above are expected to have the same signs as the first step of the model based on the same theoretical relationships previously discussed. We also include a measure for the percent of retirement plans that are allocated to risky assets to proxy for the expected returns associated with different asset classes, such as stocks.

The measure of PB, the dummy variables for financial sophistication quintiles, and education are included along with the following interaction terms: 1) PB and each financial sophistication quintile dummy variables, and 2) PB and education. We expect a positive coefficient on the latter interaction as well as the interaction for higher levels of financial sophistication. These interaction terms will also help to add specificity to our marginal effect calculations.

## **6.5 Other Model considerations**

The computation of our Heckman model includes several considerations that will allow for more accurate and reliable estimates. The first is a discussion of bootstrapping of our error terms, and the second is the treatment of imputates for our data, which is derived from multiply imputed survey results.

### **6.5.1 Bootstrapping**

Bootstrapping was developed to correct for a number of problems associated with uncertainty about the true distribution of the data (Efron 1979). The method operates by resampling the data to estimate properties of variance, standard errors, and p-values. For our model, we used 500 iterations with replacement to render our standard errors more accurate.

Ader, Mellenbergh, and Hand (2008) recommends the bootstrap procedure when the theoretical distribution of a statistic is uncertain. For our data, one of our variables of interest,

the probability of filing for bankruptcy, was created from an estimated model. Thus, the true value of this probability measure is uncertain, which affects the specification of our Heckman model. Since bootstrapping is computed independent of the data distribution, it allows us to indirectly assess the true variance and standard errors.

### 6.5.2 Imputation Adjustments

The Survey of Consumer Finances uses multiple imputation techniques that were discussed in Chapter 5. Each household is represented by five observations per variable, and missing responses are estimated using each of the five observations to capture the expected distribution of responses from that household. For statistical inference, we use the Repeated-Imputation Inference (RII) method to calculate the coefficients and standard errors. This technique requires that we run a regression for each imputation of the data then compute our parameters according to the calculations below. Here,  $Q$  represents the point estimate for a single imputation,  $U$  is the variance within an imputation,  $B$  is the variance among imputations, and  $T$  is the total variance. For our data which is imputed five times, according to Kennickell (1998), the point estimates for our Heckman model are defined as simply

$$\bar{Q} = \frac{1}{5} \sum_{i=1}^5 Q_i \quad (41)$$

To compute the standard errors of our estimates, we must compute  $U$ ,  $B$ , and  $T$  first:

$$\bar{U} = \frac{1}{5} \sum_{i=1}^5 U_i \quad (42)$$

$$B = \frac{1}{4} \sum_{i=1}^5 (Q_i - \bar{Q})^2 \quad (43)$$

$$T = \bar{U} + \frac{6}{5} B \quad (44)$$

The standard error for our Heckman model is the square root of the total variance,  $\sqrt{T}$ .

## Chapter 7: Results

The following results contains three parts: 1) the results from our Heckman model and the marginal effects of the probability of filing for bankruptcy evaluated over different subpopulations, 2) an estimate of the relative value of certain variables on the expected protection offered by the bankruptcy exemption for retirement assets, and 3) a visual and graphical representation of the expected level of retirement assets at different levels of the probability of filing for bankruptcy. This will give way to a discussion of the results and conclusions regarding our findings.

### 7.1 Model Parameters

#### 7.1.1 Heckman Coefficients

Our Heckman model, specified in Chapter 6, solves for  $\gamma$  and  $\beta$  by the respective two parts. The results for the first stage is below establishing a relationship between our independent variables and our model variable D, whether the household has retirement assets:

TABLE 5: Heckman Model Results, Part 1

Variable Name	Coefficient	Std. Error	T-statistic	P-value
<u>HAVE RETIREMENT ASSETS</u>				
Age	0.003	0.001	2.516	0.012
Log Income	0.001	0.015	0.036	0.972
Access to Employee Retirement Plan	1.363	0.048	28.231	0.000
Retire Soon (<5 years)	0.101	0.089	1.130	0.259
Educated	0.051	0.041	1.232	0.218
Financial Sophistication				
Quintile 4	0.352	0.068	5.139	0.000
Quintile 3	1.501	0.063	23.790	0.000
Quintile 2	2.452	0.070	35.245	0.000

Quintile 1	2.666	0.075	35.730	0.000
PB	-0.004	0.001	-4.186	0.000
No Kids	0.072	0.067	1.072	0.284
1 Kid	0.063	0.071	0.890	0.374
2 Kids	0.102	0.072	1.420	0.156
Married	0.385	0.040	9.740	0.000
Black	0.132	0.072	1.832	0.067
White	0.235	0.051	4.594	0.000
Liquidity Constrained	-0.047	0.044	-1.063	0.288
Constant	-2.366	0.106	-22.244	0.000

The second part of our Heckman model defines the correlation between our independent variables and the level of retirement assets in log dollars conditional on the household holding greater than \$0 in retirement assets:

TABLE 6: Heckman Model Results, Part 2

<b>Variable Name</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>T-statistic</b>	<b>P-value</b>
<b><u>LOG RET ASSETS</u></b>				
Age	0.172	0.009	18.226	0.000
Age Squared	-0.001	0.000	-13.169	0.000
Log Income	0.433	0.015	28.598	0.000
Access to Employee Retirement Plan	0.430	0.041	10.540	0.000
Retire Soon (<5 years)	0.122	0.070	1.738	0.082
Educated	0.596	0.044	13.477	0.000
<b>Financial Sophistication</b>				
Quintile 4	0.395	0.254	1.551	0.121
Quintile 3	0.482	0.203	2.370	0.018
Quintile 2	0.974	0.200	4.867	0.000
Quintile 1	1.293	0.200	6.459	0.000
<b>Interaction Terms</b>				

PB*Quintile 4	-0.007	0.024	-0.300	0.764
PB*Quintile 3	0.011	0.019	0.590	0.555
PB*Quintile 2	0.004	0.019	0.210	0.834
PB*Quintile 1	0.013	0.019	0.682	0.495
PB*Educated	0.004	0.003	1.145	0.252
PB	-0.009	0.019	-0.458	0.647
No Kids	0.139	0.065	2.127	0.033
1 Kid	-0.066	0.074	-0.891	0.373
2 Kids	0.092	0.069	1.324	0.185
Married	0.390	0.049	8.019	0.000
Black	-0.124	0.102	-1.221	0.222
White	0.164	0.067	2.428	0.015
Risky Retirement Asset Percent	0.096	0.064	1.488	0.137
Liquidity Constrained	-0.516	0.057	-9.122	0.000
Constant	1.417	0.336	4.214	0.000

The above results confirm our expectations about the direction of the relationship between some of our independent variables and the level of retirement assets. All the financial variables have an expected sign and reasonable magnitude. For example, our results demonstrate that if income increases by 1%, the conditional expectation of our retirement assets increase by .433%. Our demographic variables demonstrate weak relationships for those variables from which we expected multiple competing effects, such as having children. Other variables with clearer relationships, such as being married, demonstrate a positive relationship with log retirement assets. The probability of filing for bankruptcy is significantly negatively related to the selection into owning retirement assets, but displays no clear relationship with retirement asset levels conditional on owning retirement assets. The marginal effects will demonstrate whether this uncertain relationship holds true for all disaggregated population groups.

For our variables of interest, education and higher levels of financial sophistication are significantly and positively related to the level of retirement assets. In the second stage of the model, the interaction effects also demonstrated positive coefficients, but low levels of statistical significance and relatively small magnitudes. This implies that the interaction terms may add small amounts of information to our model specification, but does not imply that the marginal effects of PB will be the same across financial sophistication quintiles or education levels. We look to the marginal effects estimates to inform our expectation about the marginal effect of the probability of filing on the level of retirement assets.

### 7.1.2 Marginal Effects

The following section reports the marginal effects of the probability of filing for bankruptcy (measured by percent) on log retirement assets. First, we report the unconditional marginal effects of PB for different groups:

TABLE 7: Unconditional Marginal Effects of PB by Subpopulation

<b>Subpopulation</b>	<b><math>\partial \ln Y / \partial PB</math></b>	<b>Std. Error</b>	<b>T-statistic</b>	<b>P-value</b>
<u>Financial Sophistication</u>				
Quintile 5	-0.0043	0.0013	-2.822	0.005
Quintile 4	-0.0103	0.0025	-3.296	0.001
Quintile 3	-0.0010	0.0038	-2.562	0.010
Quintile 2	-0.0053	0.0028	-3.277	0.001
Quintile 1	0.0041	0.0023	0.528	0.597
<u>Education</u>				
No Bachelor's Degree	-0.0069	0.0021	-3.379	0.001
Bachelor's Degree Holders	-0.0032	0.0021	-1.471	0.141

The generally negative coefficients imply that being at high risk for bankruptcy might cause an individual to allocate fewer resources to long-term savings in the form of retirement assets. However, most of these marginal effects are not significantly different from zero.

Is the negative impact of an increase in probability of filing on retirement assets due to its impact on selection into owning retirement assets, or does it also negatively influence the retirement assets of those who do own them already? The answer cannot be addressed by the unconditional marginal effects alone. Thus, we are interested in computing the probability marginal effects and the conditional marginal effects for different subpopulations to determine whether the negative relationship holds true after selection into owning retirement assets. The following table provides probability marginal effects:

TABLE 8: Probability Marginal Effects of PB by Subpopulation

<b>Subpopulation</b>	<b><math>\partial \ln Y / \partial PB</math></b>	<b>Std. Error</b>	<b>T-statistic</b>	<b>P-value</b>
<u>Financial Sophistication</u>				
Quintile 5	-0.0004	0.0001	-4.009	0.000
Quintile 4	-0.0007	0.0002	-4.158	0.000
Quintile 3	-0.0013	0.0003	-4.225	0.000
Quintile 2	-0.0006	0.0002	-4.188	0.000
Quintile 1	-0.0005	0.0001	-4.144	0.000
<u>Education</u>				
No Bachelor's Degree	-0.0007	0.0002	-4.209	0.000
Bachelor's Degree Holders	-0.0006	0.0001	-4.219	0.000

Table 8 demonstrates the uniformly negative impact of the probability of filing for bankruptcy on selection into owning retirement assets, for all levels of financial sophistication and education. The other component of marginal effects is the conditional marginal effects, for those who have selected into owning retirement assets. This is presented below in Table 9.

TABLE 9: Conditional Marginal Effects of PB by Subpopulation

<b>Subpopulation</b>	<b><math>\partial \ln Y / \partial PB</math></b>	<b>Std. Error</b>	<b>T-statistic</b>	<b>P-value</b>
<u>Financial Sophistication</u>				
Quintile 5	-0.0080	0.0186	-0.432	0.666
Quintile 4	-0.0150	0.0138	-1.085	0.278
Quintile 3	0.0042	0.0042	0.981	0.327
Quintile 2	-0.0023	0.0025	-0.920	0.357
Quintile 1	0.0072	0.0020	3.575	0.000
<u>Education</u>				
No Bachelor's Degree	-0.0057	0.0062	-0.912	0.362
Bachelor's Degree Holders	0.0035	0.0020	1.751	0.080

This table demonstrates the resource allocation of those who already do own retirement assets in response to an increase in the probability of filing for bankruptcy. Our expectation about the positive relationship between retirement assets and the probability of filing for bankruptcy holds true for only two categories of those who do already own retirement assets: those with high levels of education and those who are most financially sophisticated. Only these two conditional marginal effects are statistically significantly different than 0.

These results match our expectations about the probability of filing for bankruptcy and informational costs. Although we highlight a significant benefit of retirement assets for all those who have higher probabilities of filing for bankruptcy, the informational and compliance costs are not hypothesized to be uniformly distributed. That is, access to information is inextricably connected to taking advantage of the exemption protection, but differs across characteristic groups.

Appendix A provides a graph for each level of financial sophistication and education to explore the relationship between various levels of the probability of filing for bankruptcy and



retirement assets, all else constant. The y-axis is total dollars in the households quasi-liquid retirement accounts, while the x-axis includes the probability of filing for bankruptcy.

Conditional and unconditional expectations are compared directly.

The graphs show a strongly negative relationship between PB and retirement assets for those with lower levels of education and financial sophistication. Having higher levels of education and financial sophistication tends to moderate this effect, especially for those who do already possess retirement assets, that is, conditional on owning retirement assets. The positive relationship with the greatest magnitude is clearly those in the highest level of financial sophistication or a bachelor's degree, conditional on already owning retirement assets.

## 7.2 Expected Benefit Calculations

### 7.2.1 Changes in PB

The above results demonstrate a change in portfolio allocation for select characteristic groups in response to bankruptcy. However, our other measure of interest is the total effect of the policy on those groups, of which the reallocation response is only a partial endogenous effect. We refer to the relationship derived in Chapter 6.3,

$$\frac{\partial(E(B))}{\partial PB} = .01Y\mu + .01Y\mu \frac{\partial \ln Y}{\partial PB} PB \quad (45)$$

Some information about the first term is found in Table 2. For the second term in Equation 44 is defined as the impact of portfolio reallocation on the total benefit for a particular individual or set of individuals resulting from the exempt status of retirement assets. For some individuals, we cannot rule out the null hypothesis that  $\frac{\partial \ln Y}{\partial PB} = 0$ . If that null hypothesis is true, hypothetically, then  $\frac{\partial(E(B))}{\partial PB}$  is simply  $.01Y\mu$ , with no additional impact of portfolio reallocation for which to account.

For those who have a positive marginal effect of PB on log retirement assets, we compute the relative magnitude of both  $.01Y\mu$  and  $.01Y\mu \frac{\partial \ln Y}{\partial PB} PB$ , the two terms in the equation above. The relative magnitudes will help us to understand what portion of the expected benefit of the bankruptcy exemptions are due to portfolio reallocation. The following table defines these percentages for the two groups that demonstrated a statistically significant positive relationship between PB and log retirement assets: 1) those who are in the upper quintile of financial sophistication and also possess retirement assets, and 2) those with a bachelor’s degree and also possess retirement assets. Note that the derivation is evaluated at the disaggregated mean for the subpopulation groups, including the mean for the probability of filing for bankruptcy.

TABLE 10: The Impact of Reallocation on Protected Assets

<b>Subpopulation</b>	<b>Total Effect</b>	<b>Effect of Reallocation</b>	<b>Percent Impact of Reallocation</b>
Financial Sophistication Quintile 5, Has Retirement Assets	\$2,816.14/ $\mu$	\$80.28/ $\mu$	2.85%
Bachelor’s Degree Holder, Has Retirement Assets	\$2,540.94/ $\mu$	\$53.52/ $\mu$	2.11%

This table implies that the response to having a high probability of filing for bankruptcy accounts for 2.85% and 2.11% of the total expected protection offered by bankruptcy exemptions for retirement assets for our two respective groups. The total benefit is described in relative terms, scaled by our constant  $\mu$  which depends on the relative portion of Chapter 7 and Chapter 13 bankruptcies, as well as the dollar value of the benefit associated with an exempt asset in Chapter 13 bankruptcy.

For all other subgroups, we cannot assume any relationship between the probability of filing and retirement assets. Thus, the relative expected benefit due to a change in the probability

of filing for bankruptcy is simply the proportion of retirement assets. Chapter 5 provides these weighted descriptive statistics disaggregated by financial sophistication and education.

### 7.2.2 Changes in Financial Sophistication and Education

The change in the expected benefit from bankruptcy exemptions for retirement assets was defined in Chapter 6 as

$$\frac{\partial \ln(E(B))}{\partial X_k} = \frac{\partial \ln Y}{\partial X_k} \quad (46)$$

The change in the percent of expected benefit is simply the unconditional marginal effect of our Heckman model. Isolating the impact of an explanatory variable will reveal how much expected financial gain can be attributable to changes in that variable, all else equal, with respect to the bankruptcy exemption for retirement assets. The marginal effects of our variables of interest, financial sophistication and education, are in the table below. The results answer the question of how much better off would an individual be if he increased his financial sophistication or education.

TABLE 11: Changes in Expected Benefit due to Changes in Financial Sophistication and Education

Subpopulation	$\partial \ln Y / \Delta X$	Std. Error	T-statistic	Pvalue
<u>Financial Sophistication</u>				
From Quintile 5 to Quintile 4	0.834	0.149	5.613	0.000
From Quintile 4 to Quintile 3	3.453	0.151	22.799	0.000
From Quintile 3 to Quintile 2	2.951	0.164	17.956	0.000
From Quintile 2 to Quintile 1	0.743	0.172	4.327	0.000
<u>Education</u>				
From No Bachelor's Degree to Bachelor's Degree	0.448	0.076	5.911	0.000

For each described changes above, the effect of an increase in financial sophistication and education are both consistently positive on the expected benefit and statistically significant at the 99.9% confidence level. That is, our model confirms that those who are more sophisticated and have higher education benefit significantly more from the bankruptcy exemption for retirement assets than those who are less sophisticated and have lower levels of education respectively. We can also identify the source of the differential: differences in the level of retirement assets. That is, households that are more financially sophisticated and have more education benefit from the bankruptcy exemption because they possess more retirement assets. We also note that part of this differential is attributable to portfolio reallocation for those who do own retirement assets and are at the highest levels of financial sophistication and education.

### 7.3 Graphical Representation

These differences can be seen in the following graphical representation of the unconditional expected level of financial benefit at different levels of financial sophistication and with different levels of probability of filing for bankruptcy. We use the following formula from Chapter 6.3:

$$\frac{\partial(E(B))}{\partial PB} = 01Y\mu \left( 1 + \frac{\partial \ln Y}{\partial PB} PB \right) \quad (47)$$

For changes in the percent probability of filing for bankruptcy, we approximate with the following:

$$E(B)|_{PB=c-1} = E(B)|_{PB=c-1} + \frac{\partial(E(B))}{\partial PB} \Big|_{PB=c-1} \quad (48)$$

where  $1 \leq c \leq 100$ .

On the y-axis, we have an expected benefit measure, scaled by our constant  $\frac{1}{\mu}$ , and on the x-axis, we measure various levels of the probability of filing for bankruptcy. Our graph

represents different characteristic groups, using the mean retirement asset level for the group. These results are displayed in Appendix B.

We also represent the data in table form in Appendix C. Note that the benefits are relative measures, and represent dollars scaled by our constant  $\frac{1}{\mu}$ . The results demonstrate a dramatic differential among characteristic groups. Those who are more sophisticated or have higher levels of education benefit a great deal more than those who are not in those groups for the same levels of the probability of filing for bankruptcy. Especially, those who are educated and those in the highest quintile of financial sophistication have the highest levels of expected benefit.

It is also worth noting that the expected benefits would be perfectly linearly related to the probability of filing for bankruptcy without the effect of portfolio reallocation. The slight negative coefficients on most of our variables accounts for the diminishing rate of increase across the x-axis. For those who are most financially sophisticated, the graph increases exponentially, due to its positive unconditional marginal effect of PB. This effect accounts for a portion of the differential across characteristic groups.

It is apparent from our estimation of the percent impact of financial sophistication and of education on the expected protection change that the primary determinant of expected benefit is the levels of retirement assets. The differences among groups in retirement assets explains most of the variation in the expected benefit from the relevant bankruptcy exemption. It is also noteworthy that based on our descriptive statistics in Chapter 5.3, the probability of filing for bankruptcy is roughly even across all subgroups. In fact, those with lowest levels of financial sophistication and education have slightly lower probabilities of filing. Having a higher

probability of filing, as demonstrated in the table above, is associated with greater expected benefits from the bankruptcy exemptions for retirement assets.

## **Chapter 8: Conclusion**

This chapter summarizes our findings from Chapter 7 and compares them to our hypothesis and to the literature. We then discuss some limitations of the model and how this research can be extended in the future to better understand behavior surrounding investment before bankruptcy.

### **8.1 Important Findings**

Our models demonstrate that the probability of filing for bankruptcy can impact the savings level in a retirement account. Some individuals will respond to conditions of high probability of filing by allocating fewer resources to a retirement account, while others will allocate greater resources. Our results demonstrate which characteristics are related to this response.

#### **8.1.1 Portfolio Reallocation**

Our theoretical framework highlighted the advantages of allocating resources to a retirement account if one's probability of filing for bankruptcy is high. However, we theorized that there is significant informational or practical barriers to sheltering assets pre-bankruptcy. We estimated that those with higher levels of education or financial sophistication will respond differently to higher probabilities of filing for bankruptcy. Based on the marginal effects for our Heckman model, the strongest evidence suggests that this is true, conditional on owning retirement assets.

Using our statistically significant results only, we conclude that the probability of filing for bankruptcy is positively related to retirement assets if two conditions are true: 1) the household already owns retirement assets, and 2) the household head is either financially sophisticated or has a bachelor's degree. Our results, then, identify a determinant of a positive

marginal effect of the probability of filing for bankruptcy: self-selecting into owning retirement assets. We infer that households with retirement assets tend to alter their behavior under new conditions of bankruptcy. However, our results demonstrate that this effect does not necessarily extend to those who do not own retirement assets. That is, we do not find strong evidence that the probability of filing for bankruptcy predicts selection into a retirement asset.

These results are in line with our expectations and our hypothesis. For the first condition in the paragraph above, an individual is more likely to have flexibility in optimizing his retirement assets if he has self-selected into owning retirement assets. If an individual has no retirement assets, we theorize that he has greater expected informational or financial barriers to optimizing his portfolio for changes in a specific benefit. Even if the individual would, under perfect information, respond to an increase in the probability of filing for bankruptcy by increasing retirement asset allocation, he might lack the flexibility to do so. For the second condition, education and financial sophistication also help the individual diminish these barriers and protect his portfolio assets to a greater extent from bankruptcy risk.

### **8.1.2 Expected Benefits**

The expected benefits of bankruptcy exemptions vary by individual based primarily on the level of retirement assets and the probability of filing for bankruptcy. We find here that financial sophistication and education significantly and strongly predict retirement asset levels. Those with higher levels of financial sophistication and education have, on average, a higher expected value associated with the exemption. That is, when the probability of filing for bankruptcy increases, highly sophisticated or educated individuals receive much greater protection.



Our model demonstrates that for those individuals who shelter assets in retirement accounts in response to the probability of filing, sheltering compounds the expected benefits. This sheltering effect, according to our results, benefits those in the highest quintile of financial sophistication and those with a bachelor's degree, both conditional on owning retirement assets. Those two classes of individuals are those with the highest levels of expected protection. The sheltering effect then helps those who are already extremely well protected. Similarly, the negative marginal effect of the probability of filing for bankruptcy for other groups will diminish their expected benefit.

In conclusion, we find evidence that the benefits associated with bankruptcy exemptions for retirement assets are distributed heavily toward those with high financial sophistication and education. Although the effect is small (less than 3 percent of the marginal expected benefit), the sheltering effect helps redistribute even more benefits to those who are already most protected. Section 8.2 below addresses the question concerning the origin of these benefits – that is, from where are these benefits distributed – and the total distributional impact of bankruptcy exemptions for retirement assets.

## **8.2 Limitations and Future Research**

Expected benefits, as calculated here, do not account for expected costs. That is, the benefits calculation takes into consideration the amount of retirement assets claimed in bankruptcy as exempt, but not the impact on credit markets. Every dollar of exempt assets for a debtor in bankruptcy is a dollar of lost revenue for creditors, resulting in profound changes in the distribution, cost and quantity of credit via general equilibrium effects. This effect, which has been documented throughout the literature, harms creditors and debtors alike. Some studies have

even suggested that the costs of these exemptions might outweigh the benefits, resulting in a net loss in economic efficiency (Li and Sarte 2006).

Our results demonstrate the strong bias toward financially sophisticated and educated individuals on the benefits side of retirement asset exemptions. Future research that examines the distribution of costs will be useful in calculating the net benefits, rather than the gross benefits, of the exemptions for retirement assets. Such a net benefit calculation will reveal whether the uneven distribution of benefits holds true after accounting for costs.

Another limitation of our research is the measurement of expected benefits in non-dollar terms. Our results are a relative measure, scaled by the constant  $\mu$ , which is calculated based on the benefits of exempt assets in Chapter 13 bankruptcy as well as the proportion of Chapter 13 filings against Chapter 7 filings. Instead, if  $\mu$  was estimated, we could determine the dollar benefits of the policy in absolute terms. Future research could estimate the instance of exempt assets for Chapter 13 filers and even determine the factors related to the probability of filing for each chapter. In the latter case, we could relax the assumption that  $\mu$  is constant if the probability of each chapter changes across the population. This would provide a more accurate measure of the expected protection.

Another possible extension is to use individual bankruptcy data to further specify the variable for the probability of filing for bankruptcy. The model we use draws primarily from debt variables and no attitudinal variables or measures of financial sophistication (Domowitz 1999). If a respecification of that model included a measure of financial sophistication, we could depart from our assumption that  $\frac{dPB}{d(\text{Financial Sophistication})} = 0$ , which would add considerable complexity to our model. If the relationship is positive, then we may be currently overestimating the expected benefits of those with highest levels of financial sophistication.

### **8.3 Concluding Remarks**

The research here makes a valuable contribution to the current literature. First, we have demonstrated a method for evaluating the probability of filing for bankruptcy from the Survey of Consumer Finances and using the measure as an explanatory variable. We have also provided relevant calculations for evaluating an individual's benefit with respect to bankruptcy exemptions. These calculations can be used to help an individual correctly evaluate the benefits of contributing to a retirement plan under varying financial conditions related to the probability of filing for bankruptcy in the future.

Perhaps most importantly, we have continued the discussion regarding bankruptcy exemptions as well as the effects of financial sophistication on the receipt of policy benefits. In line with the current body of research, we have demonstrated the uneven impact of one aspect of financial policy in the United States on different characteristic groups. Furthermore, we have highlighted the potential relevance of financial sophistication in bankruptcy policy. We can infer from the evidence here that financial sophistication continues to play a significant role in accurately evaluating policy decisions in the United States.

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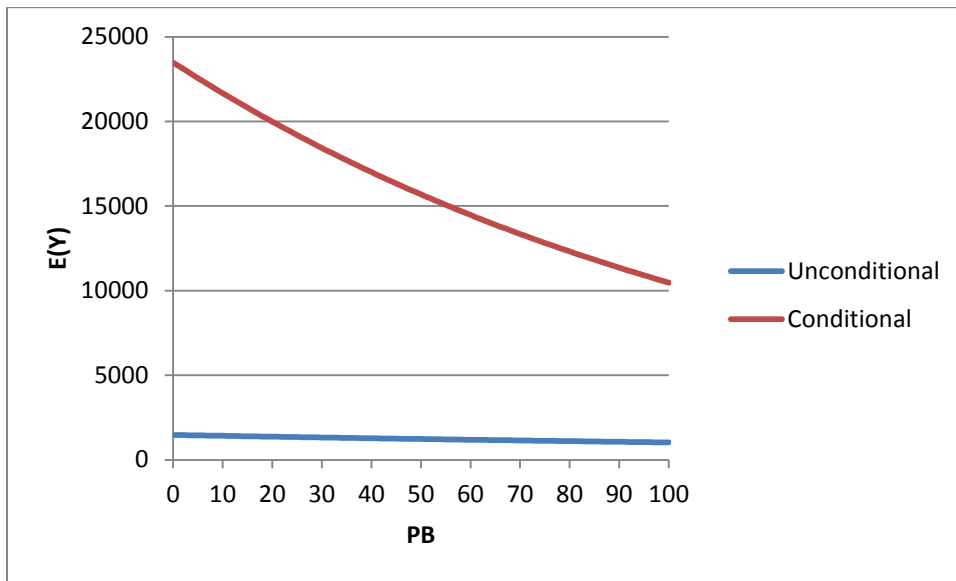
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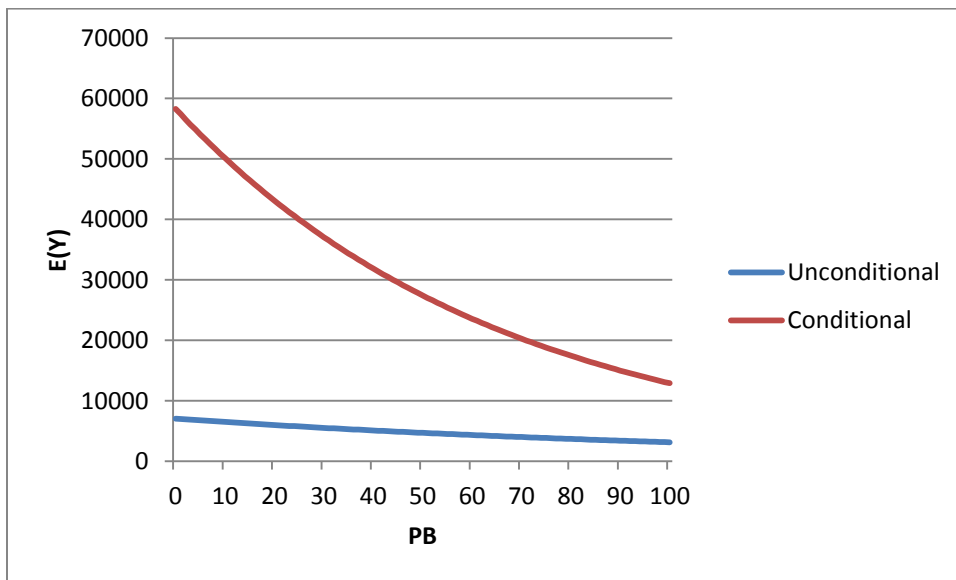
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## Appendix A: Expected Retirement Assets

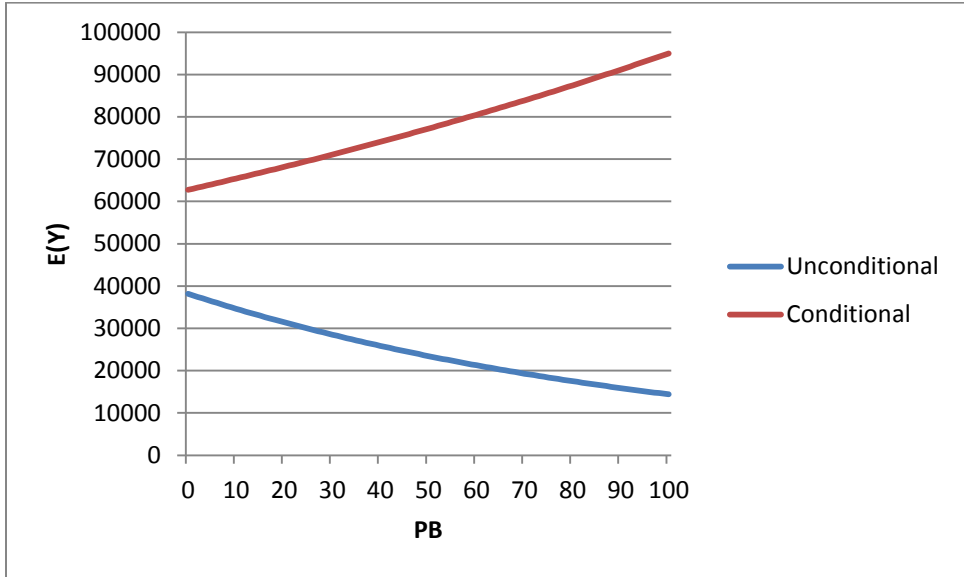
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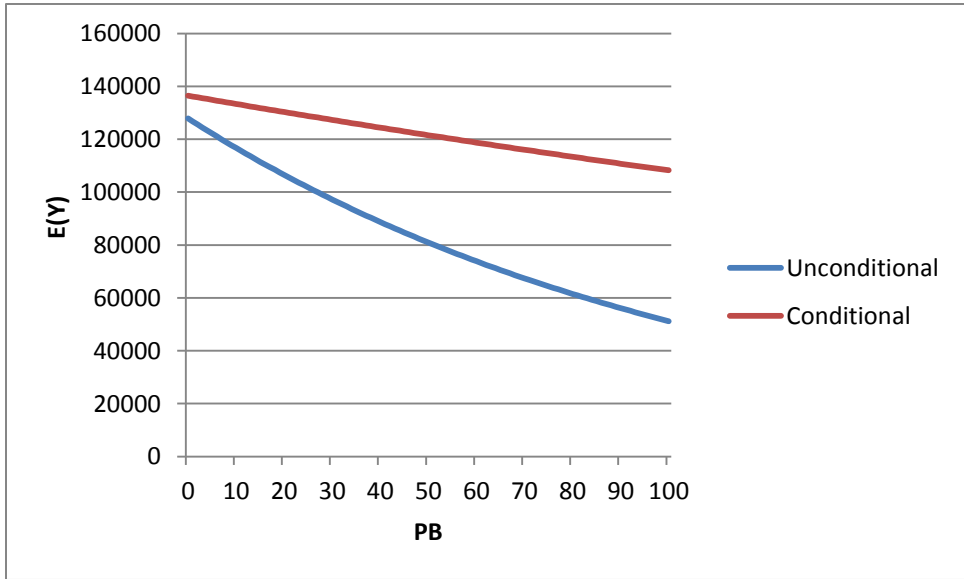
### Financial Sophistication – Quintile 4



### Financial Sophistication – Quintile 3

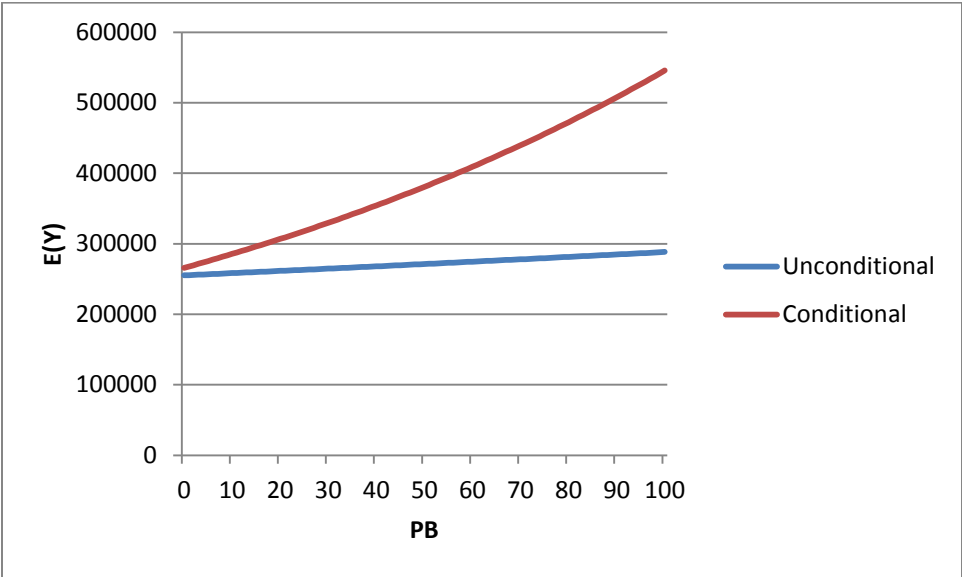


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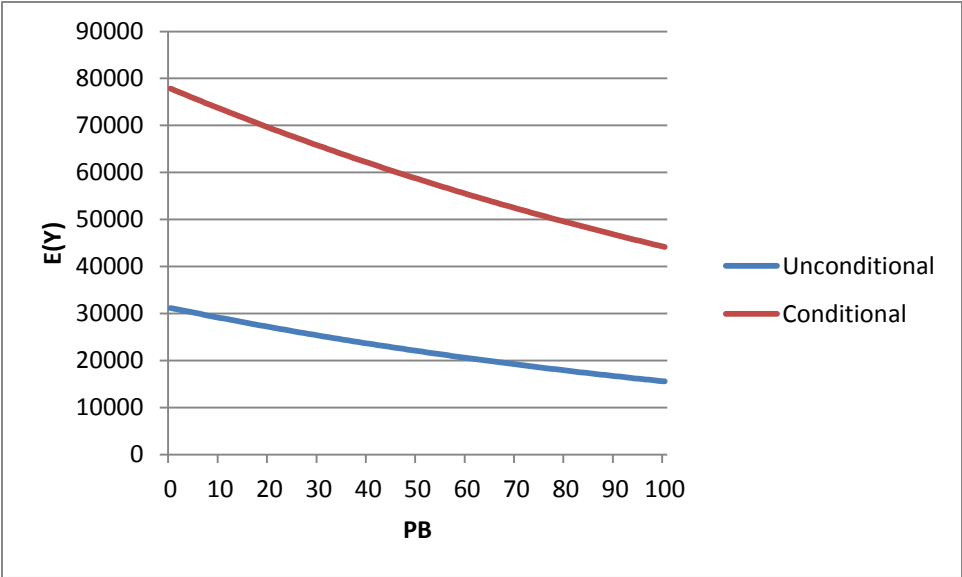




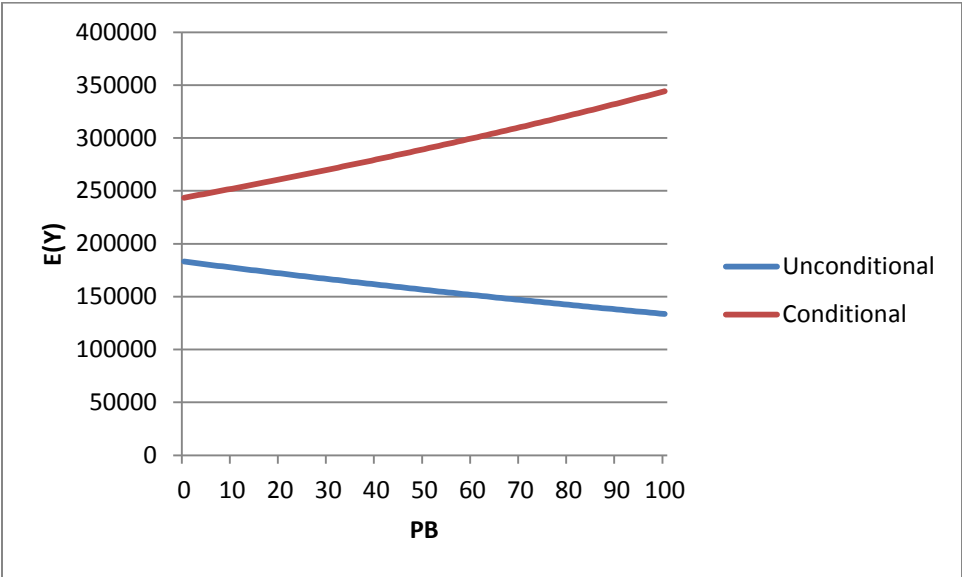
**Financial Sophistication – Quintile 1**



**Education – No Bachelor’s Degree**

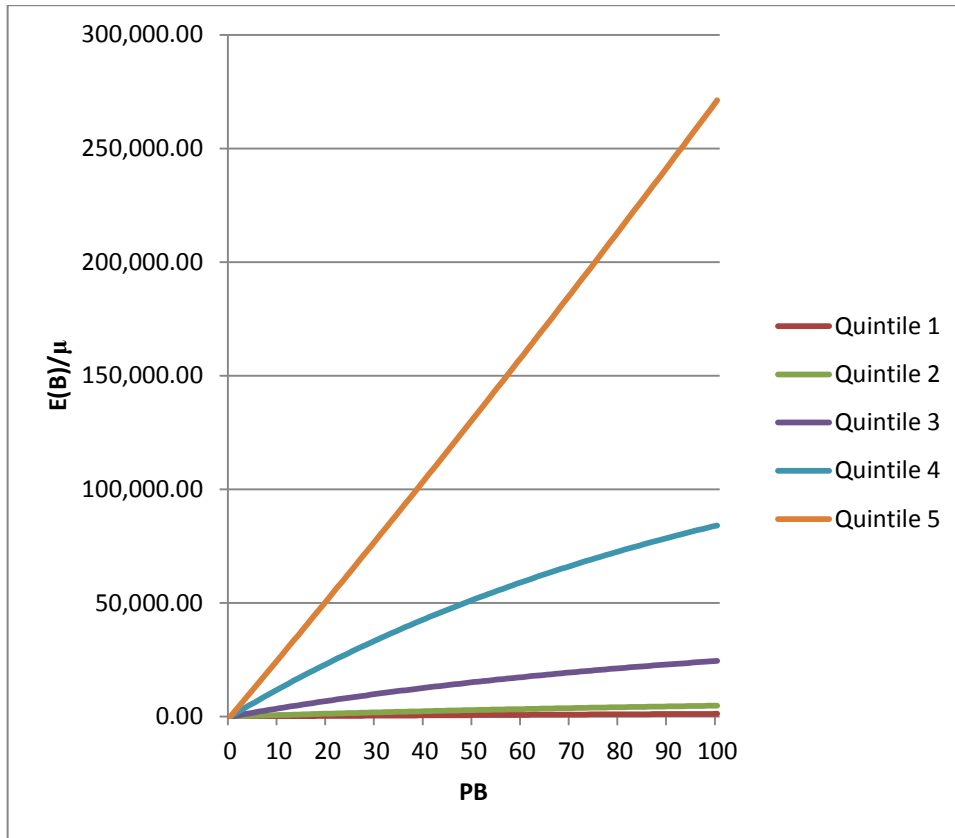


**Education – Bachelor’s Degree**

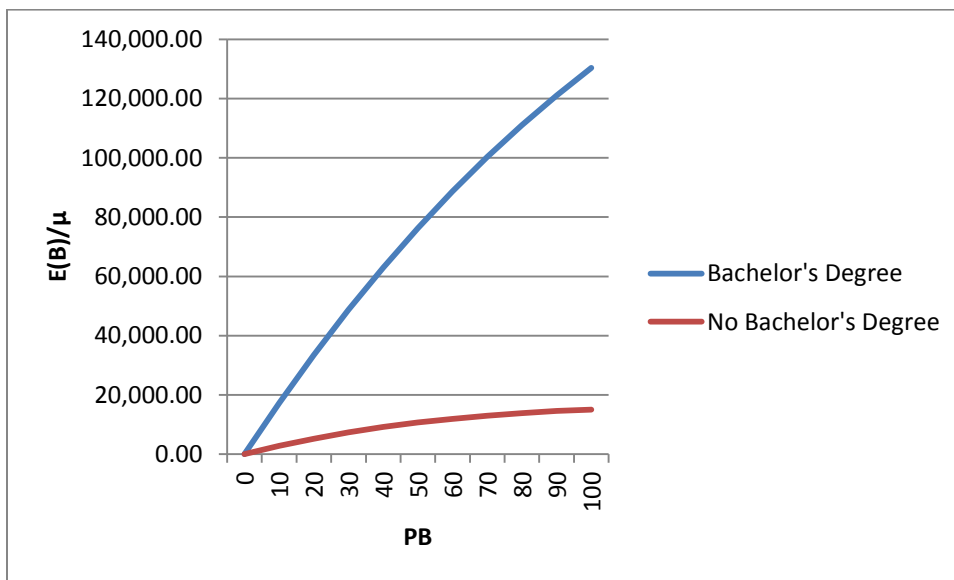


## Appendix B: Expected Benefits

### Expected Benefits by Financial Sophistication



### Expected Benefits by Education Level



**Appendix C: Expected Relative Benefit Measures**

PB	Financial Sophistication					Education	
	Quintile 5	Quintile 4	Quintile 3	Quintile 2	Quintile 1	No Bachelor's Degree	Bachelor's Degree
0	0.00	0.00	0.00	0.00	0.00	0	0
10	144.82	676.54	3,655.58	12,275.77	25,653.89	3,021.03	18,051.73
20	284.55	1,300.34	6,971.45	23,477.73	51,622.72	5,839.00	35,543.28
30	419.38	1,875.51	9,979.17	33,699.81	77,910.36	8,467.56	52,492.03
40	549.48	2,405.84	12,707.39	43,027.71	104,520.70	10,919.44	68,914.82
50	675.02	2,894.82	15,182.07	51,539.66	131,457.72	13,206.52	84,827.98
60	796.14	3,345.69	17,426.78	59,307.04	158,725.43	15,339.87	100,247.32
70	913.02	3,761.40	19,462.89	66,394.97	186,327.89	17,329.83	115,188.16
80	1,025.79	4,144.71	21,309.79	72,862.88	214,269.20	19,186.03	129,665.36
90	1,134.61	4,498.14	22,985.05	78,765.02	242,553.53	20,917.47	143,693.29
100	1,239.61	4,824.01	24,504.64	84,150.88	271,185.08	22,532.52	157,285.92