Pensions and Household Saving in The United States

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Abstract

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The goal of this research is to examine the effects of employer-provided pensions and Social Security on household saving in the United States. Current interest has intensified because of increasing concerns about insufficient saving for retirement, a trend in pensions from defined benefit to defined contribution plans, and a projected financial shortfall in Social Security. Specifically, the debate about whether higher pension benefits "crowd out" private saving has come under sharper focus among researchers and policymakers. If there is a full offset effect of pensions on private saving, then policies targeted to raise pension wealth may not necessarily increase overall retirement saving because households will decrease their private wealth accumulation instead. Three methodologies were employed in Chapter 2 ~ 4 to empirically identify the offset effects using improved data in the Health and Retirement Study (HRS). Chapter 2 presents a cross-sectional analysis in 1992. The findings show a significant but not dollar-for-dollar crowding-out effect for employer-provided defined benefit pensions and little to no offset effect for defined contribution pension and Social Security. To overcome the estimation problems such as unobserved omitted variables and insufficient variation in Social Security wealth when conducting a cross-sectional analysis, I utilize the panel structure of HRS and the recent Social Security reforms to introduce independent variation in pension wealth over time. A panel analysis using HRS data from year 1992, 1998, and 2004 is presented in Chapter 3. The panel analysis shows a statistically significant full offset effect between pensions and private saving in some specifications. Chapter 4 presents the effects of Social Security benefits withheld under the earnings test on household saving. I find evidence for a full offset effect between household saving and benefit withholding under the earnings test for those aged between 62 and

normal retirement age and those with higher educational attainment. In summary, this research supports the theory that pensions crowd out private wealth accumulation.

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DEDICATION

To my parents.

Chapter 1 Introduction

Apart from personal savings, private pension plans and Social Security are a major part of the wealth people accumulate over their lifetimes. Lately, interest has intensified because of increasing concerns about insufficient saving for retirement, a trend in pensions from defined benefit to defined contribution plans, and a projected financial shortfall in Social Security. Specifically, the debate about whether higher pension benefits "crowd out" non-pension wealth has come under sharper focus among researchers and policymakers. Economists have long been concerned that employer-provided pensions and Social Security constitute a negative incentive to accumulate wealth during one's working life. A simple life-cycle framework suggests a dollar-for-dollar crowding-out effect between pension saving (private pensions and Social Security) and non-pension saving; however, the degree of substitution also depends on many factors, such as the induced retirement effect, liquidity constraints, the annuity feature of some pension plans, bequest motives, and heterogeneity in tastes, etc. Given all these factors, the relationship between pension and non-pension wealth could range from any number less than negative one to a positive number.

This dissertation can be categorized as part of the large cross-sectional literature. It presents a cross-sectional analysis in year 1992 and a panel analysis over 3 waves of the Health and Retirement Study to estimate the effects of pensions on private wealth accumulation for pre-retirement households. A wealth equation is developed and estimated in both analyses. In addition, I estimate the effects of Social Security benefit withholding under the earnings test on household saving for those who are age 62~69 and have claimed retirement benefits. The findings suggest an offset effect between pensions and household saving.

The dissertation contributes to the research on pensions and saving in four ways. First, an updated, higher quality data set is used. In general, the scarcity of empirical evidence at the micro level is in part due to the severe data limitations that researchers face in this area. Data sets containing individual-level and household-level information on income and consumption (and therefore saving) or wealth modules are few, and very rarely contain information on private pensions and Social Security entitlements. Health and Retirement Study (HRS), a large and

comprehensive panel data set, covers a wide variety of topics on the aging population in the United States over time.[1] Since its first wave of interviews in 1992, respondents and their spouses were asked about the features of the pensions and Social Security held in addition to a variety of personal and household characteristics, including their employment history, composition of wealth, health, family status, and retirement. In this paper, I exploit the core survey and several HRS supplementary data sets regarding private pensions and Social Security wealth to construct variables for empirical testing.

Second, I present new evidence on the crowding-out effects for separate pension variables, that is, defined benefit pension (DB), defined contribution pension (DC), and Social Security retirement benefits, respectively. Previous papers often pooled the private pensions and Social Security wealth values into one variable in their wealth regressions, despite the fundamental difference among these plans. For example, an employer-provided DB plan represents a promise by the employer to provide a stream of specified benefits to the employee upon retirement, while Social Security, similar to a defined benefit plan, collects contributions in the form of Social Security taxes and pays retirement benefits until one's death after the beneficiary claims the benefits. The benefits of a DB pension plan and Social Security are calculated by formulas based on a worker's earnings history, years of service, end-of-career pay and age. In contrast, the company contributes the money to individual accounts held in the employee's own name for DC pension plans. Workers who own DC pension plans determine how much and how to invest, and therefore bear all investment risk. Though DC plans, such as 401(k), are counted as retirement pension plans by definition, the nature of these plans is more fungible and could be categorized as part of a broad measure of private wealth. In some of the empirical specifications of this paper, I add the DC pension wealth balance into the left-hand side variables in regressions and find a significant but not dollar-for-dollar crowding-out effect for employer-provided DB pensions. However, DC pension and Social Security have little to no offset effect. This could be a result of insufficient independent variation in Social Security wealth when conducting a cross-sectional analysis, or other econometric issues of measurement error, functional form misspecification, and unobserved omitted variables. Moreover, inspired by Gale (1998), all

[1] The HRS (Health and Retirement Study) is sponsored by the National Institute on Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan.

pension variables in the wealth regressions were adjusted for an age-related bias neglected by prior research that leads to understatements of the offset effect between pension and non-pension saving.

Third, I utilize the panel structure of HRS and recent Social Security reforms to correct the estimation problems in the cross-sectional analyses. Depending on age and calendar year, respondents face different rules embedded in Social Security; hence the entitled retirement benefits may be reduced and be perceived as a reduction in Social Security wealth if workers regard the compensation to be actuarially unfair. The panel nature of HRS and the policy changes over time can introduce independent variation in Social Security wealth over time. The fixed effect estimates suggest a statistically significant full offset effect of pooled pension wealth and private pension wealth on household wealth accumulation, but an insignificant crowd-out effect of Social Security wealth. Pooled OLS and random effect estimates show similar findings but with lower offset effects. Incorporating the panel structure of HRS and the policy reforms could shed light on future pension and saving research beyond what can be obtained from cross-sectional analysis.

Last, I use a saving equation to identify the effects of benefit withholding under the earnings test on household saving. Very little work has been done to examine how the earnings test rule embedded in Social Security affects household saving or how its removal in the year 2000 impacts the saving behaviors of the elderly in the United States. Under the retirement earnings test, beneficiaries' Social Security benefits are reduced when their labor incomes are above the exempt amount. The reduction in benefits is compensated by higher benefits in later years when workers retire. Whether older workers respond to the earnings test as a tax or as forced saving remains an empirical question. To the extent that benefit withholdings under the earning test represent the incremental change in Social Security wealth, and individuals face different earnings test rules depending on their age and calendar year, it introduces independent variations across individuals over time and can be used to identify the offset effects of Social Security wealth beyond a wealth equation.

The dissertation is organized as follows. Chapter 1 presents a literature review on how pensions affect saving and a summary of prior empirical research. In Chapter 2, I provide a theoretical framework to relate wealth accumulation to private pensions and Social Security,

which will be the foundation of empirical specifications in the following chapters. Chapter 2 presents the results of the wealth equation in a cross-sectional analysis using HRS 1992. In Chapter 3, I present the results of the wealth equation in a panel analysis using the HRS data from year 1992, 1998, and 2004. Chapter 4 examines the effects of Social Security benefit withholding under the earnings test on household saving for beneficiaries aged 62~69. Chapter 5 concludes the dissertation.

1.1 How Pensions Affect Saving

Theory is ambiguous about whether increases in pensions will reduce other forms of household savings. A simple life-cycle framework suggests a full offset between pension saving and non-pension saving. Pensions affect private saving through their impacts on an individual's intertemporal budget constraint. If the Social Security tax or private pension contributions paid during working years are fully compensated for by the benefits received during retirement, then the intertemporal budget constraint is unchanged. As a result, an increase in pension wealth could crowd out private wealth dollar for dollar. A number of issues, however, complicate the analysis.

First, pensions may induce earlier retirement and hence raise saving among workers. Feldstein (1974) argues that Social Security affects an individual's saving through two opposing forces. "Assets-substitution effect" leads to a reduction in saving because the availability of Social Security benefits reduces the need to accumulate assets for retirement; and "retirement effect" leads to an increase in saving because Social Security benefits, in conjunction with the earnings test, will induce earlier retirement. With a shorter working period and a longer period of retirement, people need to save more during working years.

Second, the presence of liquidity constraints also implies an increase in saving. Forced saving by Social Security and other private pensions will be higher than the amount they would otherwise choose to save if the borrowing were limited (Gustman and Steinmeier, 1999). This is especially important for some individuals with low earnings. If there is no pension system, some fraction of people may reach retirement with low or no private wealth. Thus, the forced saving created by a pension will increase their total wealth for retirement.

Third, earlier analysts have argued that information gained from employers about their pensions make the individual aware of the need for retirement saving and lead them to save more rather than less (Cagan, 1965; Katona, 1965). Lusardi and Mitchell (2007) further show that planning and financial literacy play an important role in saving behavior. Planners arrive close to retirement with much higher wealth levels and display higher financial literacy than non-planners.

In addition, the annuity feature of some pension plans, such as Social Security, could either increase or decrease the effect of the program on private saving because people might not fully value the annuity benefits. On the one hand, those annuities, unlike private wealth, can not be bequeathed to heirs or used to cover unexpectedly large expenses. Moreover, people generally doubt whether they will receive the full retirement benefits due to the change in laws and trend on U.S. pension system which has sometimes significantly altered the benefit level for beneficiaries. To the extent that people value the forced saving less than private saving, an increase in pension wealth will crowd out private wealth by less than dollar-for-dollar. On the other hand, people who live longer may value pension saving more than private saving. Pension annuity provides a more than actuarially fair price which is unavailable in the insurance market. To the extent that pensions offer a cheaper annuity, it could offset non-pension saving by an amount over its dollar value.

Lastly, the analysis to derive the dollar-for-dollar crowding out effect between pension wealth and private wealth gets even more restrictive because households save for reasons other than retirement. For example, if people save due to bequest or precautionary motives, a small increase in pension wealth will not impact private wealth accumulation.[2] Given all these factors, the relationship between pension and non-pension wealth could range from any number less than one to a positive number, although the empirical estimates tend to average somewhere between 0 (no crowding out effect) and -1 (a full offset).

[2] Alternative approaches to saving, in which individuals create the mental accounts for different assets or follow rules of thumb to save a fixed fraction of income, suggest that people do not offset the increase in pension wealth due to self-control reasons rather than intergenerational transfers. (Shefrin and Thaler, 2004)

1.2 Prior Empirical Research

Inconclusive theoretical predictions highlight the need for empirical testing. Many studies have quantified the relationship between pensions and other forms of saving. The papers in this literature can be grouped into 3 main types: time-series, cross-section, and cross-country. Feldstein (1974) was the pioneering paper to provide the time-series evidence on the negative effect of pension wealth on aggregate saving for the United States.[3] However, the results of time-series research appear to be extremely sensitive to the specifications and the exact time period chosen (Auerbach and Kotlikoff, 1983). As for the cross-country research, it is difficult to construct comparable measures of pension wealth across nations. As a result, researchers turn to cross-sectional studies for an answer, which relies on variation in pension wealth across individuals for identification. Many researchers have attempted to determine whether those who receive higher pension benefits save less and thus accumulate lower levels of non-pension wealth, holding other things equal. Previous empirical studies differ widely in their specifications and results. Table 1-1 summarizes the data sets, sample, methodologies, and the offset effects between pensions and other forms of saving from various studies. My dissertation can be categorized as part of the large cross-sectional literature.

Beginning with Feldstein and Pellechio (1979), researchers have estimated regressions in the form of the non-pension wealth as a function of pension wealth variables, controlling for lifetime income and other household characteristics. Using the 1963 Federal Reserve Board's Survey of Financial Characteristics of Consumer, Feldstein and Pellechio find support for the validity of the life-cycle theory and show that each dollar of Social Security wealth reduces the accumulation of other financial wealth by 51 cents to a dollar depending on the specification. Kotlikoff (1979) also finds evidence that Social Security payroll taxes reduce private saving using data from the 1966 National Longitudinal Sample (NLS).[4] However, his "lifetime wealth increments" variable (the amount by which the present value of Social Security benefits

[3] Leimer and Lesnoy (1982) find that programming error in calculating the Social Security wealth will substantially reduce the value and significance of the estimate on Social Security wealth variable.

[4] In his paper, variable ASST represents the present value of household accumulated Social Security taxes. The predicted value of ASST should equal -1 and be interpreted as the offset effect. Coefficient of ASST is -0.666 with a standard error of 0.305. It is significantly different from zero and lies within 1.3 standard deviation of -1.

exceeded the present value of a worker's payroll tax contribution) does not have a significant impact on pre-retirement household wealth accumulation.

Subsequent studies in the 1980's and the early 1990's have typically confirmed the basic result that pension wealth depresses the accumulation of other forms of household wealth, though the estimates are often lower than prior papers. For example, Blinder, Gordon, and Wise (1983) estimate that Social Security wealth reduces private wealth by -0.39. Diamond and Hausman (1984) estimate the offset effect of Social Security wealth on private wealth in a range between -0.25 and -0.40, using the 1966 NLS data. Hubbard (1986) studies the responsiveness of financial wealth to both Social Security and employer-provided pension wealth. He finds that an increase in Social Security wealth of one dollar reduces net worth by 33 cents, while an increase in private pension wealth of one dollar reduces net worth by 16 cents.[5] Furthermore, Gullason, Kolluri and Panik (1993) re-examine the model developed in Feldstein and Pellechio (1979) and Novos (1989) using more recent data from the 1983 Survey of Consumer Finances but find no statistically significant relationship between Social Security wealth and other forms of household wealth.[6]

Recently, the relationship between pension wealth and non-pension wealth has received renewed attention in response to better quality household level data and new methodologies. Gale (1998) points out two biases in previous empirical studies. First, without correcting for systematic biases (age-related bias), the estimate of crowding out effect of pension wealth on net worth will be biased toward zero and may even have the wrong sign. The second bias occurs when analyses focus on how pensions affect narrow measures of non-pension wealth rather than broad measures. Based on data from the 1983 Survey of Consumer Finances, Gale adjusts pension wealth for the age of the individual using a factor "Q", as defined in his paper, and finds the offset to be substantial. In the specification controlling for retirement age, the median regression shows that 82 percent of pension wealth is offset by a reduction in other wealth. These

[5] Hubbard (1986) uses data drawn from surveys conducted for the U.S. Present's Commission on Pension Policy in 1979 and 1980.

[6] A review by the U.S. Congressional Budget Office (1998) concludes that the cross-sectional evidence suggests that each dollar of Social Security wealth reduces private wealth by between zero and 50 cents, with the most likely estimate lying near the middle of that range.

estimates exceed the estimates in previous literature. Furthermore, separating the components of pension wealth yields median offset of -0.92 for private pensions and -0.51 for Social Security.

Utilizing the large and comprehensive data from the Health and Retirement Study (HRS), Gustman and Steinmeier (1999) find limited or no offset between pensions and other wealth while providing great insight into the composition of retirement wealth for those who are close to retirement. However, it is uncertain whether the low estimates result from the systematic bias mentioned in Gale (1998). Khitatrakun et al. (2000) also use the same data set and adjust the bias by controlling separately for lifetime compensation and pension wealth. That is, their estimation conditions on the total lifetime resource, which in their paper is defined as a sum of lifetime earnings, DB and DC pensions, and Social Security wealth, but it also includes future earnings, pension and Social Security wealth as separate covariates. They find no evidence of significant pension offsets at the median of the net worth distribution. However, this alternative approach will in general not yield the true offset when the true offset is less than 100 percent (Gale, 1998). Lastly, Engelhardt and Kumar (2011) exploit the HRS data and make adjustments to pension wealth variables as well. In addition, they employ an empirical strategy that combines two instrumental-variable approaches to identification.[7] In contrast to previous studies, their IV estimates suggest a significant pension-saving offset between -0.53 to -0.67 at the mean, and an offset at upper quantiles.

Cause of divergent results:

In addition to the identification strategies used, the divergent results of the cross-sectional studies may be partly due to the survey data used, the dependent variable and the pension variables defined in their papers, and other control variables included.

[7] First, they exploit the Employer-provided pension Summary Plan Descriptions (SPDs), legal descriptions of pensions written in plain English, in conjunction with detailed pension and Social Security benefit calculators to construct an instrument for self-reported pension wealth (under the assumption that any error in SPD-based pension wealth is uncorrelated with measurement error in self-reported pension wealth). Moreover, the second instrument is constructed using the "simulated instrumental-variable approach" for a set of "synthetic" workers to insure the IV is uncorrelated with any household-specific fixed effects. When this is done, all of the variation in the IV is due to cross-plan differences in generosity, not difference in earnings or household characteristics.

- Data and sample selection

It is not surprising that different data sets and sample selection strategies yield different estimates. For the purpose of examining the impacts of social security and private pensions on saving behavior, the analysis requires demographic, employment, private pensions, Social Security, asset, and income data for family units. However, we might cast doubts on some studies because of the sample chosen and should be careful when interpreting the results. For example, both Feldstein and Pellechio (1979) and Novos (1989)[8] use a relatively small data set of about 100 people. Gale (1998)'s sample size is also fairly small, totaling 638 of the original 4,262 SCF observations after sample selection. Furthermore, some studies use cross-sectional data based on particular segments of the population, such as a sample of male household heads age 45-59 in Kotlikoff (1979) or Diamond and Hausman (1984), as compared to the sample drawn from the whole population in Hubbard (1986).

In addition, various sample selection criteria were applied due to the availability of information in the data sets and concerns about the heterogeneity in saving preference among households. Gale (1998) excludes farmers and the self-employed because research shows that they have a different wealth accumulation pattern than other households. Household in which workers have pensions from previous jobs or have missing values in expected retirement date, pension and Social Security data are also excluded because data problems make it difficult to calculate the adjusting Q-factor. Others truncate samples by age, net worth (King and Dicks-Mireaux, 1982, for Canadian data; Diamond and Hausman, 1984; Hubbard, 1986), or education level (Khitatrakun et al., 2000) accordingly.

- Dependent variable and Pension variables

[8] Novos (1989) argues that the dollar-for-dollar crowding out effect found in Feldstein and Pellechio (1979) crucially on six farm operators in the sample.

In most studies, the dependent variable is defined as the asset value.[9] This broadly defined measure includes both the market value of financial and nonfinancial assets less total liabilities while some papers also try an alternative measure, which includes only the financial assets.

Results from previous papers seem to be sensitive to whether the independent variable is specified as pension coverage or pension value, measured as the contribution rate, yearly benefit amount, or present value of the pension. Even though studies calculate the pension variables in different ways, they share a common strategy: first, future benefits are projected using the respondent's eligibility, coverage, and estimated earnings. Then these future benefits are discounted to the study year by survival probabilities and interest rates according to the current formula. However, different assumptions about discount rates were used and led to different estimates of pension variables. For example, a lower discount rate would lower the offset because of a higher level of pension wealth generated. At last, the effect of a change in pension wealth on saving behavior depends on the position of an individual over her life cycle. Inspired by Gale (1998), recent studies adjust the pension wealth variables for this age-related bias. As he concludes in his paper, failing to correct for the bias will lead to a lower offset effect.

- Other control variables

In estimating the wealth equation, all studies control for the lifetime income variable. Some papers have difficulties in constructing wage histories and instead form proxies for lifetime earnings based on predicted values from a reduced-form earnings equation on demographics and employment characteristics, such as a worker's age, education, and current income, or enter these characteristics directly into the empirical specification.[10] These variables may fail to adequately account for lifetime cash earnings, and hence estimates may be biased. A

[9] In their study of determinants of saving behavior, Diamond and Hausman (1984) use the ratio of saving to permanent income in log term as the dependent variable. Attanasio and Brugiavini (2003) use saving rate as the dependent variable, which is defined as income minus consumption divided by current income when investigating the impact of the 1992 Amato reform of the Italian pension system. Attanasio and Rohwedder (2003) apply the same definition of saving rate in their study of pension wealth and household saving in the United Kingdom, utilizing the 3 major pension reforms.

[10] For example, Hubbard (1996) and Gale (1998).

unique feature of HRS that makes it substantially better suited for analyzing pension-saving offset is that HRS asked respondents' permission to link their survey responses to administrative earnings records from SSA and IRS. In later studies, they can combine it with self-reported earnings histories to construct a better measure of lifetime income for each person. The empirical results also are sensitive to whether wealth accumulation equations are specified to standardize for expected retirement date, life horizons, and other sociodemographic factors to proxy for the heterogeneity among households. For example, Engelhardt and Kumar (2007) add a richer set of control variables which reduces measured offset by 10-30 cents per dollar of pension wealth.[11]

[11] They use additional control variables that were not used in other papers, such as the dummy variables for unions, firm size, and region, fringe benefits, plan characteristics, and an extensive set of employment characteristics.

Table 1-1: Effects of Pensions on Non-Pension Wealth – Summary from Various Studies

Paper	Data/ Sample/ N	Identification strategy	Dependent variable	Pension measure	Lifetime earnings measure	Effects of Pensions on Net worth in U.S.		
						Private pension (PPW)	Social Security (SSW)	Pooled pension (PW=PPW+SSW)
Feldstein & Pellechio (1979)	Financial Characteristics of Consumers 1963/ pre-retirees and retirees, men aged 55 to 64/ N=138	OLS	Fungible Wealth	SSW (no PPW measure)	Proxied by age and current earning		-0.50 ~ -1.67 ‡	
Kotlikoff (1979)	NLS 1966/ pre-retirees and retirees, men aged 45-59/ N=2,124	OLS	Net worth	PV of SS tax contribution (ASST), lifetime wealth increment (LWI), private pension coverage	Proxied by 2-year recent income average		ASST: -0.66 ‡ LWI: 0.237	
Feldstein (1983)	LRHS 1969/ pre-retirees and retirees, employed married men aged 58-63/ N=2,087	OLS, IV, Wald	Net worth	SSW (no PPW measure)	PV of SS taxable earnings		0.16 ~ -1.34 ‡	
Blinder, Gordon and Wise (1983)	LRHS 1971/ pre-retirees and retirees, employed white men aged 60-65/ N=4,130	NLS	Comprehensive Wealth	SSW, PPW(imputed)	PV of lifetime earnings	0.30	-0.39	

Table 1-1 (Continued): Effects of Pensions on Non-Pension Wealth – Summary from Various Studies

Paper	Data/Sample/N	Identification strategy	Dependent variable	Pension measure	Lifetime earnings measure	Effects of Pensions on Net worth in U.S.		
						Private pension (PPW)	Social Security (SSW)	Pooled pension (PW=PPW+SSW)
Diamond & Hausman (1984)	NLS 1966/ pre-retirees and retirees, employed men aged 45-59 with wealth>$4,000/ N=1,095	Rough estimate	ln(wealth, saving/ permanent income)	SS benefit and PP benefit per year	an estimate of PI based on the average real earnings		-0.25~-0.4	
Hubbard (1986)	Present's Commission on Pension Policy 1979/ broad age range with wealth>$3,000/ N=3,084	OLS	ln(wealth/ permanent income)	SSW/PI, PPW/PI	Age and PI in piecewise-linear form	-0.16 ‡	-0.33 ‡	
Gullason, Kolluri, and Panik (1993)	SCF 1983/ Pre-retirees, Male head aged55-64/ N=154	OLS	Fungible Wealth	SSW, PPW	Proxied by age and current earning		0.38	
Gale (1998)	SCF 1983/ Pre-retirees, head aged 40~64/ N=638	Median reg, (Robust reg)	Net worth, financial wealth	PW, adjusted PW	Proxied by age, wage, education	-0.92 ‡ (-0.49 ‡)	-0.51 (-0.11)	-0.64~ -0.83 ‡ (-0.20~,-0.40 ‡)

Table 1-1 (Continued): Effects of Pensions on Non-Pension Wealth – Summary from Various Studies

Paper	Data/Sample/N	Identification strategy	Dependent variable	Pension measure	Lifetime earnings measure	Effects of Pensions on Net worth in U.S.		
						Private pension (PPW)	Social Security (SSW)	Pooled pension (PW=PPW+SSW)
Gustman & Steinmeier (1999)	HRS 1992/ Pre-retirees and retirees, aged 51~61/ N=7,607	OLS, Median reg, (Robust reg)	Wealth, ln(wealth), ln(wealth/ permanent income)	PW, pension coverage	PV of lifetime earnings			0.10, 0.06, (0.07)
Khitatrakun et al. (2000)	HRS 1992/ Pre-retirees and retirees, aged 51~61/ N=7,606	OLS, Median reg, Qreg	Net worth	DB, DC, SSW, and adjusted pensions	Comprehensive lifetime wealth, PV of future earnings	DB: -0.18, -0.03 DC: -0.05, -0.05	-0.07, -0.08	-0.005, 0.004
Engelhardt & Kumar (2011)	HRS 1992/ Pre-retirees, aged 51~61/ N=2,728	OLS, [IV], (IVQR)	Net worth	Adjusted PW	PV of past earnings, future earnings are proxied			0.20~0.23, [-0.53~-0.67 ‡] (0 at median, -0.3~-0.5 ‡ in upper quantiles)

Source: Author's summary.

Note: ‡ means that some of the estimates in the paper may be statistically significant from zero. The numbers in the last three columns are in general the estimates from an OLS regression or otherwise correspond with the column of identification strategy by underline or in a parenthesis.

Abbreviation: NLS: National Longitudinal Sample; LRHS: Longitudinal Retirement History Survey; SCF: Survey of Consumer Finances; HRS: Health and Retirement Study; IV: Instrument variable; Qreg: quantile regression; IVQR: instrument variable quantile regression; DB: defined benefit pension; DC: defined contribution pension; SSW: Social Security wealth; PPW: private (employer-provided) pension=DB+DC; PI: permanent income; PV: present value.

Chapter 2 Effects of Pensions on Private Wealth Accumulation: A Cross-Sectional Analysis

2.1 Theoretical Framework

Analogous to the life-cycle model presented in Gale (1998), I use a discrete, finite time horizon framework with constant relative risk aversion (CRRA) preference. Households (or workers) choose the current and future consumption to maximize lifetime utility, subject to the intertemporal budget constraint. To keep the model simple, I do not explicitly consider uncertainty, changes in rates of return, labor supply, and many other important elements.

$$\max_{\{C_t\}} \; V = \sum_{t=0}^{D} \left(\frac{1}{1+\delta} \right)^t U(C_t) \tag{1}$$

subject to

$$\sum_{t=0}^{D} R^t \cdot C_t = A_0 + \sum_{t=0}^{D} R^t \cdot Y_t - R^D \cdot B_D \tag{2}$$

where C represents consumption; Y represents income; A_0 is the individual's initial asset holding; B_D is the planned bequest; $R = \frac{1}{1+r}$ is the discount factor as a function of the real interest rate r; δ is the pure time preference rate; and D is the time of death.

The constant relative risk aversion utility function is specified as

$$U(C_t) = \frac{(C_t - \bar{C}_t)^{1-\rho}}{1-\rho} \tag{3}$$

where $\bar{C}_t$ is the minimum level of sustainable consumption per period, and ρ is the coefficient of relative risk aversion.

The first order condition of the optimization problem can be solved for the so-called Euler equation, $C_t = \bar{C}_t + \theta(C_{t-1} - \bar{C}_{t-1})$ with $\theta = \left(\frac{1+r}{1+\delta}\right)^{\frac{1}{\rho}}$. The Euler difference equation can therefore be solved for

$$C_t = \bar{C}_t + \theta^t (C_0 - \bar{C}_0) \tag{4}$$

Plugging equation (4) into the constraint equation (2) yields

$$C_0 = \bar{C}_0 + \frac{1-x}{1-x^{1+D}} \left[A_0 + \sum_{t=0}^{D} R^t (Y_t - \bar{C}_t) - R^D B_D \right] \tag{5}$$

and

$$C_t = \bar{C}_t + \theta^t \frac{1-x}{1-x^{1+D}} \left[A_0 + \sum_{t=0}^{D} R^t (Y_t - \bar{C}_t) - R^D B_D \right] \tag{6}$$

where $x = R \cdot \theta = \frac{(1+r)^{\sigma-1}}{(1+\delta)^{\sigma}}$, and $\sigma = 1/\rho$ is the intertemporal elasticity of substitution. The parentheses in equation (5) and (6) represent the "discretionary all-inclusive wealth", evaluated at time zero.

If we further extend the model by separating the income variable into labor income and pension benefits received after retirement, then equation (6) implies

$$C_t = \bar{C}_t + \theta^t \frac{1-x}{1-x^{1+D}} \cdot H_0 \tag{7}$$

and

$$H_0 = A_0 + \sum_{t=0}^{Z-1} R^t E_s + K_{pp} \sum_{t=Z}^{D} R^t PP_t + K_{ss} \sum_{t=Z}^{D} R^t SS_t - R^t B_D - \sum_{t=0}^{D} R^t \bar{C}_t \tag{8}$$

where E represents labor income; PP and SS are the retirement benefits received from private pension and Social Security, respectively, beginning in retirement year Z. As discussed in section 2, people may value the pension benefit more or less than its dollar value due to the annuity feature of some pension plans. K_{pp} represents the dollar value equivalence of private pension and K_{ss} represents the dollar value equivalence of Social Security wealth, which are

also the offset effects between pension wealth and non-pension wealth. Equation (7) implies that consumption in each period is minimum consumption plus a fraction of lifetime earnings and pension wealth less the planned bequest and lifetime consumption.

During the working period of time s, i.e. $s < Z$, the non-pension wealth (evaluated at the end of period s) is

$$A_s = R^{-s} A_0 + \sum_{t=0}^{s} R^{t-s} (E_t - C_t) \tag{9}$$

Substituting equation (7) into (9) yields

$$\begin{aligned} A_s = (1-Q) \cdot \left[\sum_{t=0}^{s} (\tfrac{R^t}{R^s}) E_t \right] - Q \cdot \left[\sum_{t=s+1}^{Z-1} (\tfrac{R^t}{R^s}) E_t \right] - Q \cdot \left[K_{pp} \sum_{t=Z}^{D} (\tfrac{R^t}{R^s}) PP_t \right] - Q \cdot \left[K_{ss} \sum_{t=Z}^{D} (\tfrac{R^t}{R^s}) SS_t \right] \\ + \left[(1-Q)(\tfrac{1}{R^s}) A_0 + Q \cdot (\tfrac{R^D}{R^s}) B_D + Q \cdot \sum_{t=0}^{D} \bar{C}_t - \sum_{t=0}^{s} (\tfrac{R^t}{R^s}) \bar{C}_t \right] \end{aligned} \tag{10}$$

where

$$Q(t, r, \delta, \sigma) = \sum_{t=0}^{s} \frac{1-x}{1-x^{1+D}} \cdot x^t = \frac{1-x^{1+s}}{1-x^{1+D}} \tag{11}$$

is comparable to the adjustment factor in equation (7) of Gale (1998).

The empirical specification in the following section is mainly based on equation (10), which relates non-pension wealth to the present value of cash wages earned to date multiplied by (1-*Q*), the present value of future earnings multiplied by *Q*, and the present value of future pension benefits from private pension and Social Security multiplied by *Q*. The terms in the last bracket, including the initial asset, planned bequests, and the accumulated minimum consumption, are assumed to be exogenously determined and vary across households. These unobservable differences will be modeled by demographic characteristics in the empirical analyses. Moreover, as argued by Gale (1998), without adjusting for the age-related bias, i.e. the factor *Q*, a regression of equation (10) would yield a biased estimated offset away from the true effect ($-K_{pp}$ and $-K_{ss}$), given that *Q* falls between zero and one.

2.2 Empirical Framework: Cross-Sectional Analysis

2.2.1 Data Sources

This paper uses the public data from Health and Retirement Study (HRS), which is a national longitudinal household survey of over 7,600 families with at least one person in their fifties. Respondents and their spouse have been surveyed every two years since 1992. This data is ideal for analyzing wealth accumulation and the role of pensions in retirement saving because it contains detailed information on net worth, pensions, Social Security, employment, and other essential variables to this field of research. I mainly focus on the baseline cohort (HRS cohort), born between 1931 and 1941 (age 51~61 in 1992).[12] A cross-sectional analysis will be evaluated in year 1992 to be comparable to prior research using HRS.

Information on wealth and pensions are particularly important for the purpose of this study. Due to the restricted access to Social Security Administration (SSA) records and pension estimation, several supplemental public data sets derived from HRS are used instead. Information on Social Security wealth comes from the version 3.1 (March 2010) of the "Prospective Social Security Wealth Measures of Pre-Retirees" data set, which is constructed from the employment sections of the HRS 1992, 1998, 2004 and the restricted SSA summary and detailed earnings and benefits files. It avoids the potential underestimate of Social Security wealth when self-reported data are used. Employer-provided pension wealth measures, including defined benefit (DB) and defined contribution (DC) pensions, are collected from the version 2.0 (December 2006) data set of "Imputations for Pension Wealth". This file contains estimated pension wealth data from current jobs based on both self-reported and the restricted employer data in HRS.[13] Wealth and other household characteristics variables are generated from the RAND HRS, a cleaned version of a subset of HRS.

[12] The complete HRS data contains 5 cohorts: HRS cohort, born 1931 to 1941, baseline 1992; AHEAD cohort, born before 1924, initially a separate study (The Study of Assets and Health Dynamics Among the Oldest Old), baseline 1993; Children of Depression (CODA) cohort, born 1924 to 1930, added to the study in 1998; War Baby (WB) cohort, born 1942 to 1947, added to the study in 1998; Early Baby Boomer (EBB) cohort, born 1948-1953, added to the study in 2004.

[13] HRS Pension Estimation program estimates the value of DB entitlements very well, using information derived from the restricted files of 1993 and 1999 employer-provided summary plan descriptions (SPDs). DC value imputations are based on self-reported data.

Furthermore, to construct lifetime earnings, I use self-reported data on current and retrospective earnings from the 1992~2006 HRS core survey to estimate four separate fixed effect log earning regressions, grouped by gender and education. More details can be found in the data appendix.

2.2.2 Empirical Specification

Extended from equation (10), the empirical specification is defined as follows. I regress the non-pension wealth in year 1992 on pension variables, including employer-sponsored pension wealth and Social Security wealth, as well as other household-specific variables after controlling for lifetime earnings.

$$A_i = \beta_0 + \beta_1 E_i^b + \beta_2 E_i^f + \beta_3 P_i^{DC} + \beta_4 P_i^{DB} + \beta_5 P_i^{SS} + \mathbf{X}_i \alpha + \varepsilon_i \quad (12)$$

where *i* indexes the household and ε is the disturbance term. I am interested in parameters β_3, β_4, and β_5, which are interpreted as the offset effect of the corresponding pension variables on non-pension wealth.

Dependent Variables

The dependent variable, A_i, is the total household net worth from the first wave of the HRS that includes owner-occupied housing assets less liabilities, net value of real estate, vehicles, business, individual retirement accounts (IRAs) and Keogh accounts, and financial assets less liabilities, such as checking, savings, or money market accounts, stocks, bonds, mutual funds, certificates of deposit, and other assets less debt. The household-level net value of total wealth in the HRS data contains information for the respondent if single, and for the household head and his/her spouse if married. Non-housing net worth is also used in some specifications.

In addition, I use an alternative specification, defined as the sum of total household net worth (or non-housing net worth) and the DC pension wealth. A defined contribution (DC) plan, such as 401(k), is an account held in the name of the employee, where the firm and the individual,

or both may contribute to the account. The covered worker may decide whether to participate, how much to contribute to the plan and how to invest contributions in stocks and other financial instruments. Though it is counted as pension wealth, the nature of these plans is more fungible (readily converted to cash), and could be categorized as part of the marketable wealth.[14] Moreover, Gustman and Steinmeier (1999) also mentioned in its footnote that including current balances in 401(k) plans as right-hand-side measures in a wealth equation would invite spurious correlation based on any unmeasured taste for saving.

Construction of Independent Variables

Pension Wealth with Adjustment

Before the advent of Health and Retirement Study, most data sets with detailed information on individual income and wealth did not have sufficient information to calculate the pension value.[15] Consequently, studies of saving behavior often ignored pension entirely or proxied with pension relevant dummies. In contrast, HRS provides a wide variety of information about private pensions and Social Security for both respondents and their spouses from their current jobs and up to three previous jobs. Pension wealth is generated by discounting the present value of the sum of future benefits at the expected retirement age to year 1992.

For each pension type, the pension variable of the i^{th} household is defined as the sum of adjusted pension wealth for person j (j = head, spouse) in the family. That is,

$$P_i^{type} = \sum_j p_{ij}^{type} Q_{ij} \tag{13}$$

where *type* refers to DC, DB, and Social Security, respectively. Pension wealth and Social Security wealth are defined as the present value of the sum of future retirement benefits of each

[14] See Wolff (2002), figure 1.

[15] With the exception of some studies based on data from the Survey of Consumer Finances.

plan, assuming continued participation until expected retirement age. Details about the construction of pensions and Social Security wealth are summarized in the data appendix.

The adjustment factor is defined as

$$Q_{ij} = \frac{1 - x_{ij}^{S_{ij}}}{1 - x_{ij}^{T_{ij}}} \tag{14}$$

where $x_{ij} = R \cdot \theta_{ij} = \left(\frac{1}{1+r}\right)\left(\frac{1+r}{1+\delta}\right)^{\frac{1}{\rho_{ij}}}$.

The value of Q_{ij} is calculated for each person in the household. S_{ij} is the number of years the individual has participated in the plan, which equals 1992 minus the starting year of work plus one.[16] T_{ij} is the individual's expected lifespan, which is equal to S_{ij} plus the remaining life expectancy based on age and subjective probabilities of living beyond 75 in the data. I use the SSA intermediate forecast for the real interest rate in 1992, that is, $r = 2.3\%$ (actually $r = 1.063/1.04 = 2.2\%$).[17] As in Gale (1998) and Khitatrakun et al. (2000), I assume $r = \delta$ in calculating the adjustment factor.

Lifetime Earnings

Exploiting the abundant information in the HRS on respondents' and their spouses' working history,[18] I develop the lifetime earnings profile for each individual in the HRS cohort using the self-reported data on current and retrospective earnings and other information. In each

[16] Initial period ($t = 0$) in the theoretical model is correspondent with the beginning year of work in the empirical specification. I also assume individuals started their work in the beginning of year and were covered by a pension since then. The wealth accumulation equation is evaluated at the end of the year 1992; thus, *S*=1992 - beginning year of work + 1.

[17] The interest rates are from the SSA Trustee Reports as of the wave year 1992. The nominal interest rate is 6.3%, and inflation is 4%. The real interest rate is defined as $(1+i)/(1+\pi)$.

[18] Most of previous pension studies have access to the restricted earnings and benefits data in the HRS. Without the restricted records, I mainly follow Khitatrakun et al. (2000)'s approach to construct the earning profiles.

wave, respondents are asked about the earnings of his/her current jobs in the last calendar year. A respondent is also asked about the last job if retired. Whether working or not, questions were asked about up to three additional jobs lasting at least 5 years retrospectively at his/her first interview. Selected observations are used to perform the fixed effect regressions for 4 mutually exclusive groups. With the gender-education group coefficients and individual fixed effects, income profiles are calculated.

There are two lifetime earnings variables in equation (12). First, E_i^b is the adjusted present value of household earnings to date for the i^{th} household, defined as

$$E_i^b = \sum_j y_{ij}^b (1 - Q_{ij}) \tag{15}$$

where y_{ij}^b is the sum of the present value of yearly wage income up to year 1992 for the j^{th} adult in the *i*th household. The adjustment factor Q_{ij} is generated based on equation (14).

Second, E_i^f is the adjusted present value of future household earnings for the i^{th} household, defined as

$$E_i^f = \sum_j y_{ij}^f \cdot Q_{ij} \tag{16}$$

where y_{ij}^f is the sum of the present value of future income after 1992 until the expected retirement year for the *j*th adult in the *i*th household.

<u>Other Control Variables</u>

HRS also provides the demographic variables, family structure, social security status, and self-reported ordinal health status, etc. These are essential determinants to study individual's retirement decisions and saving behaviors. $\mathbf{X}_i$ indicates a set of other independent variables: indicators of whether the household is headed by a female head; whether it is a couple household, age and age square of the head, education in years (or average education in years of the couple), indicators of race and ethnicity, household size, number of children, current earnings

of the head and spouse, and self-employment status. Moreover, in order to account for the saving incentives for the elderly, I include expected retirement horizon (defined as remaining life expectancy at expected retirement age), dummies for financial planning horizon (next year, next few years, 5-10 years, more than 10 years), whether they have IRA accounts, and whether they will leave a sizable bequest.

2.2.3 Sample

The sample includes households in which both the head[19] and his/her spouse are working when interviewed because the pension data is available if they currently have a job. Households in which workers had pensions from previous jobs are excluded. I also exclude separated/divorced/widowed households who might be eligible for spousal or survivor benefits if their longest marriage lasts more than 10 years because the Social Security wealth values of these respondents may be subject to errors in computation in the data set.[20] In calculating the Social Security wealth value for single households, the supplemental data of "Prospective Social Security Wealth Measures of Pre-retirees" gives measures based on the respondents' own earnings records regardless whether they might be entitled to spousal or survivor benefits based on ex spouses' or deceased spouses' Social Security earnings records. As a result, the recorded value represents a minimum amount they may receive. Austin and Hoch (2004)[21] show that excluding these observations from the analysis sample results in negligible bias in estimation. Moreover, I exclude farmers household as prior papers since Avery et al. (1986) and Hubbard

[19] For single households, the head is the respondent. For married households, the head is defined as the older respondent of the couple.

[20] The divorced/separated spouses whose marriages last 10 years or more may be entitled to 50% of the ex-spouse's benefit if it is higher than based on his/her own earning records, and the survivors are entitled to 100 % of the deceased spouses' benefits.

[21] Austin and Hoch (2004) examine the impact of a censored independent variable, which means one of the independent variable for part of the sample is subject to ceiling effect (the observed value lies above a certain ceiling value), in estimating linear regression models. They find that a "naïve" OLS regression in the presence of a censored independent variable leads to a substantial bias in the estimation of the regression coefficient associated with the variable subject to a ceiling effect. Instead, the use of "partial" OLS and maximum-likelihood approaches offers consistent estimation.

(1986) show that farmers have accumulation patterns different from those of other households. Instead of excluding self employed individuals like some papers do, I will include a dummy variable in the estimation. Other exclusions include households with missing pension or social security wealth, or imputed lifetime earnings variables. Our analysis is based on household rather than individual respondent data. Therefore, for a couple household, it is necessary to have lifetime earnings and information on pension and Social Security for both persons in the household. The remaining analysis sample consists of 1,083 households for the HRS cohort, including 802 couple households and 281 non-couple households.

2.3 Results from the Wealth Equation

2.3.1 Descriptive Analysis

Table 2-1 reports the summary statistics of selected variables for the analysis sample, weighted using the HRS household weights. Column 2 and 3 further show the sample characteristics for couple and single households, respectively. Overall, the sample consists of mostly white, married individuals in their mid-fifties, expected to retire in 7 or more years, with some college education and relatively few children at home. Around 77 percent of the sample has at least one member who was employed in a pension-covered job as of year 1992.

The lifetime earnings and wealth values in the upper part of Table 2-1 are presented in 1992 dollars and in household level. Lifetime earning is the present value of earnings profile assuming the workers continue working until the expected retirement age. The household lifetime earnings at sample mean and median are $1,235,590 and $1,063,644, which are similar to the mean estimate of $1,273,960 and median estimate of $1,099,704 in Gustman and Steinmeier (1999, Table 6). The pension and Social Security wealth are defined as the present value of retirement benefit as of expected retirement age, discounted to year 1992. Our estimates of employer-provided pension wealth and Social Security wealth are higher than the values reported in Gustman and Steinmeier (1999, Table 5) because their pension values are prorated, that is, based only on work until 1992. Even though the pension and Social Security wealth values in Table 2-1 are calculated on a different footing with the wealth accumulated in other

forms as of 1992, pension and Social Security wealth is sizable relative to non-pension wealth and plays an important role in preparation for retirement.

A comparison between those with and without private pension coverage is shown in Table 2-2. It indicates that private-pension-covered households have higher lifetime earnings and total pension wealth; however, the households with private pension coverage have less non-pension wealth on average than those without coverage. This is consistent with the possibility that pensions offset the non-pension wealth accumulation. The difference is even more significant for the non-housing financial wealth between the two groups as compared to other categories of assets. Table 2-3 gives a closer look at the distribution of non-pension wealth between two groups by the lifetime earnings percentile. Pension coverage is widespread except in the lowest quintile with only 52 percent of sample household working in a pension-covered job. Within each lifetime income quintile, the average non-pension wealth is less for those with pension coverage.

2.3.2 Empirical Findings

Table 2-4 presents the ordinary least squares (OLS) estimates on the pension wealth variables from regressions with a variety of specification in each column. Three rows present results using different definition of pension variables. Row A uses one pooled pension wealth variable, the sum of the present values of DB pension benefit, DC pension benefit, and Social Security retirement benefits as of expected retirement age, in the regression while row C uses separate pension wealth variables. Row B splits the pension wealth into employer-provided pension and Social Security wealth. All regressions control for lifetime income variables as well as other covariates. For example, Table A.1 and Table A.2 in the table appendix show the detailed regression estimates of column 2 row A (with pooled pension variable) and row C (with separated pension variables), respectively.

The first two columns have the dollar value of total net worth excluding secondary residence as the dependent variable. The estimates in the first column do not adjust the pension wealth measure. From column 2, I find that the offset effect of the pooled pension variable is

-0.27, statistically different from zero and -1 at 10% significance level. With the exception of Khitatrakun (2000), there hasn't been any study examining the potential difference of offset effect arising from each pension plan, namely DB pension, DC pension, and Social Security. When regressing non-pension net worth on DB, DC, Social Security wealth variables, and the same set of covariates, the estimate of DB pension is -0.41 and statistically significant, which indicates that an additional dollar of DB pension wealth crowds out non-pension net worth by 41 cents. DC pension and Social Security however show little or no offset effect on private saving. Furthermore, by comparing column 1 and 2, my finding supports Gale's assertion that effect of pension on private saving will bias upward without correcting the systematic bias.

In column 3, I use non-housing net worth as the dependent variable. Research shows that home equity is on average not liquidated to support general consumption needs as households age (Venti and Wise, 2004; Lusardi and Mitchell, 2007). The exclusion of home equity in the third specification enlarges the offset effect marginally for row A, B, and C, but still shows no effect from Social Security. Lastly, I try two alternative dependent variables by adding DC pension wealth into total net worth and non-housing net worth, respectively. As discussed before, DC plan is more fungible and can be regarded as part of a broader measure of marketable wealth. The adjusted R-squared statistics increase in both model 4 and 5. From row A in column 4, pension wealth significantly crowds out the marketable wealth accumulation by 37 percent. In row C, DB pension shows substantial offset effect of 42 percent on marketable wealth while Social Security shows no effect. The offset effect is slightly bigger for specification 5.

More specifications are checked and explained in text as follows. Using financial wealth as the dependent variable, I find a small (almost zero) and insignificant offset effect from regressions either with a pooled pension variable or with separate pension variables. This result is similar to Gale (1998) who finds a much smaller effect using a narrow measure of non-pension wealth. I also try the median regression for total net worth and DC pension (specification 4 in Table 2-4), which will not be as sensitive to outliers as OLS. The estimation of median regression yields -0.06 for pooled pension variable, statistically significant from zero. Using separate pension variables in median regression yields -0.11 for DB pension and 0.18 for Social Security.

2.4 Discussion: Estimation Problems

In addition to the theoretical ambiguity in the magnitude of the pension offset effect, several econometric issues need to be addressed before any conclusions can be reached. First, in contrast to private pensions, there is insufficient independent variation in Social Security when conducting a cross-sectional analysis.[22] Since there is only "one" plan associated with Social Security, there is no across-plan variation in generosity. Moreover, Social Security offers almost universal coverage due to mandatory coverage for most workers.[23] This type of identification problem is a common issue in empirical public finance but particularly severe when it comes to examining the effect of Social Security on saving behavior because the change in Social Security policy is universal, which makes it harder to apply the quasi-experimental approach (Feldstein and Liebman, 2002).

Second, as discussed in Triest (1998), functional form misspecification could introduce the omitted variable bias. This econometric problem is more serious in the case of Social Security wealth (SSW) than in that of private pensions because SSW is simply a non-linear function of lifetime income, marital status, and expected mortality, and these factors also enter the regression directly as the independent variables. Therefore, the coefficient on the SSW variable is identified by the functional form of the other variables. For example, if we allow for only a linear income effect in the specification when, in truth, private wealth varies with some nonlinear form of income, then SSW will likely be correlated with the omitted nonlinear income term, producing the classical omitted variable bias. In addition to income, Social Security wealth is strongly influenced by marital status and retirement/claiming age, but these factors are likely to themselves be determinants of private saving. As these variables that determine both non-pension wealth and pension wealth are added to the specification, this could easily introduce multicollinearity between SSW and other variables. Multicollinearity does not reduce the predictive power or reliability of the model as a whole; it only affects calculations regarding individual predictors. The OLS estimates are still unbiased, but standard errors are greater when

[22] There are two sources of identifying variation in private pensions. First, there is pension coverage variation across individuals. Second, there is variation across pension plans in generosity.

[23] Social Security coverage rose from 82.4% in 1983 to 98.4% in 1998 (Wolff, 2002).

multicollinearity is present. As illustrated in Table 2-4, the standard error of SSW estimate is in general higher than the standard errors of DB and DC estimates.

Third, the existence of unobserved heterogeneity in saving behavior will bias the offset estimates toward zero. The literature on saving has shown the importance of heterogeneity in propensities to save, even after controlling for lifetime earnings or observable characteristics. Savers are more likely to accumulate wealth in every form of saving. For example, people with a strong saving preference may seek out and accept jobs that have pension plans or offer more generous pensions. This results in a positive correlation between private pension wealth and non-pension saving. In contrast, workers have relatively little power to affect SSW except through the choices affecting insured earnings, such as the choice over retirement or claiming age. In general, this bias might not affect SSW as severe as in the case of private pension. One solution to deal with the omitted variable bias, such as the saving preference, is to proxy the unobservable variable. I try to address the heterogeneity in saving preference by introducing the risk preference parameters in the estimation of equation (12). Unlike Gale (1998) and Khitatrakun et al. (2000), I do not assume $r = \delta$ in calculating the adjustment factor, which implies constant consumption over time and ignores the heterogeneity of preference among individuals.[24] Instead, I use the imputations of the coefficient of relative risk aversion ρ from Kimball, Sahm, and Shapiro (2008). Using the designed survey responses to hypothetical gambles over lifetime income in the HRS,[25] they estimate the risk preference parameters for HRS respondents and study the behavioral heterogeneity. The time preference rate δ is taken from the nonlinear two-stage least squares estimates in Hurd (1989).[26] The results are similar to what I reported in Table 2-4. However, these individual-specific parameters enter the wealth equation indirectly through the Gale-adjustment factor. So it is possible that the correlation between the explanatory variables and the unobservable is still present.

[24] If $r > \rho$, consumption will be growing over time. If $r < \rho$, then agents choose consumption paths that fall as they age. Using the experimental survey questions in HRS, Barsky, Juster, Kimball, and Shapiro (1997) find that the mean preference is for an upward sloping consumption path, even when the interest rate is zero.

[25] The Health and Retirement Study elicits risk preferences using a battery of questions developed by Barsky, Juster, Kimball, and Shapiro (1997).

[26] Hurd estimated the preference parameter using data from the Longitudinal Retirement History Survey from 1969 through 1979. The sample consists of over 11,000 households close to their retirement years during the interview (similar age as to the sample of my study).

Finally, when one or more of the variables in the model are measured with error, it can cause biases in OLS toward zero. As mentioned in Gale (1998), pension wealth data are of general poor quality, and no matter what method of imputation is used, the amount of pension wealth is almost certainly measured with error. In addition, Feldstein (1983) points out several measurement problems in evaluating the accumulated lifetime earnings variable. In such a case, even if the Social Security wealth variable itself is measured quite accurately, the estimate of its coefficient can be inconsistent when lifetime earning is measured with error since the two variables are correlated. In my paper, the Health and Retirement Study is used. Unlike previous survey data which either lack earnings history or pension entitlement, HRS contains detailed information on all the key variables in pension-saving literature with supplemental records from Social Security Administration and employers. Using Social Security administrative earnings data and pension plan information obtained directly from employers reduces the measurement error in pension wealth. But there can be some measurement error remaining because of missing earnings information, which had to be imputed. For example, in U.S., SSW is calculated based on the highest 35 years of covered earnings. Since the respondents in our sample are still working in 1992, projected earnings were used to calculate SSW. Most of the earlier studies took this approach, which introduces measurement error in SSW. Also, survey data on private pension benefits are likely to be measured with error. Even though pension estimation software estimates the value of DB entitlement very well, respondents may not be aware of all plan features and as a result report erroneous benefit amounts. Accordingly, DB values in my paper are calculated from the 1993 employer-provided summary plan descriptions (SPDs) which were obtained based on employer contact information provided by the respondent in the 1992 core survey. Despite the efforts to increase the number of matched cases, in version 2 data set of "Imputations for Pension Wealth", 59% of respondents are missing calculated DB wealth and required imputations using self-reported DB values. As for the DC wealth measure in this paper, I combine the self-reported DC account balance as of 1992 (or the imputed account balance if the account balance is missing) with future contributions using the contribution rate reported in the core survey. Without full information on the history of employer and employee contributions as well as the history of portfolio compensation and the returns on investment, the DC wealth is more likely to be measured with error.

Table 2-1: Summary Statistics of the Analysis Sample: HRS cohort in Year 1992

Variables	Analysis Sample					
	All (N=1,083)		Couple (N=802)		Single (N=281)	
	Mean	Median	Mean	Median	Mean	Median
Lifetime Earnings	1,235,590	1,063,644	1,457,163	1,261,050	650,152	567,681
Employer-provided Pension	167,035	83,794	191,396	112,019	102,670	38,247
DB Pension Wealth	111,771	45,918	125,213	56,889	76,254	0
DC pension Wealth	55,265	0	66,183	7,500	26,416	0
Social Security Wealth	160,989	171,600	188,315	193,800	88,789	90,800
Lifetime Total Pension Wealth	328,025	266,163	379,711	298,276	191,459	131,200
Total Non-Pension Wealth	230,085	111,800	274,241	137,000	113,417	43,000
House Value (primary)	92,450	70,000	106,827	80,000	54,464	23,000
Real estate	32,230	0	39,704	0	12,483	0
Businesses	48,734	0	63,834	0	8,838	0
Vehicles	17,432	10,000	21,153	12,000	7,600	4,000
Financial asset	48,988	9,000	54,728	10,000	33,821	4,800
IRA, Keogh asset	17,093	0	20,216	1,700	8,840	0
Household Characteristics						
Age (head)	55		56		55	
Age (spouse)	51		51		-	
Expected retirement age (head)	63		63		63	
Education in years (head)	12.8		12.7		12.8	
Household Size	2.7		3.0		1.7	
Number of Children	2.8		3.2		1.5	
Fraction: Couple household	0.73		-		-	
Fraction: Single household	0.27		-		-	
- Separated	1%		-		-	
- Divorced	47%		-		-	
- Widowed	8%		-		-	
- Never married	44%		-		-	
Fraction: Female head	0.25		0.14		0.54	
Fraction: White	0.86		0.89		0.77	
Fraction: Hispanic	0.06		0.05		0.09	
Fraction: Any pension covered from current job	0.77		0.83		0.62	

Source: Author's calculation from the first wave of the Health and Retirement Study.

Note: The table is weighted using the HRS household weights.

Table 2-2: Non-Pension Net Worth for the Analysis Sample by Employer-provided Pension Coverage, HRS 1992

	Social Security Covered Only (N=246)		Pensions Covered (N=838)	
	Mean	Median	Mean	Median
Lifetime Earnings	979,990	711,559	1,311,561	1,144,424
Employer-provided Pension	-	-	216,682	143,462
Total Pension Wealth (DB+DC+SSW)	125,829	116,500	388,122	315,938
Total Non-Pension Wealth	292,056	65,000	211,666	118,000
House Value (primary)	77,542	50,000	96,882	75,000
Non-housing financial wealth	241,719	29,350	141,520	50,000
Financial asset	35,604	3,250	52,966	10,000
IRA, Keogh asset	10,787	0	18,967	1,900

Note: The table is weighted using the HRS household weights. Around 23% are non-pension covered households. Among pension-covered households, 38% have DB pension only, 21% have DC pension only, and 41% have both DC and DB pensions from current employment.

Table 2-3: Distribution of Non-Pension Wealth for Analysis Sample by Employer-provided Pension Coverage and Lifetime Income Percentile, HRS 1992

Lifetime Income Percentile	Social Security Covered Only (N=246)		Pensions Covered (N=838)	
	Percentage	Mean	Percentage	Mean
0 - 20	48%	158,397	52%	88,089
20 - 40	24%	159,540	76%	144,195
40 - 60	13%	211,890	87%	163,720
60 - 80	14%	301,773	86%	229,302
80 - 100	16%	935,484	84%	383,065
Total	23%	$ 292,056	77%	$ 211,666

Note: See Table 2-2.

Table 2-4: Effects of Pension Wealth on Non-pension Wealth, HRS 1992

	1	2	3	4	5
Dependent variable	**Total Net Worth**	**Total Net Worth**	**Non-Housing Net Worth**	**Total Net Worth + DC pension Wealth**	**Non-Housing Worth + DC pension Wealth**
Pension adjusted by Gale-factor	No	Yes	Yes	Yes	Yes
A: Pooled Pension wealth (DB+DC+SSW)	-0.20* (0.11)	-0.27* (0.15)	-0.29* (0.15)	-0.37** (0.16)	-0.41*** (0.15)
B: Private pension wealth (DB+DC)	-0.21* (0.11)	-0.29* (0.16)	-0.30* (0.16)	-	-
Social Security pension wealth	0.08 (0.27)	0.06 (0.32)	-0.08 (0.32)	-	-
C: DB pension wealth	-0.29** (0.12)	-0.41** (0.17)	-0.44*** (0.16)	-0.42*** (0.16)	-0.44*** (0.16)
DC pension wealth	-0.14 (0.10)	-0.17 (0.14)	-0.18 (0.14)	-	-
Social Security pension wealth	0.02 (0.27)	0.04 (0.32)	-0.10 (0.31)	0.12 (0.32)	-0.03 (0.31)
Adjusted R-Squared					
A:	0.3414	0.3423	0.2984	0.3467	0.3030
B:	0.3421	0.3430	0.2987	-	-
C:	0.3437	0.3450	0.3014	0.3483	0.3041

Note: *, **, *** denote the significance level at the 10%, 5%, 1%, respectively. From specification 1~3, pooled pension wealth in row A is the sum of the present values of defined benefit (DB) pension benefit, defined contribution (DC) pension benefit, and Social Security retirement benefits as of expected retirement age, and then discounted to the year 1992. For specification 4 and 5, since DC pension wealth balance as of 1992 is added into the left-hand side of regression, the pooled pension wealth is defined as the sum of DB and Social Security wealth. All specifications control for a set of independent variables as defined in text. Robust standard errors are presented in the parentheses.

Chapter 3 Effects of Pensions on Private Wealth Accumulation: A Panel Analysis

In this chapter, I will utilize the panel structure of HRS and the recent Social Security reforms to introduce independent variation in pension wealth over time to overcome the potential estimation biases.

3.1 Methodology to Correct Estimation Biases

These problems discussed in the prior chapter apply to all previous studies of pensions and saving in the U.S., and are rarely controlled except for Engelhardt and Kumar (2011), who use an instrumental-variable approach to identification using the 1992 HRS. Other than incorporating instrumental variables, recent approaches have tended to correct these estimation problems by using either panel data or several cross sections of data spanning a period of time encompassing a policy reform.

Several noteworthy studies of pension reform on household saving have utilized the reduced-form approaches on non-U.S. data. From the Italian SHIW data from 1989-1995, Attanasio and Brugiavini (2003) use a difference-in-difference estimator that exploits the differential effect of the 1992 reform on individuals across several year-of-birth cohorts and different employment groups to estimate the crowding out effect of pension wealth. They model the response of the change in private wealth relative to income (i.e. the household saving rate) to the level of SSW relative to income, accompanied by an instrumental variable technique. In their most promising specification, they find that the estimates are -0.49 for ages 46-55, -0.21 for ages 56-60, and -0.11 for ages 61-65. With the same data set from 1989-2002, Botazzi et al. (2006) look at the combined impact of three Italian pension reforms (1992, 1995, and 1997) on private wealth accumulation. They find substantial offset between private wealth and perceived pension wealth, particularly by workers who are better informed about their pension wealth. Attanasio and Rohwedder (2003) adopt a similar approach using three major U.K. pension reforms as natural experiments to examine the relationship between pension saving and discretionary private savings. The estimate of the earnings-related public pension at ages 55-64 in U.K. is -0.75, indicating a substantial crowding out effect. In addition to the natural

experiment approaches, fixed effects model may be able to remove some household-specific unobservable or time-invariant omitted variable bias. Alessie et al. (1997) utilize panel data to estimate the effect of pensions in the Netherlands and find a positive effect of occupational pensions and no effect of Social Security. They interpret these findings as evidence of unobserved heterogeneity and re-examine the model using a fixed effect estimator. The positive pension effect persists while the Social Security crowding-out effect changes drastically to -2.10, which is significantly different from zero but not from -1. As a result, estimates from these papers are more likely than most to mitigate the biases and obtain a larger magnitude for the offset effect.

One of the advantages of using the Health and Retirement Study is that it follows the same household over time. The panel structure, the changes in the private pension landscape and Social Security policies can introduce independent variation over time across cohorts that were not available in cross-sectional analyses. Because of the repeated observations at the individual level, they have more power than cross-sectional studies, by virtue of being able to exclude time-invariant unobserved individual differences, and by virtue of observing the plausibly exogenous source of identification from Social Security reforms. The key to distinguish between changes in behavior due to policy reforms and changes in behavior induced by other economically environmental fluctuation that coincide with Social Security is that Social Security reforms generally do not treat all groups of individuals in the same way. Some groups experience larger SSW changes than do others, and sometimes SSW increases for some groups while it decreases for others. Therefore, HRS possesses several advantages over conventional cross-section data sets.

3.2 Social Security Reforms since the 80s

There are several Social Security program rule changes since the 1980s, including the Social Security Amendments of 1983, and the legislations regarding the retirement earnings test. Table 3-1 provides a simple summary of major Social Security policy changes.

The Social Security Amendments of 1983 contained two provisions which may have an impact on individuals' retirement decisions, and hence altered their entitled Social Security

wealth. The two provisions are an increase in the normal retirement age (NRA) that can first affect individuals retiring in 2000 and an increase in the delayed retirement credit (DRC) for those who work beyond NRA.[27]

The NRA for full retirement benefit has been gradually raised from 65 to age 66 in 2009 and age 67 in 2027, beginning with persons born in 1938 or later. The age to be eligible for Social Security benefits remains at 62. Since early claiming will result in a permanent reduction in retirement benefits for a life time, the gradual increase in NRA means a gradual increase in the permanent benefit reduction for those who claim prior to reaching NRA. For example, Social Security benefits are reduced by 6.67% for a person who retires at 65 and whose NRA is 66 (born 1943-1954). Compared to a beneficiary whose NRA is 65 (born 1937 or earlier) and retires at 65, an increase in NRA by one year is equivalent to a 6.67% decrease in Social Security wealth. Secondly, the reform also changes the DRC based on birth year. The DRC was gradually raised for each year between the NRA and age 70 in which no benefits are received, starting with beneficiaries born in 1925 until the rate reaches 8% a year. This provision increases the Social Security benefits for those delaying retirement beyond NRA. Since NRA is increasing depending on the birth year, later beneficiaries may be experiencing fewer year of DRC adjustment but at a higher rate.

Furthermore, the change in Social Security earnings test rule also introduces variations in Social Security wealth. Workers are eligible to receive Social Security retirement benefits when they turn age 62. Once a beneficiary earns more than the exempt amount, his or her Social Security retirement benefits are reduced at a rate proportional to additional earnings until the benefits are completely withheld. There were three major changes in earnings test rules for those beneficiaries beyond NRA after year 1990. Each applied to beneficiaries of some ages and not others, so the behavior of unaffected age groups can be used to control for other changes in

[27] The 1983 Amendments also provided for taxation of Social Security benefits effective with *tax* year 1984. Beginning in 1984, it includes up to 50% of Social Security benefits as taxable income for taxpayers whose combined income (sum of adjusted gross income, half their SS benefits and any tax-exempt interest) may have exceeds $25,000 for a single taxpayer and $32,000 for married taxpayers filing jointly. The 1993 Amendments further made up to 85% of SS benefits subject to the income tax for recipients whose combined income exceeds $34,000 (single) and $44,000 (couple), effective in 1994. This usually happens if the recipients have other substantial income, such as wages, self-employment, interest, dividends and other taxable income. According to Social Security Administration, about one-third of people who get Social Security have to pay income taxes on their benefits.

saving. These changes involved different combinations of shifts in the earnings test withholding rate and the earnings exempt amount. Especially in year 2000, Congress removed the earnings test altogether for those aged at or above NRA[28], creating a quasi-natural experiment to examine the effects of Social Security. It is one of the most substantial changes in recent years because it affects not only the most recent cohorts of people who have reached the NRA but also a wider range of ages than previous modification.

3.3 Empirical Framework: Panel Analysis

The panel specification of the wealth equation to be estimated is

$$A_{it} = \beta_0 + \beta_1 E_{it}^{b} + \beta_2 E_{it}^{f} + \beta_3 P_{it}^{type} + \mathbf{X}_{it}\alpha + \varepsilon_{it} \tag{17}$$

where E_{it}^{b} and E_{it}^{f} are the adjusted present value of past and future household earnings for the i^{th} household at time *t*, P_{it}^{type} are the adjusted pension wealth variables including DB, DC, and Social Security wealth for the i^{th} household at time *t*. The methods and formula to construct variables in year 1998 and 2004 are the same as described in Chapter 2 for data in year 1992. $\mathbf{X}_{it}$ indicates a set of other independent variables as defined in section 2.2.2, and the year dummies.

The data used for the panel analysis comes from HRS 1992, 1998, 2004 because the supplemental pension data for public use are available every six years. The Social Security wealth comes from the version 3.1 (March 2010) of the "Prospective Social Security Wealth Measures of Pre-Retirees" data set. Employer-provided pension wealth measures, including defined benefit (DB) and defined contribution (DC) pensions, are collected from the version 2.0 (December 2006) data set of "Imputations for Pension Wealth" and the version 1 (July 2009) data set of "Imputations for Employer-Sponsored Pension Wealth from Current Jobs in 2004". Wealth and other household characteristics variables are generated from the RAND HRS or imputed from the core surveys.

[28] The law was enacted on April 7, 2000, but the elimination of the earnings test for beneficiaries was effective for taxable years ending after December 31, 1999. Therefore, we can consider it an exogenous policy change. Earnings tests for individuals aged 75 or older, 72-74, and 70-71 were eliminated in 1950, 1954, and 1983, respectively (Social Security Administration, 1997-2003).

To be comparable to prior research using HRS, I focus on the baseline cohort (HRS cohort), born between 1931 and 1941 (age 51~61 in 1992). The sample selection criteria in the cross-sectional analysis apply here when generating samples from HRS 1998 and 2004. In addition, under panel structure the household-wave observation remains in the sample if its marital status is the same as in 1992 wave. I also drop observations as soon as either head or spouse dies, leaves the survey, or stops working. The remaining sample consists of 1,083 households and 1,501 household-wave observations.

3.4 Results

Table 3-2 presents the summary statistics of the analysis sample in year 1992, 1998, and 2004. The 1,083 households in 1992 were followed throughout the timespan of 12 years. Given the sample selection criteria, many of the households are eligible for Social Security retirement benefits and have claimed by year 1998. Only a few of respondents haven't claimed by 2004. 348 households remained in 1998, and 70 households remained in 2004. The average lifetime earnings and non-pension wealth for remaining households in 1998 are similar to those in 1992 while the total pension wealth becomes lower. The difference results from a lower employer-provided pension wealth for those remained in 1998. By year 2004, all household heads are eligible for retirement benefits. Respondents who still remained in the analysis sample are more educated and have higher average pension and non-pension wealth and may opt to delay claiming.

The estimation results are summarized in Table 3-3. Row A shows the offset effect of pooled pension on household wealth; row B shows the offset effects of private pension variable and Social Security wealth; row C shows the effects of 3 separate pension variables, by splitting the private pension into DB and DC pension. There are 4 specifications with different dependent variables. Each column presents the estimates from wealth regression of pooled OLS model, random effects (RE) model, and fixed effects (FE) model, respectively. Robust standard errors are used to control for potential heteroskedasticity and autocorrelation over individual and time.

The results from Table 3-3 are comparable to the specification 2~5 in Table 2-4. The estimates of pooled OLS and RE regression are similar to those found in the cross-sectional

analyses but are statistically more significant. For example, the RE estimates suggest that each dollar of pooled pension wealth is associated with a 35 cents decline in non-housing net worth at 5% significant level; an offset effect of -0.46 at 1% significant level for DB pension and an offset effect of -0.32 for DC pension. There is little to no effect from SSW.

The FE results presented in the last column show substantial offset effects for all pension variables. Using the pooled pension variable, the crowding out estimate is significant at the 1% level and is insignificantly different from -1. Row B presents the results using the private pension variable and the Social Security wealth variable. Both of them show substantial crowding out effect, but the estimate for SSW variable is too imprecise to make a conclusion. Row C shows significant crowding-out effects for DB and DC pension but with an imprecise estimate for SSW variable. In particular, the significant offset effects for DC pension variables under FE model further demonstrate the importance of correcting for estimation biases, such as unobservable heterogeneity in saving preference. These results also imply that private pension saving represents asset reshuffling, not new saving. A full set of FE estimates with non-housing net worth as the dependent variables are presented in Appendix Table A.3 (pooled pension variable) and Table A.4 (separate pension variables). As mentioned in Cameron and Trivedi (2005), the FE model has the attraction of allowing one to use panel data to establish causation under weaker assumptions than those needed to establish causation with cross-sectional data or with panel data models without fixed effects, such as pooled models. On the other hand, it has several practical weaknesses. Estimation of the coefficient of any time-invariant regressor is not possible as it is absorbed into the individual-specific effect. Coefficients of time-varying regressors are estimable, but these estimates may be very imprecise if most of the variation in a regressor is cross- sectional rather than over time.

In Table 3-4, I add DC wealth to the left-hand side dependent variable. Including wealth variable as part of the dependent variable gives similar results as in Table 3-3, but the offset effect of pooled pension wealth and DB pension wealth variables are bigger. There is a statistically significant offset effect of pooled pension wealth, ranging from -0.29 to -0.35 for pooled OLS and RE regression. FE estimate is bigger and close to -1. There is a significant offset effect of private pension wealth, but insignificant effect of Social Security wealth. Both RE and FE estimates give significant crowding-out effects for DB and DC pension wealth. As

before, FE estimates show bigger offset effect. FE estimate of SSW show substantial crowding out effect, but the estimate is too imprecise to make a conclusion.

Table 3-1: Summary of Major Social Security Policy Changes

Year	Social Security Policy Changes
1983	• Increase NRA for those born in/after 1938, who turned 62 in year 2000 • Increase DRC for those born in/after 1925, who turned NRA in 1990
1990	• Lower earnings test withholding rate to 33% for aged NRA~69
1996	• Raise exempt amount to $30000 by year 2002 for aged NRA~69
2000	• Remove earnings test for ages above NRA

Table 3-2: Summary Statistics of the Analysis Sample: Year 1992, 1998, and 2004

Variables	Analysis Sample							
	All (N=1,501)		Year 1992 (N=1,083)		Year 1998 (N=348)		Year 2004 (N=70)	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Lifetime Earnings	1,242,547	1,074,241	1,235,590	1,063,644	1,250,704	1,111,138	1,292,647	1,176,952
Employer-provided Pension	155,663	77,094	167,035	83,794	127,874	55,199	133,439	41,976
DB Pension Wealth	102,861	37,622	111,771	45,918	85,850	23,419	65,789	0
DC pension Wealth	52,802	0	55,265	0	42,024	0	67,650	0
Social Security Wealth	160,775	168,006	160,989	171,600	154,664	160,427	183,434	180,407
Lifetime Total Pension Wealth	316,439	254,089	328,025	266,163	282,538	227,796	316,873	251,505
Total Non-Pension Wealth	225,626	113,689	230,085	111,800	205,796	111,162	253,787	163,399
House Value (primary res)	93,251	71,582	92,450	70,000	83,939	71,582	141,336	94,326
Real estate (not primary res)	28,630	0	32,230	0	22,934	0	8,782	0
Businesses	39,848	0	48,734	0	15,831	0	31,977	0
Vehicles	15,945	10,000	17,432	10,000	12,413	8,421	12,624	7,427
Financial asset	53,024	9,000	48,988	9,000	65,734	10,527	49,145	10,324
IRA, Keogh asset	21,164	0	17,093	0	27,610	0	43,592	2,228

Source: Author's calculation from wave 1, 4, and 7 of the Health and Retirement Study.

Note: The table is weighted using the HRS household weights. All values are converted to 1992 dollar using the BLS Consumer Price Index.

Table 3-2 (Continued): Summary Statistics of the Analysis Sample: Year 1992, 1998, and 2004

Variables	Analysis Sample							
	All (N=1501)		Year 1992 (N=1083)		Year 1998 (N=348)		Year 2004 (N=70)	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Household Characteristics								
Age (head)	57		55		59		64	
Age (spouse)	52		51		54		58	
Expected retirement age	64		63		64		66	
Education in years (head)	12.9		12.8		13.1		14.0	
Household Size	2.6		2.7		2.4		1.9	
Number of Children	2.7		2.8		2.8		2.5	
Fraction: Couple household	0.70		0.73		0.67		0.53	
Fraction: Single household	0.30		0.27		0.33		0.47	
- Separated	1%		1%		4%		-	
- Divorced	47%		47%		43%		47%	
- Widowed	8%		8%		14%		14%	
- Never married	44%		44%		39%		39%	
Fraction: Female head	0.27		0.25		0.28		0.35	
Fraction: White	0.86		0.86		0.86		0.82	
Fraction: Hispanic	0.06		0.06		0.07		0.05	
Fraction: Any pension covered from current job	0.77		0.77		0.78		0.65	

Table 3-3: Effects of Pensions on Non-pension Wealth, Panel Analyses

	Total Net Worth			Non-Housing Net Worth		
	Pool OLS	RE	FE	Pool OLS	RE	FE
A: Pooled Pension wealth	-0.27*	-0.29**	-0.95***	-0.32**	-0.35**	-1.06***
	(0.15)	(0.15)	(0.35)	(0.14)	(0.14)	(0.30)
B: Private pension wealth	-0.31**	-0.33**	-0.91**	-0.35**	-0.38***	-1.07***
	(0.15)	(0.15)	(0.38)	(0.15)	(0.15)	(0.35)
Social Security wealth	0.34	0.31	-1.19	0.13	0.09	-0.98
	(0.30)	(0.32)	(1.33)	(0.28)	(0.31)	(1.11)
C: DB pension wealth	-0.38**	-0.40**	-1.06	-0.43***	-0.46***	-1.38**
	(0.17)	(0.17)	(0.75)	(0.16)	(0.16)	(0.65)
DC pension wealth	-0.25	-0.27	-0.86***	-0.29	-0.32*	-0.96***
	(0.17)	(0.17)	(0.31)	(0.17)	(0.17)	(0.26)
SSW pension wealth	0.32	0.30	-1.14	0.12	0.08	-0.87
	(0.30)	(0.32)	(1.34)	(0.28)	(0.30)	(1.13)
R-squared						
A: within		0.3611	0.5882		0.4115	0.6256
Between		0.3272	0.0629		0.2792	0.0341
Overall	0.3416	0.3414	0.0514	0.2973	0.2967	0.0252
B: within		0.3679	0.5886		0.4164	0.6256
Between		0.3296	0.0657		0.2809	0.0333
Overall	0.3444	0.3442	0.0541	0.2991	0.2986	0.0245
C: within		0.3649	0.5896		0.4147	0.6306
Between		0.3306	0.0658		3.2823	0.0333
Overall	0.3450	0.3448	0.0542	0.3001	0.2996	0.0246

Note: *, **, *** denote the significance level at the 10%, 5%, 1%, respectively. Data come from HRS 1992, 1998, 2004. Pooled pension wealth in row A is the sum of the present values of defined benefit (DB) pension benefit, defined contribution (DC) pension benefit, and Social Security retirement benefits as of expected retirement age, and then discounted to year 1992. All specifications control for a set of independent variables as defined in text. Robust standard errors are presented in the parentheses.

Table 3-4: Effects of Pensions on Non-pension Wealth and DC Pension Wealth, Panel Analyses

	Total Net Worth + DC Pension Wealth			Non-Housing Net Worth + DC Pension Wealth		
	Pool OLS	RE	FE	Pool OLS	RE	FE
A: Pooled Pension wealth	-0.31**	-0.33**	-1.43**	-0.38***	-0.41***	-1.61***
	(0.15)	(0.15)	(0.63)	(0.14)	(0.15)	(0.54)
B: Private pension wealth	-	-		-	-	-
Social Security wealth	-	-		-	-	-
C: DB pension wealth	-0.39**	-0.41***	-1.37*	-0.44***	-0.47***	-1.66***
	(0.16)	(0.16)	(0.74)	(0.16)	(0.15)	(0.64)
DC pension wealth	-	-	-	-	-	-
SSW pension wealth	0.42	0.38	-1.64	0.20	0.15	-1.43
	(0.32)	(0.34)	(1.38)	(0.30)	(0.32)	(1.20)
R-squared						
A: within		0.3413	0.6011		0.3780	0.6318
between		0.3294	0.0695		0.2817	0.0429
overall	0.3413	0.3410	0.0534	0.2964	0.2959	0.0303
C: within		0.3479	0.6013		0.3833	0.6320
between		0.333	0.0714		0.2845	0.0415
overall	0.3453	0.3451	0.0552	0.2995	0.299	0.029

Note: *, **, *** denote the significance level at the 10%, 5%, 1%, respectively. Data come from HRS 1992, 1998, 2004. Since DC pension wealth balance is added into the left-hand side of regression, the pooled pension wealth is defined as the sum of DB and Social Security wealth. All specifications control for a set of independent variables as defined in text. Robust standard errors are presented in the parentheses.

Chapter 4 Household Saving and Benefits Withheld under the Earnings Test

4.1 Earnings Test: Tax or Forced Saving?

Under the retirement earnings test, beneficiaries' Social Security benefits are reduced when their labor incomes are above the exempt amount, until benefits are exhausted; hence, it has long been perceived as an implicit tax on labor supply in the literature and a disincentive to work among the older workers. Upon this hypothesis, benefit withholdings under the earnings test is regarded as an incremental reduction in Social Security wealth. However, a general consensus from economic theories is that an actuarially fair delayed retirement credit (DRC) above the normal retirement age (NRA) and automatic recomputation[29] at NRA would offset the effects of earnings test. That is, if current benefit withholdings were exactly compensated by future benefit increases, and individuals were forward-looking, then the earnings test would not affect benefit claiming choices, earnings, or labor supply hours. One can view the earnings test as a kind of forced savings (Gruber and Orszag, 1999). The elderly may treat the benefits withheld under the earnings test as a deferral instead of an implicit tax. Upon this hypothesis, a dollar of voluntary saving would be crowed out for a dollar of benefit withheld under the earnings test.

Whether older workers respond to the earnings test as a tax or as forced saving remains an empirical question. There is a handful of papers regarding the effects of the earnings test on retirement choices in U.S., such as labor supply, benefit-claiming, and timing of retirement; however, the findings are far from conclusive. Leonesio (1990) points out that only a few earlier studies take into account both "tax" and "sequential transfer" features embedded in the U.S. earnings test rules when they investigate the effects of changes in the earnings test rules.[30] If both

[29] A worker's benefit is reduced if he or she begins receiving benefits before NRA. However, if he or she continues to work and has benefits fully or partially withheld under the earnings test, benefits "lost" as a result of earnings test are restored starting at NRA.

[30] In Leonesio (1990)'s comprehensive literature review, he pointed out that earlier research didn't take into account other Social Security features, especially the actuarial adjustment for early retirement, the delayed retirement credit, and the automatic benefit recomputation provision, which may significantly offset the earnings test's penalty. These points are cogently made in Blinder, Gordon, and Wise (1980), Burkhauser and Turner (1981).

features were fully incorporated into the model, the impact of the earnings test is small and that eliminating the test above NRA would have a minor impact on labor supply of older American workers. This conclusion was echoed by Gruber and Orszag (2003) who find no robust influence from earnings test modification from 1973 to 1998 on the labor supply decision of men but acceleration in benefit receipts. On the other hand, some studies suggest otherwise. For example, Friedberg (2000) obtains a small but significant impact on employment among older workers when examining their responses to three past earnings test rule changes in 1978, 1983, and 1990. Some more recent studies exploiting the earnings test abolition in year 2000, diverse data sets, and more sophisticated models, find a larger impact of the earnings test on work incentive (Haider and Loughran, 2007, 2008; Song and Manchester, 2007; Engelhardt and Kumar, 2009).[31] However, there is still no decisive conclusion whether older American workers treat the earnings test as an implicit tax or a deferral of benefits.

In spite of the interest in earnings test, to the best of my knowledge, it is somewhat surprising that no empirical evidence exists on how the earnings test rule embedded in Social Security affects household saving or how its removal in year 2000 impacts the saving behaviors of the elderly in the United States.[32] To the extent that benefit withholdings under earning test represent the incremental change in Social Security wealth, and individuals face different earnings test rules depending on their age and calendar year, it introduces independent variation across individuals over time and can be used to identify the offset effects of Social Security wealth beyond a cross-sectional wealth equation.

[31] Haider and Loughran (2007, 2008) study the effects of the earnings test removal following the 1983 and 2000 changes using a reduced-form model and the data of CPS, NBDS and CPS-SER, while Song and Manchester (2007) use quantile regression methods to examine the uneven impact of earnings test elimination across the distribution of earnings in the administrative files from the Social Security Administration. Using data from the 1996-2004 of the Health and Retirement Study (HRS), Engelhardt and Kumar (2009) develop a measure of exposure to the earnings test by calendar year and birth month and year to examine work incentive.

[32] van der Klaauw and Wolpin (2008) use a structural dynamic model to examine the impact of changes in Social Security rules on retirement decisions and saving behavior of low income household.

4.2 Model

4.2.1 Empirical Specification

Method

I regress household saving (S_{it}) on the head's benefit withholdings under the earnings test (et_{it}) and a set of control variables ($\mathbf{X}_{it}$) for three age groups, including those aged between 62 and NRA, those attaining NRA during the year, and those aged above NRA. A robust estimator of variance is used considering the possible presence of serial correlation and heteroskedasticity in the panel data.[33]

$$S_{it} = \alpha + \beta \cdot et_{it} + \theta' \mathbf{X}_{it} + e_{it} \qquad (17)$$

where β is the estimate of interest and implies the offset effect of Social Security wealth on private saving, and e_{it} is the error term. That is, if the beneficiary regards benefits withheld under the earnings test as a perfect substitute for private saving, then β would equal -1. A value of the parameter greater than minus one implies a less than complete displacement between private saving and Social Security wealth. All specifications control for a set of independent variables, including total household income, DRC rate, NRA, whether a couple household, head's age, education in years, retirement age, joint life expectancy, self-rated health status dummies (excellent, very good, good, poor) with those reported fair health as the base group, household size, number of kids, initial total net worth of assets and year dummies.

Saving Variable

There are three different ways to measure savings among individual households: (1) saving is the difference between disposable personal income and consumer expenditures; (2) saving is

[33] I test for serial correlation and heteroskedasticity after pooled OLS and panel-level model as suggested in Wooldridge (2002) page 176~178. The hypothesis of no first-order autocorrelation is not rejected, but the presence of heteroskedasticity is detected at 1% significant level.

computed as the algebraic sum of net new money put into assets plus net repayments of debt obligations; (3) saving is measured as the first difference in wealth between two time periods, adjusting for any capital gains or losses and net transfers into the household (Juster et al., 1999). In the following analysis, I adopt the second definition. I did not use the first definition because there is limited information on household consumption until the supplemental survey to the HRS, the Consumption and Activities Mail Survey (CAMS), which was conducted since 2001. After 2000, only workers under NRA are still subject to earnings test. It leaves us much smaller sample for analysis purpose. On the other hand, the HRS data provide detailed wealth information,[34] which is useful when successive waves of wealth modules are used to compute saving. However, one critical problem with the measure of saving as the first difference wealth is the difficulty to distinguish between active saving and passive saving (Juster et al., 2005; Alessie et al., 1999). The level of an asset changes for two reasons: either some of it is sold or purchased (active saving), or the price of asset changes (capital gains/losses or passive saving). Many components of wealth, in particular stocks and housing, increase or decrease over time due to these unforeseen changes. Given the biennial data and the significant market fluctuation during the study period, saving variable generated using this definition shows substantial noises. Thus, I did not use the third definition, either.

Starting year 1998 forward, respondents were asked about their "active saving since the previous survey" specifically to the components of wealth where capital gains are most relevant. In the following analysis, saving is defined as the annual net asset acquisition of liquid asset, such as IRA (or Keoghs), stocks, mutual fund, checking, savings or money market accounts, CD, bonds. Active saving in IRA or Keoghs and in equities for publicly traded corporations or mutual funds is the self-reported acquisition of assets less withdrawals in these accounts. Annual value of active saving in other liquid assets are defined as the changes in the self-reported value of the assets between waves after adjusting for time length between interviews, based on the assumption that capital gains in their assets are relatively small. Total saving is the sum of active saving in each component.

[34] When wealth variables are used to compute savings, the verdict on quality is more cautious, in part due to the inherently larger role measurement error plays in the first difference formulation. HRS's survey design tried to mitigate the bias due to missing data. Further discussion about the data quality of HRS could be found in Smith (1995) and Juster et al. (1999)

Benefit Withholdings Under the Earnings Test

The tax feature of earnings test includes the earnings threshold and benefit withholding rate. Before the abolition of earnings test in year 2000, the benefit reduction rate was $ 1 for every $3 of wage earnings above the earnings test threshold (an implicit tax rate of 33%) for individual at or above the normal retirement age and $1 for every $2 (an implicit tax rate of 50%) for those aged 62 to NRA. After year 2000, the test only applies to people aged below the NRA. Age also determines whether a beneficiary is subject to a high or low earnings threshold. Table 4-1 summarizes the earnings test rules embedded in Social Security. Depending on their ages and the calendar year after claiming, beneficiaries will face different rules especially for those aged at or above NRA. Individuals turning 62~(NRA-1) faced the same test rules before and after year 2000, except that the threshold amounts were gradually increased. Moreover, NRA was increased for those born in/after year 1938. More details of major Social Security policy changes ware explained in Section 3.2 and Table 3-1.

The benefit withholdings under the earnings test are calculated for each respondent during the study period, using the following formula.

$$et_k = \max\{\min(\tau_k[Y - E_k], B), 0\} \tag{18}$$

where k represents age during the study year and can be grouped into four categories, including 62~NRA-1, turning NRA during the year, NRA+1~69, and above 70. B is the entitled benefit amount after taking into account the actuarial adjustment factor based on claiming age but before applying the earnings test; τ_k is the withholding rate; Y is the wage earnings and E_k is the exempt amount shown in Table 4-2, et_k is the benefits withheld that the worker incurs at age k if he earns Y.

HRS provides information on claiming age, wage earnings, and Social Security retirement income received, which allows us to calculate the benefit withholding for each respondent. Few steps were followed to generate the benefit withholding amount. First, I calculate each respondent's potential benefit withholding, $\tau_k[Y - E_k]$, based on his/her wage income and earnings

test rule for the corresponding year and age. If his/her wage income (Y) is lower than the exempt amount, then the benefit withholding amount is set to zero. Second, the entitled benefit B is derived from the observed Social Security retirement income received in the later waves when the beneficiary is no longer subject to the earnings test, adjusted to the corresponding wave by cost-of-living-adjustment (COLAs).[35] Third, I use the Social Security retirement income received during the year to determine whether the benefits were completely withheld. If the wage income is higher than the exempt amount and the received retirement income is positive, it means that the benefits were not completely withheld under the earnings test and the benefit withholding equals the amount from the first step. On the other hand, if the received retirement income is zero with wage income higher than the exempt amount, it means the benefits were complete withheld, so benefit withholding equals the amount from the second step. It is also worth noting that a special monthly earnings test rule applies in the first year of entitlement because some people claim in mid-year may have earned more than their annual exempt amount. Therefore, the calculation of benefit withholding is adjusted for the first year of entitlement.

4.2.2 Data and Sample

I examine the equation (17) using the data from HRS 1998~2006. In HRS, respondents were asked about their incomes, savings and other flow variables (information over an interval of time) for the previous calendar year at interview, while the wealth measure is the asset value held at the time of interview. Therefore, the study period is from 1997 to 2005. The analysis sample consists of households aged between 62 and 69 who may be subject to earnings test during the study period. That is, after earnings test is eliminated in 2000, those aged above NRA are excluded from the sample. Households who have not yet claimed Social Security benefits are excluded. To focus on the relationship between private saving and Social Security retirement benefits, I further exclude households who have ever received Social Security Disability Insurance (SSDI) and

[35] A COLA is an automatic adjustment in benefits that occur annually. The purpose of the COLA is to ensure that the purchasing power of Social Security and Supplemental Security Income (SSI) benefits are not eroded by inflation. A COLA increases a person's Social Security retirement benefits by approximately the product of the COLA and the benefit amount. Examples of how COLA is applied to retirement benefit can be found at http://www.ssa.gov/oact/cola/colaapplic.html.

Social Security Income (SSI) in any wave, or reported eligible for disability benefits. Other exclusions include households who claimed Social Security benefits before age 62 because they are more likely to receive benefits for survivor and dependent of disabled or retired, and those with missing values in household saving. There are 1,889 year-household observations. These observations are referred to as the "analysis sample" throughout the following text. Table 4-3 summarizes its sample size by birth and calendar year. We can categorize the analysis sample into 3 groups: Group 1 consists of those who are turning ages 62~(NRA-1) and will be entitled to reduced Social Security benefits because of early claiming; Group 2 are for those who turn NRA during the year; and Group 3 is the relative older group who have attained ages NRA~69. Beneficiaries in Group 2 and 3 can entitle to full Social Security benefits if they have claimed after NRA and delayed retirement credit if there is any benefit withholding under the earnings test. The sample size decreases after year 2000 because of the removal of earnings test for those aged above NRA; however, as a result of gradual increase in NRA for those born in/after 1938, there will be more and more people subject to the earnings test as illustrated in an increasing size of group 2.

4.3 Results

4.3.1 Descriptive Analysis

Table 4-4 presents statistics for households aged 62~69 with non-missing active saving values during the study period. There are 4,179 year-household observations. The average saving is low and 45% of respondents are still working for pay with an average wage earnings of $15,626. When categorized by claiming status, I found that respondents who have claimed the Social Security retirement benefits have higher saving, lower wage earnings, household income, and non-pension wealth as compared to those who have not yet claimed. For those who have claimed, 35% of them are still working for pay with average wage earnings of $7,936 and approximately 14 years of education; 73% are married; 61% have male household heads; and the average age is 66.3 for household heads and 64.3 for their spouses. Households on average have 3.04 children. For those who yet to claim, the average age for household heads is 63.6 and 78% of them are still working for pay with more income and non-pension wealth. On average, their self-reported health status is better than those who have claimed.

Table 4-5 shows the statistics for those who have claimed Social Security retirement benefits by whether they are affected by the earnings test. There are 1,344 year-household observations for those who are not subject to the earnings test. This group consists of respondents aged above NRA after the earnings test removal in year 2000 and is excluded from the analysis sample. As a result, their benefit withholding is recorded as zero. On average, these beneficiaries have higher saving, wage earnings, household income, and non-pension net worth. 37% of them are still working for pay, which is higher than those who are still subject to the earnings test and may be indirect evidence of the influence of the earnings test on their labor supply. The summary statistics of the analysis sample are listed in the second column of Table 4-5 or Table 4-6. These households are subject to the earnings test, including those who earn less than exempt and do not have their benefits withheld by the earnings test.

Table 4-6 presents summary statistics of the analysis sample by age groups: below NRA (group 1), turning NRA (group 2), or above NRA (group 3). Most of the respondents are retired at the time of interview with only 34% of them still working for pay. Simply comparing group 1 of those aged below NRA and group 3 of those aged above NRA, I find that saving and earnings are decreasing as people aged while group 3 accumulated more non-pension wealth. Benefit withholdings is lower for group 3 because of lower wage earnings and less restrictive earnings test rule; however, the older group also faces a lower delayed retirement credit rate.

In order to show a complete picture of saving patterns during the study period, Table 4-7 presents descriptive statistics of household active saving by year and age for those who are 62~69 years old and have claimed retirement benefits (See Table 4-5). The trend of saving for younger and older age groups is also shown in Figure 4-1. Before year 2000, saving is increasing for those below and at/above NRA, though the older age group has lower average saving. Between year 1999 and 2001, saving decreases for the younger group while it keeps an upward trend for the older group. From year 2001 to 2005, the trends of saving show similar movement; however, the older groups are having higher saving than the younger group. One potential explanation results from the removal of the earnings test for those aged above NRA. If the older age group regards the earnings test as a forced saving, then the reduction of benefit withholdings is replaced by more voluntary (active) saving after year 2000, which indirectly supports the hypothesis that the

earnings test crowd out household saving; however, a more sophisticated model should be examined before any conclusion is drawn.

Table 4-8 provides descriptive statistics of household saving and benefit withholding under the earnings test of the analysis sample by socio-economic groups. Workers with college attainment or in better health status on average save more and have higher benefit withholding given higher wage earnings. The bottom table further presents the components of household saving by year. I group them into 3 categories, including IRA and Keoghs saving, stocks and mutual funds, and other liquid assets such as checking, savings or money market accounts, CD, and bonds. Figure 4-2 shows the trends of these saving components. There is a continuous dissaving for IRA and Keoghs accounts at old age. Saving in stocks and mutual funds remains positive and stable over years. There is an upward trend for saving in other liquid assets.

4.3.2 Empirical Findings

The estimation results are summarized in Table 4-9 and Table 4-10. Robust standard errors are presented in the parentheses. Table 4-9 shows the results of the effect of benefit withholding under the earnings test on household saving by age groups. The reported estimates are coefficients of benefit withholding under the earnings test, i.e. the parameter β, from saving equation (17) in Section 4.2.1 using OLS, random effects and fixed effects. The complete estimation of pooled OLS model with various set of control variables is presented in the appendix Table A.5.

The pooled OLS estimate for all groups is -1.04, which is significantly different from zero at the 1% level, but is insignificantly different from -1. It implies that beneficiaries who are subject to the earnings test regard it as a forced saving. Breaking the sample into two age groups gives a coefficient of -1.17 for group 1, significant at a 5% level, and a coefficient of -0.75 for group 2&3, but insignificantly different from zero. It indicates that beneficiaries aged between 62 and NRA-1 are more likely to regard benefit withholding under the earnings test as a forced saving instead of tax as compared to the age group aged at or above NRA. This is consistent with the findings in the literature that the actuarial adjustment factor appears to be actuarially fair for the age group below NRA even though they face the more strict earnings test rules (Gustman and

Steinmeier, 2004). Moreover, group 2&3 in the analysis sample has a relatively lower DRC rate. For example, the average DRC rate in Table 4-6 is 4.82 for those aged above NRA and is 6.56 for those aged below NRA. Older age groups' benefits reduced under the earnings test may not be completely compensated by the same increase in future benefits. Therefore, the earnings test is more like a tax to them even though the withholding rate has been reduced and earnings threshold has been increased. This finding indirectly supports the research that the abolition of earnings test above NRA will encourage work for the elderly if they regard teh earnings test as an implicit tax on labor.

The panel nature of the data allows us to exploit the random effects and fixed effects specifications. If there is a presence of unobserved effect, then the OLS estimates will suffer from an omitted variable bias problem. It will bias the estimate upward. In contrast, the random effects and fixed effects model provide a consistent estimator under certain assumptions. In Table 4-9, the estimates from the random effects model are similar to the ones from the pooled OLS model. The coefficient is -1.08 for all groups, significantly different from zero at a 1% level. It means that every dollar of benefits withheld under the earnings test would crowd out private saving by about a dollar. Workers on average perceive the earnings test as a kind of forced saving. Furthermore, the coefficient of -1.47 for group 1 is also significantly different from zero at a 1% level, while the coefficient for group 2&3 is -0.73 and insignificantly different from zero. The fixed effect estimates have the same sign and similar magnitude except for the older age groups, as shown in the bottom of Table 4-9. All of the FE estimates are insignificantly different from zero due to a large standard error. This is partly because of the sample selection criteria and data structure. In order to perform a fixed effects model, we need to observe at least 2 waves of data for each respondent; however, the observations are excluded once the earnings test is no longer applied to them. For example, those aged above NRA (potential group 3) after year 2000 are dropped from the analysis sample so the observations of group 3 are substantially decreased. As illustrated in Table 4-3, we also find that respondents born before 1929 and after 1941 are excluded because they only have one wave of observation available. As a result, the estimates for separate groups may be obscure, especially for the older age group. By comparing the results from the pooled

OLS, random effects, and fixed effects model, there is no strong evidence showing that uncontrolled individual heterogeneity biases the estimates.[36]

Earnings test rules are quite complicated. Low financial literacy or lack of information would affect people's labor, saving, retirement and claiming decisions. For example, Lusardi (2008) shows that people close to their retirement year are lack of planning and lack of wealth; half of the older workers know little about their pensions and the rules governing Social Security benefits; and financial illiteracy is widespread among the general population and particularly among some demographic groups, for instance, those with low education. Whether the earnings test is perceived as forced saving lies in the basic understanding of the transfer features. Table 4-10 presents the estimates of the effects of benefit withholding under the earnings test on household saving by educational attainment and group using the OLS, random effects, and fixed effects models. For workers with some college or more advanced education, there is a dollar for a dollar crowding out effect between benefit withholding and household saving. The offset effect is smaller and insignificant for those with lower educational attainment. For all sample, the pooled OLS estimates and random effect estimates are similar. The fixed effect estimates give the same sign and similar magnitude. When splitting the sample by age, the same conclusion prevails. Even for the older age group with higher education, the pooled OLS estimate is -1.49 and the random effect estimate is -1.45, significant at 10% level. These results support the findings in the literature that financial literacy plays a role in household saving decisions.

[36] In Table A.5, I control for parents' education as a proxy for intellectual quality (or heterogeneity) in model 3. The offset effect increases from -0.88 to -0.93.

Table 4-1: Summary of Earnings Test Rules

		Before year 2000	After year 2000
General rule		Benefit is reduced under the earnings test until all entitled benefit is exhausted.	
First year of entitlement		Monthly ET rules applies for months after claiming (Benefit withholding rate is based on age and calendar year as below)	
Age (k)	62~(NRA-1)	Benefit withholding is 50% of the wage above lower exempt amount	
	Turning NRA	• ET tax 50% of wage above lower exempt amount for months before birthday. • ET tax 33% of wage above higher exempt amount for months after attending NRA.	• ET tax 33% of wage above higher exempt amount for months before NRA.
	(NRA+1)~69 (months before turning 70)	ET tax 33% of wage above higher exempt amount	No ET
	>=70	No ET	No ET

Note: ET is short for earnings test.

Table 4-2: Earnings Test Exempt Amount

Year	Lower exempt	Higher exempt	
	62~NRA-1	NRA~69	Turning NRA
1991	7,080	9,720	
1992	7,440	10,200	
1993	7,680	10,560	
1994	8,040	11,160	
1995	8,160	11,280	
1996	8,280	12,500	
1997	8,640	13,500	
1998	9,120	14,500	
1999	9,600	15,500	
2000	10,080		17,000
2001	10,680		25,000
2002	11,280		30,000
2003	11,520		30,720
2004	11,640		31,080
2005	12,000		31,800
2006	12,480		33,240

Source: Social Security Administration.

Table 4-3: Sample Size, by Birth and Calendar Years

	Calendar Year					
	1997	1999	2001	2003	2005	
Birth Year	Before E.T. Removal		After E.T. Removal			
1927	21					
1928	34					
1929	20	63				
1930	34	81				
1931	97	89	0			
1932	95	95	0			
1933	68	83	0	0		
1934	72	91	0	0		
1935	35	55	0	0	0	
1936		57	104	0	0	Group 3
1937		44	71	0	0	
1938			57	81	0	
1939			38	68	43	Group 2
1940				56	87	
1941				37	54	
1942					35	Group 1
1943					24	

Year	1997	1999	2001	2003	2005	Total
Group 1	175	156	166	172	145	814
Group 2	95	91	104	70	98	458
Group 3	206	411	0	0	0	617
Total	476	658	270	242	243	1,889

Note: Group 1 turns ages 62 ~ (NRA-1); Group 2 turns age NRA during the year; and Group 3 is the older group who have attained ages NRA ~ 69. Earnings test is eliminated for those ages above NRA after year 2000.

Table 4-4: Summary Statistics for Those Aged 62-69, by Claiming Status

Variables	All respondents (age 62~69)		Have claimed SS		Have not yet claimed SS	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Saving	304	260,329	2,985	94,086	-8,861	518,886
DRC rate	6.01	0.88	5.86	0.82	6.50	0.88
Working for pay (=1 if yes)	0.45	0.50	0.35	0.48	0.78	0.41
Wage earnings	15,626	39,262	7,936	24,552	41,906	62,128
Household income	78,526	144,275	67,837	133,357	115,056	171,691
Total Non-pension Wealth	788,115	2,614,044	712,628	1,890,570	1,046,096	4,230,882
Household characteristics:						
Age (head)	65.7	2.5	66.3	2.3	63.6	1.9
Age (spouse)	63.5	6.6	64.3	6.3	60.5	6.7
Couple HH (=1 if yes)	0.73	0.44	0.73	0.44	0.73	0.44
Male HH head (=1 if yes)	0.62	0.48	0.61	0.49	0.66	0.47
Education (years)	13.98	2.36	13.79	2.33	14.63	2.35
Size of household	2.02	0.85	2.00	0.80	2.11	0.99
Number of kids	2.99	1.78	3.04	1.79	2.82	1.72
Health status (1~5, 1=Excellent; 5=Poor)	2.40	0.96	2.42	0.96	2.32	0.94
N	4,179		3,233		946	

Source: Health and Retirement Study 1998~2006.

Note: Saving, benefit withholdings, wage earnings, household income, and total non-pension wealth are converted to 2000 dollar using the BLS Consumer Price Index.

Table 4-5: Summary Statistics for Beneficiaries (aged 62-69), Whether Affected by the Earnings Test

Variables	Beneficiaries who have claimed SS (age 62~69)		Subject to Earnings Test		Not Subject to Earnings Test	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Saving	2,985	94,086	1,264	76,213	5,404	114,576
Benefit withholding	392	2,697	671	3,502	0	0
DRC rate	5.86	0.82	5.85	0.98	5.88	0.54
Working for pay (=1 if yes)	0.35	0.48	0.34	0.47	0.37	0.48
Wage earnings	7,936	24,552	6,645	21,100	9,750	28,620
Household income	67,837	133,357	64,024	74,673	73,197	186,842
Total Non-pension Wealth	712,628	1,890,570	608,961	1,077,544	858,333	2,633,056
Household characteristics:						
Age (head)	66.3	2.3	65.2	2.1	68.0	1.4
Age (spouse)	64.3	6.3	63.3	6.1	65.9	6.2
Couple HH (=1 if yes)	0.73	0.44	0.75	0.44	0.71	0.45
Male HH head (=1 if yes)	0.61	0.49	0.62	0.49	0.61	0.49
Education (years)	13.79	2.33	13.73	2.28	13.87	2.40
Size of household	2.00	0.80	2.04	0.87	1.94	0.70
Number of kids	3.04	1.79	3.05	1.81	3.01	1.77
Health status (1~5, 1=Excellent; 5=Poor)	2.42	0.96	2.41	0.97	2.43	0.95
N	3,233		1,889		1,344	

Source: Health and Retirement Study 1998~2006.

Note: Saving, benefit withholdings, wage earnings, household income, and total non-pension wealth are converted to 2000 dollar using the BLS Consumer Price Index.

Table 4-6: Summary Statistics of the Analysis Sample (Beneficiaries Who Are Subject To the Earnings Test), By Age Group

Variables	All (age 62~69)		Group 1: 62~NRA-1		Group 2: turning NRA		Group 3: NRA+1~69	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Saving	1,264	76,213	2,652	67,136	1,123	71,350	-463	89,840
Benefit withholding	671	3,502	905	3,904	457	2,443	520	3,592
DRC rate	5.85	0.98	6.56	0.70	5.98	0.71	4.82	0.41
Working for pay (=1 if yes)	0.34	0.47	0.34	0.47	0.39	0.49	0.30	0.46
Wage earnings	6,645	21,100	6,014	14,147	10,600	33,663	4,541	15,594
Household income	64,024	74,673	64,124	76,359	68,607	82,847	60,491	65,380
Total Non-pension Wealth	608,961	1,077,544	551,765	854,933	746,163	1,536,670	582,573	907,289
Household characteristics:								
Age (head)	65.2	2.1	63.3	0.9	65.1	0.3	67.7	1.4
Age (spouse)	63.3	6.1	61.6	6.0	63.1	5.7	65.6	5.8
Couple HH (=1 if yes)	0.75	0.44	0.75	0.43	0.72	0.45	0.76	0.43
Male HH head (=1 if yes)	0.62	0.49	0.60	0.49	0.63	0.48	0.63	0.48
Education (years)	13.73	2.28	13.64	2.14	13.92	2.28	13.70	2.46
Size of household	2.04	0.87	2.05	0.86	1.98	0.72	2.08	0.96
Number of kids	3.05	1.81	2.90	1.73	3.01	1.75	3.30	1.92
Health status (1~5, 1=Excellent; 5=Poor)	2.41	0.97	2.40	0.91	2.39	0.99	2.43	1.02
N	1,889		814		458		617	

Source: Health and Retirement Study 1998~2006.

Note: Sample includes those who have claimed Social Security retirement benefits and may be subject to earnings test. Saving, benefit withholdings, wage earnings, household income and total non-pension wealth are converted to 2000 dollar using the BLS Consumer Price Index.

Table 4-7: Summary Statistics of Household Saving for Beneficiaries Aged 62-69, by Age Group and Year

Year		Group 1 (62~NRA-1)	Group 2&3 (NRA~69)	All Groups
1997	**Mean**	**1,556**	**-2,640**	**-1,097**
	S.D.	38,765	103,586	85,624
	N	175	301	476
1999	**Mean**	**3,795**	**1,030**	**1,685**
	S.D.	82,478	71,616	74,279
	N	156	502	658
2001	**Mean**	**1,298**	**4,321**	**3,654**
	S.D.	65,501	66,920	66,578
	N	166	586	752
2003	**Mean**	**4,251**	**5,839**	**5,449**
	S.D.	82,068	157,416	142,563
	N	172	527	699
2005	**Mean**	**2,401**	**4,294**	**3,870**
	S.D.	58,199	83,326	78,369
	N	145	503	648
Total	**Mean**	**2,652**	**3,097**	**2,985**
	S.D.	67,136	101,571	94,086
	N	814	2,419	3,233

Note: Sample includes those who have claimed Social Security retirement benefits. Household saving is converted to 2000 dollar using the BLS Consumer Price Index.

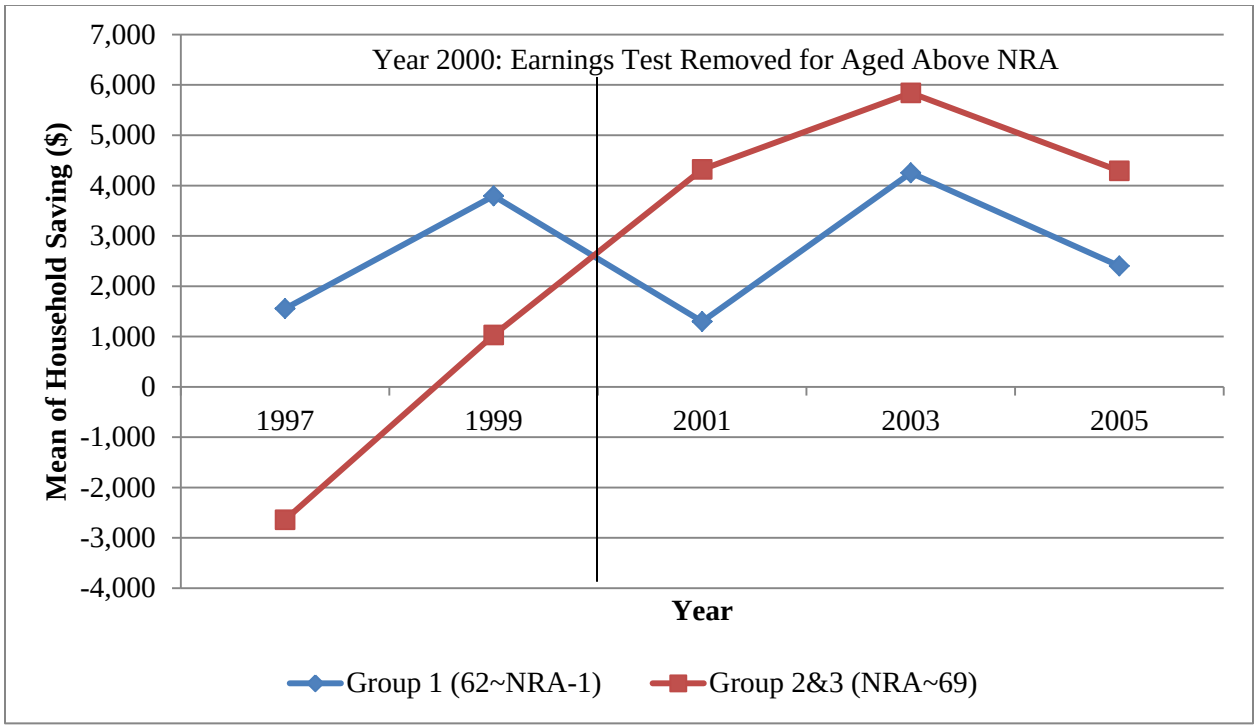

Figure 4-1: Mean of Household Saving for Beneficiaries Aged 62-69, Year 1997-2005

Table 4-8: Household Saving and Benefit Withholding under the Earnings Test of the Analysis Sample by Socio-Economic Group, Year 1997-2005

Variable	Educational Attainment			
	College and Above (N=1087)		No College (N=802)	
	Mean	S.D.	Mean	S.D.
Saving	2,240	93,587	-59	42,576
Benefit Withholding under the E.T.	843	4,296	437	1,945

Variable	Health Status			
	Excellent/Very Good/Good (N=1644)		Fair/Poor (N=245)	
	Mean	S.D.	Mean	S.D.
Saving	1,417	75,876	241	78,590
Benefit Withholding under the E.T.	701	3,633	470	2,436

Components of Household (Active) Saving

Year		Total Active Saving	IRA (or Keoghs)	Stocks/Mutual Funds	Other Liquid Assets
1997	**Mean**	**-1,097**	**-1,069**	**899**	**-927**
	S.D.	85,624	16,081	13,236	83,375
	(N=476)				
1999	**Mean**	**1,685**	**-2,827**	**1,248**	**3,264**
	S.D.	74,279	18,623	17,774	69,926
	(N=658)				
2001	**Mean**	**821**	**-3,465**	**455**	**3,831**
	S.D.	54,659	18,844	21,662	45,025
	(N=270)				
2003	**Mean**	**2,601**	**-1,774**	**1,716**	**2,659**
	S.D.	95,874	15,655	15,781	92,226
	(N=242)				
2005	**Mean**	**3,911**	**-2,148**	**1,161**	**4,898**
	S.D.	58,743	16,929	11,330	54,086
	(N=243)				
Total	Mean	1,264	-2,253	1,096	2,422
	S.D.	76,213	17,466	16,408	72,140
	(N=1889)				

Note: Active saving is defined as the net asset acquisition of liquid asset, such as IRA (or Keoghs), stocks, mutual fund, checking, savings or money market accounts, CD, bonds, per year. All values are converted to 2000 dollar using the BLS Consumer Price Index.

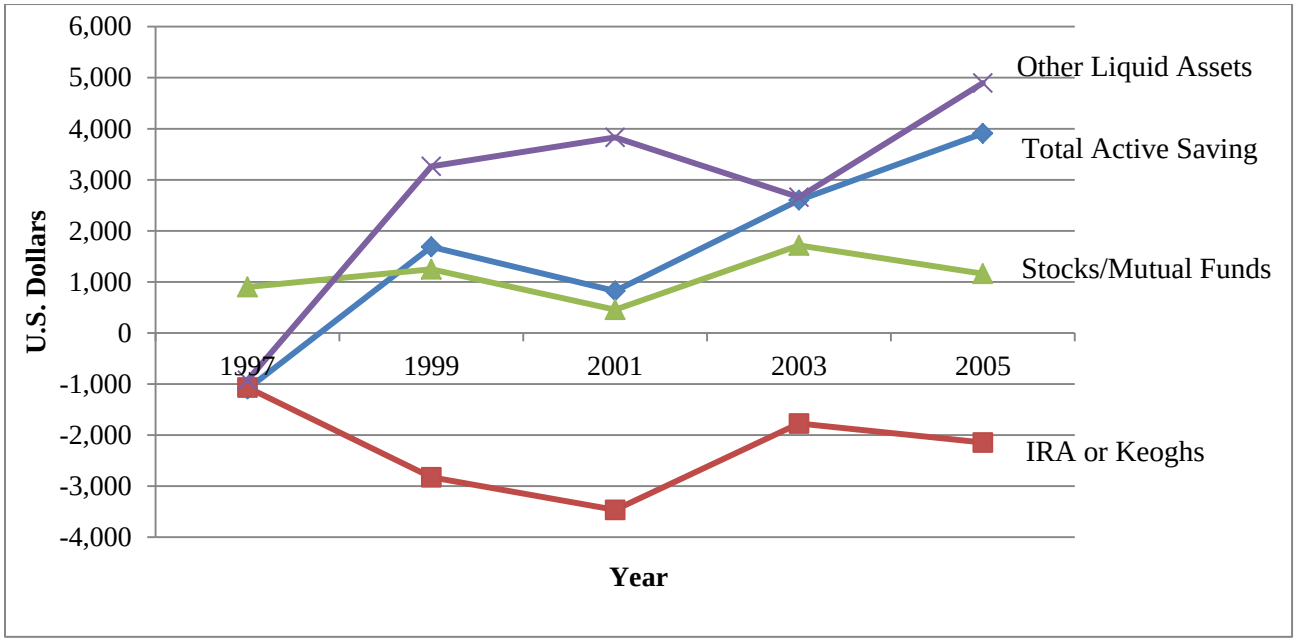

Figure 4-2: Components of Household Saving (Mean), Year 1997-2005

Table 4-9: Regression Estimates of the Effect of Benefit withholding Under the Earnings Test on Household Saving, by Age Group

	Pooled OLS		
	All groups (62~69)	Group 1 (62~NRA-1)	Group 2&3 (NRA~69)
Explanatory variable: Benefit withholding under ET	**-1.04***** (0.37)	**-1.17**** (0.47)	**-0.75** (0.53)
R-squared	0.0305	0.0678	0.0553
N	1826	784	1042

	RE		
	All groups (62~69)	Group 1 (62~NRA-1)	Group 2&3 (NRA~69)
Explanatory variable: Benefit withholding under ET	**-1.08***** (0.38)	**-1.47***** (0.44)	**-0.73** (0.56)
R-squared (within)	0.046	0.001	0.095
R-squared (between)	0.030	0.078	0.043
R-squared (overall)	0.0304	0.064	0.0552
N	1826	784	1042

	FE		
	All groups (62~69)	Group 1 (62~NRA-1)	Group 2&3 (NRA~69)
Explanatory variable: Benefit withholding under ET	**-0.80** (1.00)	**-1.28** (0.83)	**1.82** (1.99)
R-squared (within)	0.081	0.177	0.274
R-squared (between)	0.001	0.001	0.000
R-squared (overall)	0.008	0.0016	0.0083
N	1826	784	1042

Note: The dependent variable is the household active saving defined in the text. *, **, *** denote the estimates differ from zero at the 10%, 5%, 1% significance level, respectively. All specifications control for a set of independent variables, including total household income, DRC rate, NRA, whether a couple household, head's age, education in years, retirement age, joint life expectancy, self-rated health status dummies (excellent, very good, good, poor) with those reported fair health as the base group, household size, number of kids, and year dummies. Robust standard errors are presented in the parentheses.

Table 4-10: Regression Estimates of the Effect of Benefit withholding Under the Earnings Test on Household Saving, by Educational attainment

	Pooled OLS					
	All groups (62~69)		Group 1 (62~NRA-1)		Group 2&3 (NRA~69)	
	College and above	No college	College and above	No college	College and above	No college
Explanatory variable: Benefit withholding under ET	**-1.38*** ** (0.47)	**-0.38** (0.44)	**-1.05*** (0.59)	**0.00** (0.53)	**-1.49*** (0.76)	**-1.06** (0.82)
R-squared	0.0568	0.0363	0.1099	0.0547	0.1218	0.084
N	1053	773	433	351	620	422

	RE					
	All groups (62~69)		Group 1 (62~NRA-1)		Group 2&3 (NRA~69)	
	College and above	No college	College and above	No college	College and above	No college
Explanatory variable: Benefit withholding under ET	**-1.42*** ** (0.50)	**-0.41** (0.43)	**-1.5*** ** (0.52)	**-0.11** (0.54)	**-1.45*** (0.81)	**-1.24** (0.78)
R-squared (within)	0.120	0.012	0.013	0.002	0.279	0.060
R-squared (between)	0.037	0.042	0.129	0.064	0.088	0.079
R-squared (over all)	0.0565	0.0363	0.1005	0.0543	0.1216	0.0838
N	1053	773	433	351	620	422

	FE	
	All groups (62~69)	
	College and above	No college
Explanatory variable: Benefit withholding under ET	**-1.06** (1.24)	**-0.71** (1.20)
R-squared (within)	0.179	0.051
R-squared (between)	0.001	0.006
R-squared (over all)	0.0251	0.0101
N	1053	773

Note: see Table 4-9.

Chapter 5 Conclusion

Pension literature has long suggested that higher pension and Social Security benefits crowd out other sources of household wealth accumulation; however, the inconclusive results from the theoretical and empirical viewpoints motivate my dissertation to re-examine the relationship between pensions and household saving in the form of wealth accumulation or active saving, using a better data set and a variety of empirical specifications.

With detailed information from the Health and Retirement Study, I find a negative relationship between pooled pension wealth, namely the sum of private pension and Social Security wealth, and non-pension net worth. A cross-sectional analysis on HRS 1992 suggests an offset effect of -0.27, which is statistically significantly different from zero and -1. This finding is in line with some previous papers that households accumulate fewer non-pension net worth in response to higher future promised Social Security and pension benefits, but it is not a complete offset. In contrast to prior research in the literature, I regress non-pension net worth on separate pension variables, including DB, DC, and Social Security wealth variables, allowing each pension plan to have different impacts on wealth accumulation. I find that an additional dollar of DB pension wealth crowds out non-pension net worth by 41 cents while DC pension and Social Security show little or no offset effect on private saving. I also demonstrate the importance to correct the systematic biases suggested in Gale (1998); however, the offset effects I find in this paper are not as substantial as the ones in his study. This difference may result from the data set used and the extent that proxy variables in his paper fail to adequately account for lifetime earnings. Gale uses data from the 1983 Survey of Consumer Finances. Since the early 80's, there has been a shift away from defined benefit pension plans in the private sector. Given that we find larger DB offsets in this paper, the greater importance of DB pension in his sample may account for some of the differences. Furthermore, I try two alternative dependent variables by adding DC pension wealth into total net worth and non-housing net worth, respectively. The adjusted R-squared statistics increase in both models. The estimates show that pooled pension wealth (sum of DB and Social Security wealth) significantly crowds out marketable wealth accumulation by 37

percent. Using separate pension variables in the regressions, DB pension shows substantial offset effect of 42 percent on marketable wealth while Social Security still shows no offset effect.

From the cross-sectional results, I consistently find no offset effect between Social Security and private wealth accumulation while DB pension shows a significant crowding out effect. Several econometric issues need to be addressed before we can conclude there is no offset effect for Social Security. For example, functional form misspecification and heterogeneity in saving preference may create an omitted variables bias problem. Measurement error in pension variables will also bias the estimates toward zero. These estimation problems are more severe in the estimate of Social Security in the cross-sectional analyses due to a lack of variation in Social Security wealth. These estimation problems apply to all previous studies of pensions and saving in U.S., and are rarely controlled for except by Engelhardt and Kumar (2011). Recent approaches tend to correct these estimation problems by incorporating instrumental variables, or using either panel data or several cross sections of data spanning a period of time encompassing a policy reform.

In Chapter 3, I examine a panel specification of the wealth equation incorporating the expectation of Social Security reforms and an actuarially unfair earnings test rule for those aged above NRA. These changes can introduce independent variation in Social Security wealth over time across cohorts. Some groups experience larger SSW changes than do others depending on age and calendar year. Using data from HRS 1992, 1998, and 2004, I present results from the pooled OLS, random effects model, and fixed effects model. The fixed effect estimates suggest a statistically significant full offset effect of pooled pension wealth and private pension wealth on household wealth accumulation, but an insignificant crowd-out effect of Social Security wealth. Pooled OLS and random effect estimates show similar findings but with lower offset effects. Compared to what has been found in the relatively recent literature, my estimates are similar to those by Gale (1998), and Engelhardt and Kumar (2011), who found substantial crowding-out effects after correcting the age-related bias and estimation bias. In conclusion, incorporating the panel structure of HRS and the policy reforms could shed light on future pension and saving research beyond what can be obtained from cross-sectional analysis. However, we can not conclude whether the insignificant estimates of Social Security wealth variable implies no offset effect on private wealth accumulation or insufficient variation in Social Security wealth to identify the true impact.

In order to identify the relationship between Social Security and private saving I examine the effects of benefit withholdings under the earnings test on household active saving for those beneficiaries aged between 62 and 70 using data from HRS 1998~2006. Entitled retirement benefits may be reduced when workers earn above a threshold. Even though the lost benefits will be compensated for with a higher benefit level in the future, the benefit withholdings under the earnings test may be perceived as a reduction in Social Security wealth if workers regard the compensation to be actuarially unfair. If the beneficiary regards benefit withholding under the earnings test as a perfect substitute for private saving, the coefficient of benefit withholding will be equal to -1. A value of the parameter greater than minus one implies a less than complete displacement between private saving and Social Security wealth. The results from Chapter 4 show a full offset effect between household saving and benefit withholding under the earnings test for those aged between 62 and normal retirement age (NRA). The younger cohort is more likely to regard benefit withholdings under the earnings test as a kind of forced saving instead of a tax as compared to the older age groups aged above NRA. Moreover, the findings also suggest a full offset effect for those with some college or more advanced educational attainment.

My findings in this research suggest a few policy implications and opportunities for future research. First, there is an offset effect of employer-provided pension on private wealth accumulation. It implies that policies targeted to raise private pension wealth will decrease household wealth accumulation. In contrast, no significant offset effect is found for Social Security wealth. It could mean an insufficient variation in the data so an identification method other than wealth equation should be employed; or it shows no crowding-out effect of Social Security so policies targeted to increase social security wealth will raise overall household wealth for retirement. This is still a pending question for future research using U.S. data sets.

Second, I found a full offset effect of Social Security benefit withholding under the earnings test on household saving for those aged below NRA, which implies they perceived earnings test as forced saving taking into account both tax and sequential transfer features embedded in the Social Security rules. It indirectly suggests that earnings test would not affect workers aged below NRA to change their labor, retirement and other behavior. In addition, my findings also support the importance of financial literacy in retirement and saving planning.

Lastly, to the best of my knowledge, it is somewhat surprising that no empirical evidence exists on how the removal of earnings test in year 2000 for those aged above NRA impacts the saving behaviors of the elderly in the United States. Given the quasi-natural experiment in year 2000 (exogenous policy change), future research can test the hypothesis whether the earnings test is perceived as an implicit tax or a deferral by examining the changes in saving behavior of the beneficiaries before and after the abolition using a reduced-form difference-in-difference approach. If the elderly persons treat the retirement earnings test as a "deferral", their saving before the abolition of earnings test would be crowed out dollar by dollar. As a result, those aged above NRA are expected to ***increase*** their private saving when the earnings test has been taken away. However, if there is no effect on the policy variable, then those aged above NRA may perceive the earnings test as an implicit tax. This approach can exploit an added source of identification—and an alternative way to control for unobservable influence, which is comparable to the study in Chapter 4.

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Appendix A: Construction of Variables in Chapter 2

1. (Expected) Retirement Age

Data source: pension data set of "Imputations for Pension Wealth" (version 2.0) and the RAND HRS section I: Retirement Plans, Expectations.

- In the pension data set, there is a variable of expected retirement age available for year 1992 and 1998, respectively. For those respondents with missing values, the retirement ages are obtained from the retirement year indicators: the self-report retirement year if says retired or imputed from the self-report planned retirement year.

- For respondent who reported they would never stop working or who were partially retired and have intention to reenter the job market, if the respondent is not retired and the expected retirement age is not available, even from the later waves, then some assumptions are applied: the normal retirement age (NRA) is assumed as expected retirement age for respondents who had not reached NRA in year 1992; for respondent whose age is between NRA and 72 in year 1992, the expected retirement age is 72; for people who were older than 72 in year 1992, they are assumed to stop working in year 1992.

2. Lifetime Earnings Profile

Data source: employment section of 1992~2006 core survey. A respondent is asked about the current job in every wave. If the respondent is not working, information about the last job is collected. Whether working or not, additional past jobs are asked retrospectively at his/her first interview (HRS cohort in 1992, WB cohort in 1998, and EBB cohort in 2004). Moreover, a set of questions in wave 3 (year 1996) is inquired about the first full time job.

- Earnings observation:

Earnings observations for the HRS cohort mainly come from the first wave employment section (F: current job; G: last job; H: prior jobs). Up to 8 different values can be obtained for each respondent. If the respondent is working at the interview, earnings of the current job in the last calendar year and the starting pay of the current job will be asked. In addition, if they are included in a pension plan, the expected pay at the earliest time eligible for full pension benefit is recorded in the pension part of current job employment section. If the respondent is not currently working, the starting pay and the pay when left the last job are asked. Moreover, whether the respondent is working or retired, the earnings at the end of three additional previous jobs lasting five or more years are recorded as well.

Adopting the same method in Khitatrakun et al. (2000), earnings observed in the subsequent waves are used only when the jobs in respective waves are the respondent's wave 1 job. Observations are offered in the current job section if he continues the wave 1 job or in the last job section if he retires from the wave job. Similar to wave 1, extra expected earnings value can be found in the pension part of current job section.

- Working period:

Retirement status and job history will be used to determine a respondent's lifetime working period, which is defined as the ending year of the latest job minus the beginning year of the earliest full-time job. In the wave 1 survey, start and stop year of the last job (if retired) and additional past jobs are recorded. If the respondent is working, the start year of current job is asked, and the stop year depends on the respondent's expected retirement age, assuming working on the current job until then. In addition, respondents are asked about the beginning year of the earliest job worked six months or greater in the wave 3 survey. Some reference variables from the RAND HRS are used as a cross reference to determine the length, such as status of job history, number of jobs reported, total years worked from self report, years of tenure on current job, years of tenure at longest reported tenure, month and year last job ended. At last, a lower limit for start year (respondent's school years plus 6) is imposed to rule out unreasonable low value.

- Specification:

Earning observations are deflated to 1992 dollars by the Consumer Price Index (CPI) and a panel data of real wage is formed. Adopting the same specification in Khitatrakun et al. (2000), separate age-earnings profiles were estimated by sex and education, that is, 4 mutually exclusive groups: non-college female, non-college male, college female, and college male. Selected observations are used to perform 4 fixed effect regressions, $\ln(y_{it}) = \beta_0 + \beta_1 Age_{it} + \beta_2 Age_{it}^2 + f_i + e_{it}$, where y_{it} is the real wage of individual *i* at age *t*., f_i is an individual fixed effect and e_{it} is the error term. With the gender-education group coefficients and individual fixed effects, a real earnings profile is calculated for each respondent. Then the income profiles are discounted according to the formula in text to construct lifetime earnings variables, using the real interest rate.

3. Social Security Wealth

Data source: HRS "Prospective Social Security Wealth Measures of Pre-retirees" (version 3.1).

- HRS utilizes information from HRS respondents who authorized the University of Michigan's Institute for Social Research to obtain administrative records from the Social Security Administration to calculate and impute Social Security (SS) wealth to respondents

in the 1992, 1998, and 2004 waves of the study. The *Prospective Social Security Wealth Measures of Pre-Retirees* data set consists of respondent-level, cross-sectional files constructed from the employment sections of the HRS 1992 (wave 1), HRS 1998 (wave 4), HRS 2004 (wave 7) and the restricted SSA summary and detailed earnings and benefits files. In this public use file, imputed Social Security wealth is available only for individuals who have not yet retired (as evidenced by claiming SS benefits). The data is organized to match the RAND HRS data files.

- Three types of Social Security benefits are generated in this data set, including respondent's own retirement insurance benefits (based on his own lifetime earnings), incremental auxiliary spouse benefits (based on the spouse's lifetime earnings), and the incremental survival benefits (based on the deceased insured worker's lifetime earnings). The present value of the stream of Social Security retirement insurance benefits are generated for each claim date using the survival probabilities and interest rates from the SSA life tables (by year of birth and sex) and the SSA Trustee Reports, respectively. Values are then adjusted to the wave dollars.

- Each wave, in addition to any adjustments made for early or late claiming, they weight the three types of Social Security benefits by the appropriate survival probabilities. Note that incremental auxiliary spouse and survivor wealth are zero for the higher earner (by definition). Individual's Social Security wealth is defined as

$$SSwealth_i = PIA_i \sum_{t=0}^{T} P_{it}(1+r)^{-t} +$$
$$\max(0.5PIA_j - PIA_i, 0) \sum_{t=0}^{T} P_{it}P_{jt}(1+r)^{-t} +$$
$$\max(PIA_j - PIA_i, 0) \sum_{t=0}^{T} P_{it}(1-P_{jt})(1+r)^{-t}$$

- The total household wealth is defined as $HH\ SSwealth_{ij} = SSwealth_i + SSwealth_j$

4. Employer-Provided Pension Wealth

Data source: pension data set of "Imputations for Pension Wealth" (version 2.0), the RAND HRS section F: Pension, and the employment section of core survey from year 1992 to 2006.

- The public released pension information is available only for the current jobs based on both the self-reported and the employer-provided summary plan descriptions (SPDs) data. Using

information on year of participation, expected date and amount of initial benefits for pensions, and data on interest rates, survivor benefits, and mortality probabilities, they calculate each worker's pension wealth for their current jobs.

- Pension wealth for the current job in year 1992

  - DB pension: In the data, the imputed DB pension variable (DBXP_92X) represents the present discounted value of future DB benefits as of expected retirement age, assuming the person works up to that target age. This means that the value include future accruals after 1992. In order to generate the DB pension wealth variable for regression purpose, the value of DBXP_92X is discounted to year 1992 by a nominal interest rate of 6.3% for respondent who is not retired. If the respondent is retired, then the value of PVXP_92 is used.

  - DC pension: The DC values are those reported by respondents with a DC and/or combination plans in the survey year, based on the self-reported data. The DC amounts are account balances as of 1992 and do not include future contribution. Therefore, future accruals are calculated from the time of interview to the expected age to receive benefit (or expected retirement age), and discounted to 1992 to be added to the DC balances available, using the information on contribution rate (a percentage of earnings) from the employment section of core survey. During the interview, the HRS asked how much the respondent contributed to the plan and how much their employers contributed to the account. If the rate is missing, then information from following waves is used; otherwise, I assume the respondents and their employers contribute the same rate of 5%.

Appendix B: Tables

Table A.1: Effect of Pooled Pension Wealth on Non-pension Wealth: HRS 1992

Dependent variable: Total household net worth (excluding the secondary residence)

	Coefficient		Robust Std. Err.
(Adjusted) Household earnings to date	0.26		0.17
(Adjusted) Household future earnings	-0.11		0.14
(Adjusted) Pension wealth	**-0.27**	*	0.15
Couple household (yes:1)	-100,689	**	42,841
Female head household	-12,906		21,957
Head's age	-95,139		102,072
Head's age square	903		895
Education in years	-1,685		5,733
White	29,648		25,594
Hispanic	-31,304		22,953
Household size	10,844		7,799
Number of children	395		5,129
Household current year earnings	5	***	1.35
Self-employed (yes: 1)	238,956	***	38,732
Expected retirement horizon	-941		1,235
Whether have IRA wealth (yes:1)	73,450	***	20,546
Financial planning horizon: Next year (yes:1)	26,854		45,055
Financial planning horizon: Next few years (yes:1)	41,964	*	23,755
Financial planning horizon: 5-10 years (yes:1)	36,695		28,209
Financial planning horizon: >10 years (yes:1)	-3,680		37,224
Will leave sizable bequest (yes:1)	85,448	***	18,218
Constant	2,370,543		2,910,065

Note: *, **, *** denote the significance level at the 10%, 5%, 1%, respectively. The pooled pension wealth variable is the sum of the present values of defined benefit (DB) pension benefit, defined contribution (DC) pension benefit, and Social Security retirement benefits as of expected retirement age, and then discounted to year 1992. The lifetime earnings and pension variable are adjusted by the adjustment factor, defined in text.

Table A.2: Effects of DB, DC, and Social Security Pension Wealth on Non-pension Wealth: HRS1992

Dependent variable: Total household net worth (excluding the secondary residence)

	Coefficient		Robust Std. Err.
(Adjusted) Household earnings to date	0.30	*	0.18
(Adjusted) Household future earnings	-0.14		0.15
(Adjusted) DB pension wealth	**-0.41**	**	0.17
(Adjusted) DC pension wealth	**-0.17**		0.14
(Adjusted) Social Security pension wealth	**0.04**		0.32
Couple household (yes:1)	-116,123	***	43,569
Female head household	-12,527		21,885
Head's age	-84,732		98,643
Head's age square	801		861
Education in years	-771		5,588
White	26,152		26,024
Hispanic	-28,444		22,921
Household size	11,568		7,991
Any resident children (yes:1)	239		5,116
Any resident children × number of resident children	5		1.34
Household current year earnings	236,359	***	38,651
Self employed (yes: 1)	-837	***	1,228
Expected retirement horizon	72,091		20,548
Whether have IRA wealth (yes:1)	30,807	***	45,376
Financial planning horizon: Next year (yes:1)	41,776		23,937
Financial planning horizon: Next few years (yes:1)	35,509	*	27,854
Financial planning horizon: 5-10 years (yes:1)	-3,353		37,512
Financial planning horizon: >10 years (yes:1)	83,662		18,246
Will leave sizable bequest (yes:1)	2,082,973	***	2,818,001
Constant	0.30		0.18

Note: *, **, *** denote the significance level at the 10%, 5%, 1%, respectively. In this table, I regress the non-pension total net worth on three separated adjusted pension wealth variables as compared to the adjusted pooled pension wealth variable in Table A.1. Each pension wealth variable is defined as the present values of expected retirement benefit from respective plan, and then discounted to year 1992. The lifetime earnings and pension variable are adjusted by the adjustment factor, defined in text.

Table A.3: Effect of Pooled Pension Wealth on Non-pension Wealth: Fixed Effect Estimates

Dependent variable: Non-housing Net Worth

	Coefficient		Robust Std. Err.
(Adjusted) Household earnings to date	-1.20	*	0.69
(Adjusted) Household future earnings	-1.12	***	0.31
(Adjusted) Pension wealth	**-1.06**	***	0.30
Head's age	126,048		162,989
Head's age square	-1,088		1,417
Household size	-17,199		24,263
Number of children	-36,095		57,047
Household current year earnings	4	***	1.44
Expected retirement horizon	-4,550		7,660
Whether have IRA wealth (yes:1)	66,471		77,504
Financial planning horizon: Next year (yes:1)	31,219		106,931
Financial planning horizon: Next few years (yes:1)	90,837		106,607
Financial planning horizon: 5-10 years (yes:1)	-24,417		76,123
Financial planning horizon: >10 years (yes:1)	224,523	*	117,821
Will leave sizable bequest (yes:1)	65,606		78,864
Year dummy: 1998	72,384		86,964
Constant	-2,778,652		4,665,764

Note: See Table 3-3. *, **, *** denote the significance level at the 10%, 5%, 1%, respectively.

Table A.4: Effects of DB, DC, and Social Security Pension Wealth on Non-pension Wealth: Fixed Effect Estimates

Dependent variable: Non-housing Net Worth

	Coefficient		Robust Std. Err.
(Adjusted) Household earnings to date	-1.37	*	0.75
(Adjusted) Household future earnings	-1.12	***	0.36
(Adjusted) DB pension wealth	**-1.38**	**	0.65
(Adjusted) DC pension wealth	**-0.96**	***	0.26
(Adjusted) Social Security pension wealth	**-0.87**		1.13
Head's age	169,370		186,609
Head's age square	-1,482		1,653
Household size	-24,643		32,129
Number of children	-37,183		58,345
Household current year earnings	4	***	1.53
Expected retirement horizon	-3,860		6,805
Whether have IRA wealth (yes:1)	84,411		83,380
Financial planning horizon: Next year (yes:1)	34,972		104,106
Financial planning horizon: Next few years (yes:1)	79,602		101,748
Financial planning horizon: 5-10 years (yes:1)	-17,318		77,299
Financial planning horizon: >10 years (yes:1)	200,555	**	101,686
Will leave sizable bequest (yes:1)	77,006		84,287
Year dummy: 1998	65913.24		89144.97
Constant	-3,931,439		5,190,898

Note: See Table 3-3. *, **, *** denote the significance level at 10%, 5%, 1%, respectively.

Table A.5: Pooled OLS Regression Estimates of Benefit Withholding Under the Earnings Test on Household Saving, Various Specifications

Variable	Model_1	Model_2	Model_3	Model_4
Benefit withholding	-0.9**	-0.88**	-0.93**	-1.04***
	(0.42)	(0.42)	(0.45)	(0.37)
Household income	0.13***	0.13***	0.14**	0.15***
	(0.05)	(0.05)	(0.06)	(0.05)
DRC rate	6,477	6,214	5,000	4,374
	(13,954)	(14,128)	(14,676)	(14,468)
NRA	10,760	10,769	9,891	10,832
	(19,007)	(19,058)	(19,926)	(19,127)
Couple	-5,184	-5,279	-5,279	-3,383
	(5,689)	(5,686)	(5,923)	(5,679)
Age	533	532	-14	47
	(3,542)	(3,567)	(3,669)	(3,643)
Education	99	208	150	313
	(846)	(862)	(889)	(845)
Retirement Age	304	320	309	371
	(289)	(288)	(308)	(277)
Life expectancy	-437	-426	-463	-490
	(558)	(557)	(603)	(528)
Household size	1,365	1,300	1,096	1,003
	(2,073)	(2,056)	(2,269)	(2,009)
Number of kids	-2,537	-2,502	-2,704	-2,587
	(1,613)	(1,595)	(1,768)	(1,632)
Year 1999	-742	-212	1,197	951
	(8,851)	(9,030)	(9,515)	(9,455)
Year 2001	-6,780	-6,301	-4,648	-3,913
	(15,371)	(15,566)	(16,224)	(16,385)
Year 2003	-13,744	-13,308	-11,024	-9,977
	(24,742)	(25,149)	(25,779)	(25,714)
Year 2005	-21,503	-20,936	-18,313	-17,213
	(30,034)	(30,302)	(31,220)	(31,313)
Health: Excellent		-9,156	-9,442	-7,665
		(8,139)	(9,111)	(7,576)
Health: Very good		-209	-400	112
		(6,390)	(7,178)	(6,319)
Health: Good		1,847	1,672	2,116
		(6,148)	(6,985)	(6,154)
Health: Poor		-5,766	-5,068	-5,225
		(15,347)	(15,881)	(15,287)
Mother's education			1,541	
			(990)	
Father's education			-1,190	
			(761)	
Initial household net worth				-0.01
				(0.01)
Constant	-7.75E+05	-7.76E+05	-6.79E+05	-7.42E+05
	(1.25E+06)	(1.25E+06)	(1.30E+06)	(1.26E+06)
Adj. R-squared	0.015	0.0154	0.0159	0.0197
N	1826	1826	1687	1826

Note: *, **, *** denote the significance level at the 10%, 5%, 1%, respectively. Robust standard errors are presented in the parentheses.

VITA

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