Financing Retirement Consumption and Bequests

by

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Abstract

This dissertation consists of three essays that evaluate possible vehicles for financing either retirement consumption or bequests. Chapter 1 compares the use of Roth and tax-deferred retirement accounts for retirement consumption with the use of taxable accounts. Previously, economists have often assumed that retirement savings should be done in a tax-deferred account. However, the advent of Roth-style tax-favored accounts and concerns about the tax implications of increasing retirement income through distributions from tax-deferred accounts warrant revisiting this question. I use data on married couples in the HRS and NBER's TAXSIM model to measure the probability of a household facing a higher tax rate at ages 62, 65, and 69 than the household faced at age 57. When the marginal tax rate is higher, the household could decrease their lifetime tax burden by choosing a Roth-style account over a tax-deferred account. I also measure the probability of facing a marginal tax rate that is sufficiently high that the household minimizes tax payments by using a taxable account rather than a tax-deferred account, when a Roth option is not available. I find that for distributions beginning at age 69, between 10 and 35% of households with taxable income at age 57 should prefer a Roth account to a tax-deferred account, but very few households prefer a taxable account.

Chapter 2 models the tax-savings available through the use of tax-favored retirement accounts for bequests. Past research on tax-favored retirement accounts has focused on the incentives and effects of these accounts within the framework of the life-cycle model. However, tax-favored accounts also offer substantial tax savings for bequeathed assets. This chapter examines the incentives tax-favored accounts provide for bequests and simulates models of the available tax savings. The benchmark model calculates that the tax savings associated with a tax-deferred account (TDA) that is used to optimally bequeath assets exceeds the tax savings of a TDA used to produce a steady stream of retirement income by by 27.2%. Use of a Roth account for a bequest increases tax savings by an additional 32% over a bequeathed TDA.

Chapter 3, joint work with Hui Shan, considers reverse mortgages as a method of financing retirement consumption. Housing wealth is the most important non-pension wealth component for many elderly homeowners in the United States. Reverse mortgages allow elderly homeowners to consume housing wealth without having to sell or move out of their homes. Though the U.S. reverse mortgage market has grown substantially, very few eligible homeowners use reverse mortgages to achieve consumption smoothing. This chapter examines all Home Equity Conversion Mortgage (HECM) loans originated between 1989 and 2007 and insured by the Federal Housing Administration (FHA). It shows how characteristics of HECM loans and HECM borrowers have evolved over time, compares borrowers with non-borrowers, and analyzes loan outcomes using a hazard model. In addition, it conducts numerical simulations of HECM loans originated in 2007 to illustrate how the profitability of the FHA insurance program depends on factors such as termination rates, housing price appreciation, and the schedule of payments. This analysis serves as a starting point in understanding the implications of recent growth in the reverse mortgage market. Our results also suggest caution in predicting the profitability of the current HECM program.

Thesis Supervisor: James M. Poterba
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Introduction

This thesis consists of three essays that evaluate vehicles for financing either retirement consumption or bequests. The first two chapters consider two types of tax-favored retirement accounts: tax-deferred accounts, in which contributions are tax-deductible, accruals are not subject to taxation while remaining in the account, and distributions from the account are taxed as ordinary income; and Roth accounts, in which contributions are made with after-tax dollars, but neither accruals within the account nor distributions from the account are subject to taxation. The third chapter, which is joint work with Hui Shan, considers a very different potential source of funding for retirement consumption: extracting equity from a primary residence through a reverse mortgage.

Economists have often assumed that to the extent possible, retirement savings should be done in a tax-deferred account. However, the advent of Roth-style tax-favored accounts and concerns about the tax implications of increasing retirement income through distributions from tax-deferred accounts warrant a revisiting of this question. Specifically, Gokhale, Kotlikoff, and Neumann (2001) shows that for some low-income households, taking distributions from a tax-deferred account can raise the degree to which Social Security benefits are taxable, such that this additional taxation swamps the benefit of the tax-deferral. In Chapter 1, I use data on married couples in the HRS and NBER's TAXSIM model to measure the probability of a household facing a higher tax rate at ages 62, 65, and 69 than the household faced at age 57. When the marginal tax rate is higher, the household could decrease their lifetime tax burden by choosing a Roth-style account over a tax-deferred account. I also measure the probability of facing a marginal tax rate that is sufficiently high that the household minimizes tax payments by using a taxable account rather than a tax-deferred account, in the absence of a Roth option. I find that for distributions beginning at age 69, between 10 and 35% of households with taxable income at age 57 should prefer a Roth account to a tax-deferred account, but very few households prefer a taxable account. This chapter is a revised and expanded version of my MIT Masters thesis.

Past research on tax-favored retirement accounts has focused on the incentives and effects of these accounts within the framework of the life-cycle model. However, many households hope to leave a bequest, and tax-favored accounts also offer substantial tax savings for bequeathed assets. Chapter 2 examines the incentives tax-favored accounts provide for bequests and simulates models of the available tax savings. The simulation focuses on the savings associated with the differential tax treatment of tax-favored accounts under the assumption that marginal income tax rates are constant over time. The benchmark model calculates that the tax savings associated with a tax-deferred account (TDA) that is used to optimally bequeath assets exceeds the tax savings of a TDA used to produce a steady stream of retirement income by by 27.2%. Use of a Roth account for a bequest increases tax savings by an additional 32% over a bequeathed TDA.

Housing wealth is the most important non-pension wealth component for many elderly homeowners in the United States. Reverse mortgages allow elderly homeowners to consume housing wealth without having to sell or move out of their homes. However, historically very few eligible homeowners have used reverse mortgages to smooth consumption in retirement. To encourage the development of the market for reverse mortgages, in the late 1980s the Federal Housing Administration (FHA) initiated a program of insuring a standardized reverse mortgage products known as Home Equity Conversion Mortgage (HECM) loans. The final chapter analyzes HECM loans and simulates models of the profitability of the FHA insurance program. It shows how characteristics of HECM loans and HECM borrowers have evolved over time, compares borrowers with non-borrowers, and analyzes loan outcomes using a hazard model. The numerical simulations on HECM loans originated in 2007 illustrate how the profitability of the FHA insurance program depends on factors such as termination rates, housing price appreciation, and the schedule of payments. This analysis serves as a starting point in understanding the implications of recent growth in the reverse mortgage market and suggests caution in anticipating the profitability of the current HECM program.

Chapter 1

Variation in Marginal Tax Rates Around Retirement and the Return to Saving in Tax-Favored Accounts

1.1 Introduction

Since the 1980s, the US has moved from a pension system dominated by defined benefit (DB) plans, pensions that pay out an annual benefit based on the worker's final salary and years of service, to one dominated by defined contribution (DC) plans, such as 401(k) plans.[1] This change has attracted much attention from economists, as the switch exposes plan participants to a very different set of risks than the previous regime. In addition, plan participants must make a number of decisions that previously were made for them by plan administrators, such as how much to save, how to invest the assets, and how quickly to consume their wealth in

[1] See Buessing and Soto (2006), Clark and McDermod (1990), Gustman and Steinmeier (1992), Ippolito (1995), Kruse (1995), and Papke (1999).

retirement. One decision that has not received much attention is the choice of what type of account to use for retirement savings. This is in part because conventional wisdom has been that the answer is straightforward: workers at a firm offering a 401(k) or similar plan should take advantage of the tax-favored treatment of these accounts.

In recent years, this answer has become unsatisfactory for two reasons. First, the 2006 advent of Roth 401(k) plans, in which contributions are subject to taxation but then accrue gains tax-free, as an alternative to traditional tax-deferred 401(k)s, with tax-deductible contributions and taxable distributions, means that this answer is incomplete. When both options are available, a worker must decide how to allocate her retirement savings across tax treatments. Secondly, a recent paper by Gokhale, Kotlikoff, and Neumann (2001), argues that using a tax-deferred 401(k) may not be advantageous for all households. For those with low retirement income, taking distributions from a tax-deferred account can raise the degree to which Social Security benefits are taxable, such that this additional taxation swamps the benefit of the tax-deferral. This means that when only a tax-deferred 401(k) plan is available, some lower income workers are better off saving for retirement in a taxable account outside of the plan if there is no increase in compensation associated with participation.

This paper seeks to shed light on the decision of the type of account to use in saving for retirement by investigating the patterns of taxation facing married households as they age, using data on income and other determinants of taxation from the Health and Retirement Study (HRS), and making use of the TAXSIM program of the National Bureau of Economic Research (NBER) to calculate the marginal tax rate on a dollar contributed to or distributed from a tax-deferred account.[2] When comparing Roth and tax-deferred savings accounts, the after-tax value of an equivalent investment depends only on the marginal tax rate (MTR) faced at the time the tax is levied, either at contribution or at distribution. Similarly, I will

[2]For an explanation of TAXSIM, see Feenberg and Coutts (1993).

later show that the value of access to a tax-preferred account can be expressed in terms of the MTR associated with such an account that would yield the same after-tax balance as a regular taxable account. Thus MTRs at different ages are a sufficient statistic for the factors that make various savings vehicles more or less attractive to a household seeking to maximize consumption. I find that a substantial minority of households, between 10% and 35%, face lower marginal tax rates at age 69 than at age 57, suggesting that Roth accounts should be an important part of retirement planning. In contrast, very few households face high enough marginal rates to recommend choosing a taxable over a tax-deferred account.

The paper proceeds as follows. The next section reviews the related literature on tax-favored accounts and retirement savings, and section 3 provides background information on tax-favored savings accounts and Social Security benefit taxation. Subsequently, I describe my data and the TAXSIM program used to calculate MTRs. I also describe the sample used in my analysis and changes in income sources as my sample ages. In the fifth section, I investigate the question of how often the marginal tax rate faced at the time of withdrawal from a tax-favored account exceeds the rate faced at the time of contribution, and how often the marginal rate is enough higher to imply that a tax-deferred account would be dominated by a fully taxable account. This is accompanied by a discussion of the characteristics associated with higher marginal rates in old age. The penultimate section considers strategies that a household might employ to minimize tax costs resulting from tax-deferral, and the final section concludes.

1.2 Literature Review

Buessing and Soto (2006) reports a shift in the pension landscape between 1981 and 2003. In 1981, more than eighty percent of workers covered by a pension plan had DB coverage, and perhaps a quarter of these had a DC plan as well. In contrast, by 2003, more than sixty percent of pension covered workers depended solely upon a DC plan. Other work on this transition suggests that in the early eighties, the increase in DC plan coverage was mostly due to shifting employment patterns and the addition of supplemental DC plans, rather than a switch away from DB plans by established companies.[3] However, in later years, Papke (1999) finds evidence of firms substituting away from DB plans toward DC plans. By the early two thousands, firms with both types of plans were less likely to offer the traditional pension plan to new workers, and in some cases DB plan benefits were frozen at the accrued value for all workers at the firm.[4] Also, since the early nineties, cash balance plans have expanded significantly as many firms convert traditional DB plans to this new type of pension, nominally a DB plan but accruing value in a way that mirrors DC plans.[5]

One of the early questions raised by the proliferation of tax-deferred savings accounts was whether such accounts represent new savings or simply a transfer of existing assets or planned savings to the tax-favored vehicle. The debate is summarized in Engen, Gale and Scholz (1996) and Poterba, Venti and Wise (1996). Essentially, Engen, Gale and Scholz (1996) argue that much of the balance in Individual Retirement Accounts (IRAs) is not likely to represent new savings, but Poterba, Venti and Wise (1996) counter that much of the balance of 401(k) plans consists of savings that would not have been done without the availability of such plans. Engen and Gale (2000) then suggests that the proportion of 401(k) contributions that represent new savings varies by earnings level.

Another important question raised by the transition from DB to DC pensions is

[3] See Clark and McDermod (1990), Gustman and Steinmeier (1992), Ippolito (1995), and Kruse (1995).

[4] See Munnell and Soto (2007).

[5] See Coronado and Copeland (2004), D'Souza, Jacob, and Lougee (2008), and Beussing and Soto (2006). Cash balance conversions from traditional DB plans were common in the mid and late nineties, as such a switch offered significant tax advantages over a switch from a DB to a DC plan. However, popular and legal controversy, including congressional hearings in 1999 and 2003, slowed the stream of conversions for a while. The rules and status of cash balance pension plans were normalized by the Pension Protection Act of 2006.

how the risk profile facing workers has changed. Bodie, Marcus and Merton (1988) discussed the different types of risks faced by participants in either type of plan, but data was not brought to this issue until more recent years. Samwick and Skinner (2004) use data on DC and DB plans from the Survey of Consumer Finances, along with synthetic earnings histories, to compare the present discounted value (PDV) of wealth accumulations under each regime. They find that for many workers, DC plan accumulations are likely to exceed the PDV of DB plan benefits. Schrager (2005) studies a similar question using the Panel Study of Income Dynamics, and finds that increasing job turnover in the nineties has made DC plans relatively more attractive to workers. Poterba, Rauh, Venti and Wise (2007) use the HRS to simulate DB and DC plan balance distributions for each household and find that although DC plans yield a higher PDV than private-sector DB plans, they are also more likely to generate very low retirement balances.

Recently a few papers have investigated the question of how to optimally make use of the available vehicles for retirement savings. As mentioned previously, it had generally been assumed that tax-favored accounts are the optimal means of accumulating retirement wealth. However, Gokhale, Kotlikoff and Neumann (2001), shows that for low-income households, making maximum contributions to a tax-deferred account could theoretically increase the lifetime tax burden by triggering the taxation of Social Security benefits. Butricia, Smith and Toder (2008) also investigate how benefit taxation affects retirement income. In addition, Kotlikoff, Marx and Raphson (2008) considers the question of whether a tax-deferred or Roth account is preferable under different assumptions about future tax regimes. My paper differs from these because I use actual earnings histories from the HRS rather than simulated earnings histories, allowing me to observe stochastic variations in earnings paths over time. In addition, I can calculate the percentage of households that have earnings such that they could be exposed to the Social Security benefit taxation trap exposed by Gokhale, Kotlikoff and Neumann (2001). My paper is also unique in that I consider the optimality of using tax-favored accounts both when a Roth option is and is not available, and that I focus on the choice of savings vehicles when the household is already close to retirement age, when beliefs about the future evolution of the tax code are less important than at younger ages.

1.3 Institutional Background

1.3.1 Value of Tax-favored Accounts

Currently, the US tax code allows for many types of tax-favored accounts. Some of the most common include traditional Individual Retirement Accounts (IRAs), tax-deferred 401(k)s and similar accounts, and Roth versions of both IRAs and 401(k)s. Table 1.1 summarizes key aspects of the different types of accounts, and further details of the history and characteristics of these accounts are described in the appendix. The results in this paper abstract from the details of the many different types of tax-favored accounts available and consider three generic savings vehicles, denoted as a taxable account, a tax-deferred account, and a Roth account. All of the accounts have the same investment opportunities. The taxable account is funded with after-tax dollars, and accruals are taxed annually at a constant rate,[6] with no tax due when money is withdrawn from the account. Contributions to the tax-deferred account are tax-deductible, no tax is levied on accruals within the account, and distributions are taxed as ordinary income as long as the account holder has reached the age of 59 $\frac{1}{2}$. The Roth account differs in that contributions are not deductible, but distributions of both the principal and any accrual are non-taxable after age 59 $\frac{1}{2}$.

[6] Actual taxation of capital income depends on whether the income is received as interest, dividends, or capital gains. Applying a constant tax rate that is independent of the tax rate on income is most similar to current tax treatment of qualified dividends, and represents an intermediate case between the tax treatment of interest, taxed as ordinary income, and the tax treatment of capital gains, which are taxed at a constant rate only upon accrual.

Tax-deferred and Roth accounts are considered tax-favored because they eliminate the taxation of income from assets held in such accounts. More explicitly, a pre-tax contribution of C made at time 0 and held in a taxable account that accrues value continuously at a pre-tax rate of r for T periods will yield the following balance at time T, with the contribution taxed at the marginal ordinary income rate that applies in time 0, t_i^0, and capital income taxed each period at the constant rate t_r:

$$balance_T^{taxable} = (1 - t_i^0)Ce^{r(1-t_r)T}$$

Holding funds in a tax-deferred account (TDA) causes three changes: it eliminates the tax on capital income, eliminates the income taxability at time 0, and causes the full balance to be taxed when it is withdrawn in time T at the marginal ordinary income rate t_i^T, yielding the following after tax balance:

$$balance_T^{TDA} = (1 - t_i^T)Ce^{rT}$$

In contrast, holding funds in a Roth account only eliminates the capital income tax, but does not change the timing of income taxation. The following equation describes the balance:

$$balance_T^{Roth} = (1 - t_i^0)Ce^{rT}$$

Thus, if the tax rate is constant, the tax-deferred and Roth accounts are equivalent, although the reported balance in a tax-deferred account will appear larger because taxes have not yet been levied. Both have a higher after-tax balance than a taxable account facing the same marginal income tax rate because they avoid capital income taxation. Some examples are shown in Table 1.2; the first column shows the ratio of the pre-tax contribution to the after-tax balance for a taxable account facing different marginal rates, assuming a capital income tax rate of 15%, a nominal interest rate of either 6 or 10%, and a holding period of either five or twelve years.[7] The second column shows the same ratio for a Roth or tax-deferred account associated with a given marginal rate.

From these equations and the table, it is clear that for any MTR, the Roth account will be preferred to the taxable account. Similarly, the choice between tax-deferred and Roth accounts is straightforward, and depends only on the marginal income tax rates that apply at the time of contribution and withdrawal of the funds. If the marginal rate is higher at the time of contribution, the tax-deferred account is preferred, but if the marginal rate is higher at the time of distribution, the Roth account will be preferred. Comparing the taxable account with the tax-deferred account is slightly more difficult when the tax rate can change over time. For example, table 1.2 shows that for either a five or twelve year holding period and a 6% nominal interest rate, a tax-deferred account facing a marginal rate of 28% or above is inferior to a taxable account facing a rate of 15% or less. However, if the interest rate is 10%, the taxable account with a 15% rate is preferred to the tax-deferred account with a 28% marginal rate only for the five year holding period. For the twelve year holding period, the benefit of tax-deferral compensates for the higher marginal rate on this account. More generally, one can solve the above equations for the tax rate that would cause the tax-deferred account to yield the same balance as the taxable account:

$$t_i^{T*} = 1 - (1 - t_i^0)/e^{rt_rT}$$

For any t_i^T greater than t_i^{T*}, the taxable account will be preferred to the tax-deferred account, and for any t_i^T less than t_i^{T*}, the tax-deferred account will be preferred. The t_i^{T*} that

[7] A 6% return roughly corresponds to the average nominal annual return on a diversified portfolio of bonds, and a 10% rate to the return on large-cap equity. According to the 2005 SBBI Yearbook, the compound annual total return for long-term government bonds was 5.4% from 1926 to 2004, 5.9% for long-term corporate bonds, and 10.4% for large company stock. A five year holding period corresponds to the time between ages 57 and 62, and a twelve year holding period corresponds to the time between ages 57 and 69.

corresponds to a given t_i^0 is presented in column three of Table 2. The above equation shows that t_i^{T*} will be increasing in t_i^0, r, t_r, and T. Intuitively, this means that the benefits of a tax-deferred account are increasing with respect to the available return on capital, the marginal rate of capital taxation, and the intended holding period of the asset. Thus if an individual is choosing between taxable and tax-deferred accounts with given marginal tax rates, a higher return on capital or a longer holding period will make the tax-deferred account more attractive.

As noted in the introduction, conventional wisdom has been that the lack of labor income in retirement causes marginal tax rates to be lower in retirement, or at least not higher than in previous years, so tax-deferred accounts should be the optimal retirement savings vehicle. Roth accounts are only recommended early in the lifecycle of those that expect relatively high tax rates in retirement, or perhaps for those that expect an increase in statutory rates in the future. However, there is little evidence that marginal rates in retirement are relatively low: first, because we know little about the paths of income before and after retirement, and secondly because the complexity of the tax code, especially the phasing in and out of various provisions, means that higher incomes do not always correspond to higher MTRs. For example, Gokhale, Neumann, and Kotlikoff (2001) finds that lower income households could experience reduced lifetime consumption and higher lifetime tax-bills as a result of fully participating in a tax-deferred 401(k) because of increased taxability of Social Security benefits. This result can be linked to high MTRs associated with the phase-in of Social Security benefit taxability.

1.3.2 Social Security Taxability

As a response to long-term concerns about the viability of the Social Security program, the Social Security Amendments of 1983 enacted several provisions to restore solvency to the system over a seventy-five year horizon. Scheduled increases in the payroll tax rate were accelerated, the full benefit retirement age was set to gradually increase, and most relevant to the purposes of this paper, up to fifty percent of household benefit payments became subject to taxation, with revenues flowing into the Social Security trust fund. The income threshold above which benefits are taxable was set at $25,000 for single households, and $32,000 for those married filing jointly and was deliberately not indexed for inflation so that the taxability of benefits would be introduced gradually. Ten years later, further reform set a second threshold ($34,000 and $44,000, respectively), above which 85% of benefits become taxable.

To calculate the portion of Social Security benefits that are taxable, a household starts with its adjusted gross income (AGI) less Social Security benefits, and adds in several items exempted from AGI, most notably tax-exempt interest income. They then add half of their Social Security benefits and fill out a worksheet that compares this amount with the applicable thresholds. If the household's total is less than the first threshold, none of the Social Security income is taxable. If the household's total is between the two thresholds, the lesser of half the difference between the total and the threshold or half of benefits are taxable. If the total is above the second threshold, the household similarly transitions to 85% taxability. The phasing in to higher levels of benefit taxability occasions a jump in marginal tax rates. For example, if a household has income such that they are in the first transition range, an additional dollar of taxable income will cause another fifty cents of Social Security benefits to be subject to tax, so the effective MTR is 1.5 times the statutory rate. Similarly, in the second phase-in, the effective marginal rate is 1.85 times the statutory rate. The size of the transition range is directly linked to the amount of Social Security benefits received.

How significant might the increased taxation of Social Security benefits be? For example, consider the case of a married household that has $18,000 in taxable income as well as Social Security benefits and a large tax-deferred account.[8] In my HRS sample, average Social Security benefits for a household with a 65-year-old male are around $12,000. If the household takes no distributions from the tax-deferred account, or up to a $8,000 distribution, none of the Social Security benefits will be taxable. On the other hand, if the household takes a distribution from the account of $26,000, 85% of benefits, or $10,200, is taxable. If we assume that the household takes the standard deduction, they face a statutory MTR of 15%, so they pay an extra $1530 in taxes. This is equivalent to a 12.75% reduction in Social Security benefits. A distribution between $8,000 and $26,000 results in a lower tax penalty, but the transition into benefit taxation generates higher effective marginal rates, 22.5% and 27.75%. A second example is a household that receives the maximum possible benefit, about $28,000.[9] In this case, any distribution from a tax-deferred account will trigger Social Security benefit taxation. Benefit taxability again reaches 85% with a $26,000 distribution, and the household faces the same 12.75% reduction in benefits, or a $3570 tax penalty. If the household's economic situation does not change, it may face such a penalty year after year.

Some twenty years after taxability of Social Security benefits was introduced, the fraction of households subject to the tax growing each year, as is the amount of revenue collected. In the 2000 HRS, about one third of households receiving Social Security income pay taxes on some portion of their benefits, and about one fifth have sufficient income levels that 85% of benefits are taxable. For married households with Social Security income, those numbers rise to one half and thirty-five percent. Nationally, revenues collected from Social

[8]The numbers in this example were chosen to most clearly illustrate effect of Social Security benefit taxation, but are not unreasonable. $18,000 is slightly less than the average wage earnings of 69-year-old individuals in my sample, as reported in Table 1.3. Similarly, in Section 1.5.2, I report the average simulated distribution from a tax-deferred account as just over $7,000.

[9]If both spouses claim benefits upon reaching age 65 in 2003 and each had earnings that exceeded the upper limit on Social Security taxation in each of the 35 previous years, household benefits are approximately $28,000.

Security benefit taxation have grown steadily over time, from about five billion dollars in 1984 to more than twelve billion in 2006 (using constant 2003$), as shown in Figure 1.1. The increase in revenue can be attributed to three things: first, the lack of inflation indexing of the taxability threshold means that each year, more households are subject to a tax; second, because benefit levels are based on a formula that inflates wages by real wage growth rather than just inflation, real benefits are increasing over time; and finally, the addition of the second threshold in 1993.

1.4 Data Description

Data for this paper comes from the HRS, a biannual survey of elderly and near-elderly households starting in 1992. I construct variables for tax-filing status, dependents, age exemptions, taxable income sources, and deductions using the survey responses of married couples in the original HRS cohort from the 1992-2004 waves of the HRS, generally following the methods of Rohwedder, et al. (2005). This includes constructing mortgage interest paid as a percentage of reported mortgage debt, with the percentage reflecting the average annual interest rate paid on a 30-year loan as calculated by HSH Associates.[10] I depart from the Rohwedder, et al. (2005) method by using data from the Social Security Administration (SSA) on earnings and Social Security benefits. HRS asked respondents to give permission to access their earnings and benefits histories from the SSA in both 1992 and 2004. I make use of the benefits histories and two types of earning records provided by SSA that go back to 1980: w-2 earnings and Medicare covered earnings.[11] Unfortunately, SSA data cannot be merged with any geographic data in the HRS, so I assume that all households are located in Massachusetts, following Gokhale, Kotlikoff, and Neumann (2001). Further,

[10] See `http://www.hsh.com/mtgst.html`

[11] The primary difference between these two measures of earnings is that w-2 earnings deduct contributions to tax-deferred accounts.

I face one issue that Rohwedder, et al. (2005) did not: distinguishing between qualified and unqualified dividend income. I assume that qualified dividends are a fixed fraction of total dividends, based on the numbers reported in the Statistics of Income for 2005.[12] Finally, I use a variation of NBER's TAXSIM program to calculate the MTRS for the years the male member of the couple is or would be between the ages of 57 and 69, based on a uniform 2003 tax code and Social Security benefit taxability thresholds corresponding to their real values in each year.

In many cases, implementing TAXSIM at younger ages requires the extrapolation of the values of input variables into the period before 1992. I have data on wages and Social Security benefits in prior years, but other income variables must be extrapolated. I assume that no unemployment insurance benefits are received, that dividends and other capital income, including interest, rental, and business income, remain constant in real terms, and that pension income starts at the age reported in the HRS and has a constant nominal value. Deductions must also be extrapolated; I assume that rent payments and property taxes remain constant in real terms, that charitable contributions are a constant, household-specific fraction of income, that there are no deductible medical expenses, and that outstanding mortgage debt declines annually at a household-specific rate.

For my analysis, I choose to use a tax code that is constant except for one element: the Social Security benefit taxability thresholds decline in real terms over time because of the lack of inflation indexing. To accomplish this, I convert all values into 2003 dollars and let TAXSIM calculate the AGI that would pertain in the absence of Social Security income. I compare the AGI and the Social Security benefits received by a household to the applicable real threshold and calculate the portion of benefits that are taxable and whether benefit taxability is being phased-in. Then I add taxable benefits to ordinary income, rerun

[12]See Marcia and Bryan (2007).

TAXSIM to get the MTR that applies to non-wage income, and multiply this marginal rate by the appropriate factor to account for the phasing in of benefit taxability.[13] To streamline my analysis, I consider only couples that are married at the time I begin my calculations, the year the male reaches age 57, and omit couples that experience a divorce during my sample period. In addition, I must make several sample restrictions due to data availability: both members of the couple must be alive in 1992 and linked to the SSA records, and the male must be born between 1926 and 1935. This range of birthdates leads to a sampld of couples with males ages 57 to 62 in 1992, allowing me to construct the needed variables for all ages between 57 and 69. The consequences of these sample restrictions on my sample size are as follows: there are 7648 households in the 1992 HRS cohort, 4545 of which are married both in 1992 and when the male is 57 years old. Further limiting the sample to couples with the male born between 1926 and 1935 results in 2380 households, and dropping those that experience a divorce leaves 2316 households. Of these, 1640 have SSA records for both household members and make it into my sample.

Because I calculate MTRs over a twelve year sample period, the household may experience the death of one or both members. In the case of a widow(er), the household files as single and faces the resulting tax brackets. If both household members pass away, MTRs for subsequent years are coded as missing. To consider the effects of these sample composition choices, we can consider the sample of HRS married couples with the male aged 57 in 1992. In 2004 the male has reached age 69, and we find that 73.1% of these households

[13]The 2003 tax brackets are as follows, according to the 1040 Instructions for 2003, available at `http://www.irs.gov/pub/irs-prior/i1040--2003.pdf`.

Marginal Tax Rate	Single	Married Filing Jointly
10%	Below $7,000	Below $14,000
15%	$7,001-$28,400	$14,001-$56,800
25%	$28,401-$68,800	$56,801-$114,650
28%	$68,801-$143,500	$114,651-$174,700
33%	$143,501-$311,950	$174,701-$311,950
35%	Above $311,950	Above $311,950

still survive as married couples. For 21.1% of households, only a widow(er) remains, and in 2.5% of households, both have passed away. Only 3.3% of couples have experienced a divorce after twelve years.

Summary statistics for the values of the variables that serve as inputs into TAXSIM are shown in Table 1.3, for both age 57 and age 67, with the full sample in Panel A. Throughout my analysis, households are weighted by their 1992 household weight. It is clear that as they age, households become less likely to receive wage and dividend income, and more likely to receive income from property, pensions, and Social Security. In addition, at age 67, households are less likely to be eligible to take tax-deductions for property tax payments, mortgage interest payments, and charitable donations.[14] A drop in average wages for primary earners[15] at age 67 suggests that many may only work part-time later in life, however, the increase in average secondary wages implies that lower earning women may be less likely to remain in the labor force. The increase in average Social Security benefits both reflects that older couples are more likely to have both members claiming benefits and those who wait longer to claim benefits have larger benefits.

Panel B of Table 1.3 shows summary statistics for the sample of households that report holding a positive balance in a tax-deferred account in at least one wave of the HRS, a sample consisting of 1206 households. A comparison of these two samples suggests that households with tax-deferred accounts tend to have higher earnings at age 57 and more capital income at age 67, but are otherwise very similar. Households in this sample may be slightly more likely to receive various income types and be eligible for various deductions, but these differences are relatively small. Overall, these results suggest that households with tax-deferred accounts have larger lifetime incomes than others.

[14]Medical expense deductions are very close to zero at all ages.

[15]Primary earners are males in households with both members of the couple surviving, and of the surviving widow(er) otherwise.

As noted in the introduction, the expectation of lower tax rates in retirement is based on the idea that that taxable income will be lower after earnings have ceased. Although this seems a reasonable assumption, it has not generally been examined. Several papers have noted that since the 1970s, the economic status of the elderly has improved and the incidence of poverty has declined.[16] This may indicate that the assumption of lower income in retirement is outdated. Indeed, Table 1.3 indicates that although both the probability and the level of earnings decrease between ages 57 and 67, other types of income increase simultaneously. In Figure 1.2, we can see that the profile of a broad income concept, AGI plus non-taxable Social Security benefits, declines at a surprisingly shallow rate. At age 70, the income levels at the 25th, 50th and 75th percentiles of the distribution are well over half of the income level at age 55, when earnings are near their lifetime peak. Although it is difficult to discern in the figure, income levels at the bottom of the distribution do drop significantly, and upon reaching age 70 are not much more than a third of the age 55 level.

Marginal tax rates depend not on this broad income measure, but on taxable income, which may exclude some Social Security benefits and capital income and also takes into account a tax exemption for the elderly and a myriad of deductions and credits. Figure 1.3 shows the profiles of taxable income for various quantiles, and all decline more significantly than did the broader income concept. This implies that over time, households shift from earned income to less heavily taxed sources of income, and may also reap greater benefits from tax deductions and credits. However, the idiosyncratic nature of this transition, particularly the differences in the timing of retirement by different households, may lead to "churning" within the distribution at a higher rate than during the working life. A comparison of the MTRs facing individual households at different ages can better show the probability of facing high rates when taking distributions from a tax-deferred account.

[16]See Moon and Juster (1995) for an overview.

1.5 Analysis of Marginal Tax Rates

1.5.1 First Dollar MTR

I first consider the question of how households should allocate their first dollar of retirement savings. I use Medicare covered wages, supplemented by w-2 earnings when Medicare wages are not available, to determine the MTRs that apply before making any tax-deferred contributions. Throughout this section, actual MTRs are divided into bins corresponding to the statutory rates. Most of the marginal rates calculated by TAXSIM are tightly clustered around the statutory rates, but phase-ins and phase-outs of deductions and Social Security benefit taxation cause some outliers. In addition, the 33% and 35% bins are grouped together because of their low frequency. The distribution of MTRs faced at ages 57, 62, 65 and 69 are shown in Panel A of Table 1.4. As households age, the proportion of households facing lower MTRs increases, so that at age 69, almost one-third of households face a zero marginal rate and just over two-thirds face a marginal rate of 15% or less. However, the fraction of households facing a rate of 25% or more stays relatively stable around 10%, suggesting that a portion of the population may have an income profile that does not significantly decline with age.

Table 1.5 calculates the distribution of MTRs at ages 62, 65, and 69 by the marginal tax rate at age 57. Thus along the diagonals are the percentages of households facing roughly the same MTR, and below the diagonal the percentages of households facing higher marginal rates. In addition, Panel A of Table 1.6 summarizes the percentage facing higher rates at each age, or the percentage of households that would face lower discounted lifetime tax payments by taking the first dollar of their distribution from a Roth account rather than a tax-deferred account. At age 62, almost half of households facing marginal rates of 0 or 10% at age 57 are now facing higher rates, and 14 to 25% of households that faced rates of 15%

or more at age 57. At age 69, these numbers drop to around a third for households in the lowest age 57 bins, and to 10 to 19% for those facing higher marginal rates. This indicates that a non-trivial fraction of households would pay less in taxes by choosing Roth accounts instead of tax-deferred accounts, especially if they face low marginal rates at age 57 or plan to begin distributions relatively soon.

The second two panels of Table 1.6 show the percentages of households that would pay less in taxes by using a taxable account than by taking distributions from a tax-deferred account, for 6% and 10% nominal return on assets. These are the households with marginal rates at ages 62, 65, and 69 that are higher than the equivalent marginal rate for their age 57 tax rate, as explained in section 1.3.1. I first consider the case of a 6% annual return on assets. Among households facing age 57 marginal rates of 10% or less, upon reaching age 62, the fraction of households that prefer the taxable account is nearly as high as the fraction that prefer the Roth: between 45% and 50%. Households facing a 15% marginal rate also have only a slightly lower probability of choosing the taxable account, a drop from 25% to 22%. This lines up with Gokhale, Kotlikoff and Neumann's (2001) assertion that some low-income households may not realize a tax savings by using tax-deferred accounts. In contrast, households facing higher rates at age 57 are less likely to be better off using a taxable account: the fraction preferring a taxable account is 40 to 80% lower than the fraction preferring a Roth. However, by age 69, the fraction preferring the taxable account is much lower for all households facing positive marginal rates at age 57, and is less than 3% for those with an age 57 marginal tax rate of at least 25%. These overall patterns persist when a 10% nominal return is considered, though even fewer households prefer taxable accounts. By age 69 and with asset returns of 6 and 10%, only 11.5% and 3.3% of all households pay lower lifetime taxes by using a taxable account than by taking distributions from a tax-deferred account, and many of these faced a zero marginal rate at age 57. Thus households with longer savings horizons are unlikely to face a scenario in which taking retirement distributions from a tax-deferred account is dominated by making use of a taxable account.

1.5.2 Sample with Tax-deferred Accounts: Last Dollar MTR

The preceding analysis reports the attractiveness of Roth and taxable accounts for the general population. However, those actively saving for retirement may differ from the general population in significant ways, so looking at the change in MTRs for a sample of households with tax-deferred accounts may be more informative in ascertaining their optimal choice of savings vehicle. Additionally, for the subset of households that regularly makes contributions to a tax-deferred account and limited access to Roth savings, the relevant question may be whether the household should substitute some Roth savings for tax-deferred savings. Thus for this portion of my analysis, I use only households that report having a positive balance in a tax-deferred account in some wave of the HRS and calculate the MTR that corresponds to the last dollar of the contribution made or distribution taken. This allows me to discover how many households would have been better off by replacing some of their tax-deferred savings with savings in some other type of account. I use wages as reported on w-2 forms rather than Social Security wages to account for possible tax-deferred contributions to 401(k)s during the working life. Additionally, I calculate simulated distributions from tax-deferred accounts at ages 62, 65 and 69 as a fraction of the reported or interpolated balance in the account in that year, setting that fraction equal to the ratio of the number of members of the couple still alive to the sum of their life expectancies. The simulated distribution is not subtracted from the remaining account balance, so at each age, my analysis implies an assumption that distributions begin at that age at a rate that is sustainable for the remaining life expectancy of the couple. The size of the average simulated distribution is $7,138 and does not vary greatly with age. In my sample, distributions are small relative to other income sources. Because tax-deferred accounts have only become widely available in the 1980s and my sample reached age 62 by 1997, households have not had as many years to accumulate tax-favored savings as future cohorts will. Thus my calculations should be taken as conservative estimates of the impact of taking tax-deferred distributions on last-dollar marginal tax rates in retirement.

Again, Table 1.7 calculates the distribution of MTRs at ages 62, 65, and 69 by the MTR at age 57, and Panel A of Table 1.8 summarizes the percentage facing higher rates at each age, or the percentage of households that could lower their discounted lifetime tax payments by taking the last dollar of their distribution from a Roth account rather than a tax-deferred account. These results follow the same patterns evident in the first dollar MTR results for the full sample, though the fraction of the population preferring a Roth is larger, especially for those facing very low MTRs. This suggests that among those facing very low marginal rates, households with tax-deferred savings accounts are more likely to face a low rate only temporarily, perhaps due to unemployment or unusually large deductions. At age 62, roughly three-quarters of households with marginal rates of 0 or 10% at age 57 are now facing higher rates, and at age 69, about half these same households would have preferred a Roth account. Among households facing rates of 15% or more at age 57, only 16 to 32% experience higher rates at age 62, and 9 to 28% at age 69. This indicates that many current holders of tax-deferred accounts would pay less in taxes had they used Roth accounts in addition to tax-deferred accounts and taken a portion of their distribution from the Roth account.

In the second two panels of Table 1.8 are the percentages of households that would pay less in taxes by taking the last dollar of their distribution from a taxable account than from a tax-deferred account for a 6% and 10% nominal return on assets. Again, the results look very similar to the full sample results, but with slightly higher magnitudes. Among households facing age 57 marginal rates of 15% or less, upon reaching age 62, the fraction of households that prefers the taxable account is only slightly smaller than the fraction that prefers the Roth account. In contrast, households facing higher rates at age 57 are less likely to prefer a taxable account than to prefer a Roth account. By age 69, the fraction preferring the taxable account is much lower for all households facing positive marginal rates at age 57, and is less than 5% for those with an age 57 marginal tax rate of at least 25%. Similar patterns emerge when a 10% nominal return is considered, but even fewer households prefer taxable accounts. By age 69 and with nominal asset returns of 6 or 10%, only 14% and 3.5%, respectively, of all households in the sample would pay lower lifetime taxes by using a taxable account than by taking distributions from a tax-deferred account.

1.5.3 Understanding Increases in Marginal Tax Rates

As we have seen, though few households would prefer a taxable account to a tax-deferred account, a substantial minority is better off using a Roth account than a tax-deferred account because they face higher marginal tax rates later in life. Why might they face higher rates? As mentioned before, they may simply have more taxable income than previously, through some combination of full- or part-time earnings, capital income, pension benefits, and Social Security benefits. Table 1.9 shows the distribution of taxable income at ages 62, 65, and 69 into bins corresponding to the statutory rates, by the bin at age 57. This table differs from Table 1.7 in that it does not account for the impact of phase-ins and claw-backs on the actual marginal rates faced. It shows that for those with age 57 taxable income placing them in the 15% bracket or lower, increases in taxable income are responsible for nearly all of the increase in marginal tax rates at ages 62 and 65, and most of the increase at age 69. These might represent households that were unemployed or underemployed and returned to work, or households that had retired but were not yet receiving pension or Social Security benefits. For those with more substantial taxable income at age 57, increases in taxable income also play a role in raising marginal rates, accounting for between half and all of the marginal rate increases at age 62, and between 35 and 60% of the marginal rate increases at age 69.

In thinking about increases in taxable income, it should be noted that households that are still working full time are unlikely to be taking distributions from retirement accounts, so increases for these households should not be a concern. Though retirement is notoriously difficult to measure, determining the presence of earned income for an individual is straightforward. Thus Panels A and B of Table 1.10 show the percentages of households at ages 62, 65, and 69 that still have one or both members of the couple earning income for various cuts of the data. Those facing higher marginal rates at later ages are much more likely to have one or both members of the couple still earning income. At age 62, more than 40% of households facing higher marginal rates have two wage-earners, and more than 80% have at least one wage-earner. By age 69, these percentages have dropped, but those with higher marginal rates are still much more likely to have earned income than is the population at large.

If taxable income has not increased for a household but the MTR has, two plausible reasons might be that the household has been widowed or that the household is experiencing a phase-in of Social Security benefit taxation. After a household is widowed, different tax brackets apply, so the same taxable income could trigger a much higher rate. However, Panel C of Table 1.10 shows that those facing higher MTRs are less likely to have been widowed than the full sample. This might occur if becoming a widow incurs a loss of pension or Social Security benefits, or if assets have been used to cover end-of-life expenses, so less capital income is generated. This corresponds to Current Population Survey data that show that elderly widows are more likely to be impoverished than elderly couples.[17]

[17]See Committee on Ways and Means, U.S. House of Representatives, 2004. Note that the portion of my sample that is widowed at age 69 is much lower than the fraction reported in Section 1.4 for a sample of age 57 couples. This is because my sample requires both members of the couple to be alive in 1992. Thus the widow(er)s observed in my sample are disproportionately drawn from the later birth years of the sample.

As explained in section 1.3.2, as a household is phasing into Social Security benefit taxation, the MTR is increased by a factor of 1.5 for the first threshold and 1.85 for the second threshold. Thus the phase in could be a significant factor contributing to higher MTRs. Table 1.11 shows the distribution of AGI plus half of Social Security benefits across the thresholds of benefit taxability for households receiving Social Security benefits in the full sample and among those facing higher MTRs. For any age group, this distribution shifts up as the sample is restricted to households experiencing larger relative increases in marginal rates, with a smaller fraction in the lowest taxability category and a larger fraction in the highest category. This suggests that households with very low income levels at later ages, as measured by AGI plus half of Social Security benefits, are less likely to face higher marginal rates than they faced at age 57. This occurs because for any level of age 57 taxable income, those with higher taxable income levels at later ages are more likely to make it into a high MTR sample than those with lower taxable incomes. Table 1.11 also indicates that at each age the percentage of the sample falling into a phase-in range increases for samples with higher MTRs. This indicates that the phase-in ranges and the associated amplification of MTRs are an important factor leading some households to face higher MTRs. At age 62, more than 20% of those facing higher marginal rates are also experiencing a phase-in of Social Security benefits. By age 69, the fraction increases to 48%. Comparing this number with the fraction of the same sample that has at least one wage earner, which is 59%, suggests that the Social Security benefit taxability phase in is only slightly less important in triggering higher MTRs than is continued labor supply. These numbers suggest that the Social Security trap of Gokhale, Kotlikoff and Neumann (2001) provides an incentive for households to choose Roth accounts over tax-deferred accounts. For those with rates high enough to recommend a taxable account, the incidence of facing a transition into Social Security benefit taxability is similarly high. However, the small overall number of households in this circumstance makes this phenomenon of less interest. Overall, the distributions of households across

Social Security benefit taxability ranges illustrate the potential importance of this aspect of the tax code, but also suggest that many households that face higher MTRs at age 69 could avoid this outcome by adjusting the timing of Social Security benefit claims and withdrawals from TDAs.

1.6 Strategic Behavioral Adjustments

The findings of the previous sections show that a non-trivial fraction of people could end up facing higher MTRs when they are of an age to take distributions from tax-deferred accounts than they did when contributing. This suggests both that Roth accounts will be highly attractive to households that anticipate higher future rates and that households facing future uncertainty may want to diversify retirement contributions between Roth and TDAs. On the other hand, to the extent that the relatively higher MTRs are a result of under- and unemployment, some of these households may not be making any contributions to retirement accounts in years with low marginal rates. If contributions are made, households are likely to adopt strategic behavior that minimizes the tax costs of saving. In particular, if the high MTRs result from the phase in of Social Security taxability, households have considerable scope for strategic tax minimization.

What strategies might a household adopt to minimize the tax cost of retirement saving? First I consider actions that might be taken ex-ante, or by a household that is contributing to retirement savings and suspects that the MTR they currently face may be lower that the rates they will face in retirement. As explained, this household could contribute some or all of their retirement savings to a Roth savings vehicle rather than to a tax-deferred account. Although Roth 401(k)s became a legal possibility in 2006, many employers do not yet choose to make this option available to employees. Thus this option is only available to households that are eligible to contribute to a Roth IRA.[18] In 2007, each spouse can contribute up to $4,000.[19] Although this limit may be lower than the total amount a couple wishes to save, it allows part of a household's savings to face a lower rate of taxation. A second option that may be available to a pre-retirement household facing a relatively low marginal tax rate is to roll over funds from an existing IRA or 401(k) into a Roth IRA, with three limitations. First, savings in a 401(k) from a current job cannot be rolled over while the individual remains employed at the current firm. Second, until 2010, Roth conversions are limited to households with a modified AGI less than $100,000. In 2010 and subsequent years, there is no AGI limit. Finally, to accomplish the roll over, the household will have to pay taxes on the entire amount being transferred. If the individual holding the account is younger than 59 $\frac{1}{2}$, using the funds in the account to pay the taxes will trigger a penalty tax of 10% on the portion of the account that is not rolled over, which is likely to make such a choice very unattractive. This difficulty can be circumvented if the household can pay the taxes due out of current income or savings that is not tax-deferred.[20]

In addition, there are several strategies that a household could adopt ex-post, or when it arrives at retirement with a large amount of tax-deferred wealth and faces high MTRs. If the high rates result from high income from other sources that may not persist throughout retirement, a household might choose to take only minimum distributions from tax-deferred accounts and spend down other assets until taxable capital income becomes less substantial and the value of nominal pensions is eroded by inflation. However, if the high marginal rates result from the phase in of Social Security benefit taxability and the size of tax-deferred distributions, tax savings can be generated by limiting the number of years in

[18]Roth eligibility for 2007 phases out starting at an income of $156,000 ($99,000) for a married filing jointly (single) household, and ending at $166,000 ($99,000). Under current laws, in 2010 and subsequent years, households with income that exceeds the Roth eligibility limit can instead contribute to a traditional IRA on an after-tax basis, and then roll the account over into a Roth IRA in the following year.

[19]In addition, individuals are not allowed to contribute more than their individual annual earnings.

[20]Another option is to take a distribution from Roth principal.

which the household both takes a large distribution and receives benefits.

One way to avoid high marginal rates in this scenario is to delay the claiming of Social Security benefits. Mahaney and Carlson (2007) indicates that a large tax savings may be accomplished by waiting to claim Social Security benefits for the primary earner until that person reaches age 70, and meanwhile funding consumption by taking tax-deferred distributions. They argue that financial planners tend to overestimate the returns to tax-deferred savings by ignoring investment fees. Additionally, the value of a delay in claiming Social Security benefits has increased in recent years due to the increase in the Full Retirement age and a provision of the Senior Citizens' Freedom to Work Act (2000) that allows spouses to claim spousal benefits when the primary earner has reached the full retirement age but is not yet receiving benefits. This strategy could generate long-run tax savings for many households that expect at least one individual to live into their late seventies.

A household that has chosen to claim Social Security benefits could minimize benefit taxation by "bunching" distributions from tax-deferred accounts. In one year the household could take a large distribution and face benefit taxation, and then in the following year(s) take only the minimum distribution. In this way, the household would incur a lower average tax liability. A related option is that the household could roll over funds from a tax-deferred account into a Roth account. If the account holder is over age 59 $\frac{1}{2}$, the penalty tax will not be an issue. Because a large rollover could still push the household into a very high marginal tax bracket, in some cases it will be advantageous to spread the transfer over time, rolling over smaller amounts each year. The household might also find it advantageous to delay claiming Social Security benefits until after the rollovers are accomplished.

1.7 Conclusion

In this paper, I consider the question of how a married household that is nearing retirement should allocate retirement savings across available vehicles: taxable savings accounts, tax-deferred savings accounts, and Roth accounts. Overall, in any age 57 tax rate bin, tax-deferred savings is optimal for the majority of households, but a substantial minority, between 10% and 35% at age 69, do better with a Roth account. The probability of preferring a Roth account increases for lower MTRs, for earlier anticipated retirement withdrawals, and for the sample of households with observed tax-deferred savings. In particular, for the sample with TDAs, up to half of those with low MTRs at age 57 prefer a Roth account at age 69. Additionally, more than half of all households prefering a Roth account at age 69 have at least one wage-earner, though average wages are lower than at age 57. Among households receiving Social Security benefits and facing higher MTRs, almost half are transitioning into benefit taxability. When households face uncertainty about future income and MTRs, it may be optimal to diversify retirement savings across both types of accounts. If a household knows that current circumstances provide temporarily low MTRs, they should direct new savings to Roth vehicles as much as possible, and perhaps roll over funds from existing tax-deferred accounts.

In contrast, taxable accounts never dominate a Roth account, and when a Roth account is not available, diversification between taxable accounts and tax-deferred accounts is generally ill-advised. Such a move should only be considered if the household is facing a marginal tax rate of 15% or less, if expected nominal returns are low, if distributions will start relatively soon, and if the household will not be able to delay claiming Social Security benefits. The Social Security trap identified by Gokhale, Kotlikoff, and Neumann (2001) causes only a small percentage of households to face MTRs that are high enough to recommend taxable accounts over tax-deferred accounts. For affected households, taxable savings accounts are likely to be a less effective strategic response than delays in claiming Social Security benefits and adjustments in the timing of tax-deferred distributions.

This paper has focused on households that are close to retirement age in order to avoid excessive extrapolation of taxable income and deductions to years before 1992. Because my analysis considers households near the peak of the age-earnings profile, the reported percentages of households that do better with a Roth account are likely to be an lower bound on the percentages of households preferring Roth accounts at younger ages. In addition, my focus on near-elderly households and a relatively short time span justifies using a uniform tax code throughout my analysis, and ignoring the effects of future changes to the tax code. Kotlikoff, Marx, and Raphson (2008) show that for younger households, expectations about the future tax code may dominate other considerations in determining the optimal investment vehicle. While future increases in statutory rates make the Roth account more attractive, a switch to a consumption based tax favors tax-deferred savings. Thus the strategy of diversifying the tax treatment of retirement savings across Roth and tax-deferred accounts seems appropriate for those far from reaching retirement. The desired allocation will depend almost entirely on the probabilities assigned to different legislative outcomes, and is therefore highly subjective.

In future work, I hope to address two issues that are beyond the scope of this paper. First, few researchers have considered the question of how the possibility of divorce affects optimal retirement preparation. Unfortunately, the small number of divorces in the HRS sample I analyze precludes drawing any conclusions about how divorce affects the optimality of retirement savings vehicles. Second, a large fraction of household savings finances bequests, rather than consumption. The tax treatment of inherited assets and MTRs faced by heirs may have important implications for the optimal choice of investment vehicles. I explore this issue in the following chapter.

Figure 1.1: Aggregate Real Revenues from Social Security Benefit Taxation, 2003 $

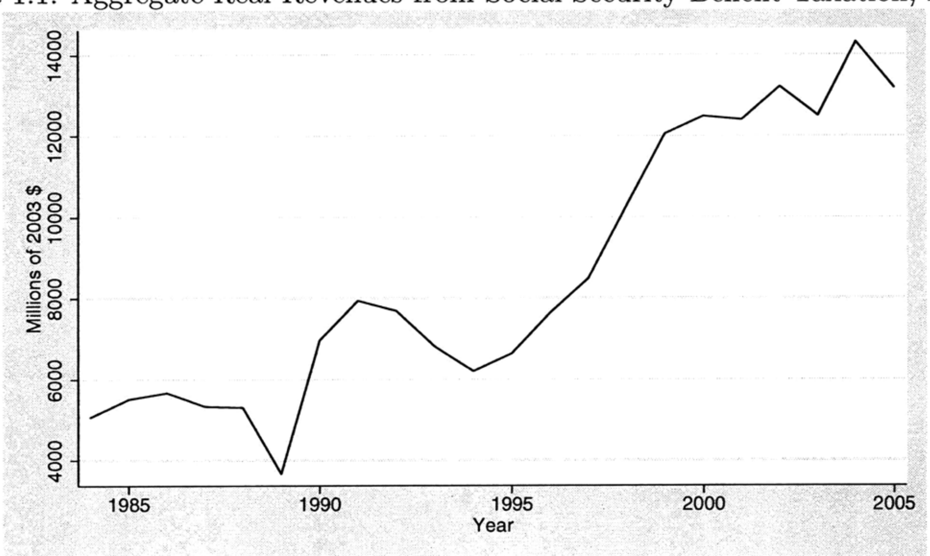


Figure 1.2: Age Profiles of Adjusted Gross Income Plus Social Security Benefits, Full Sample

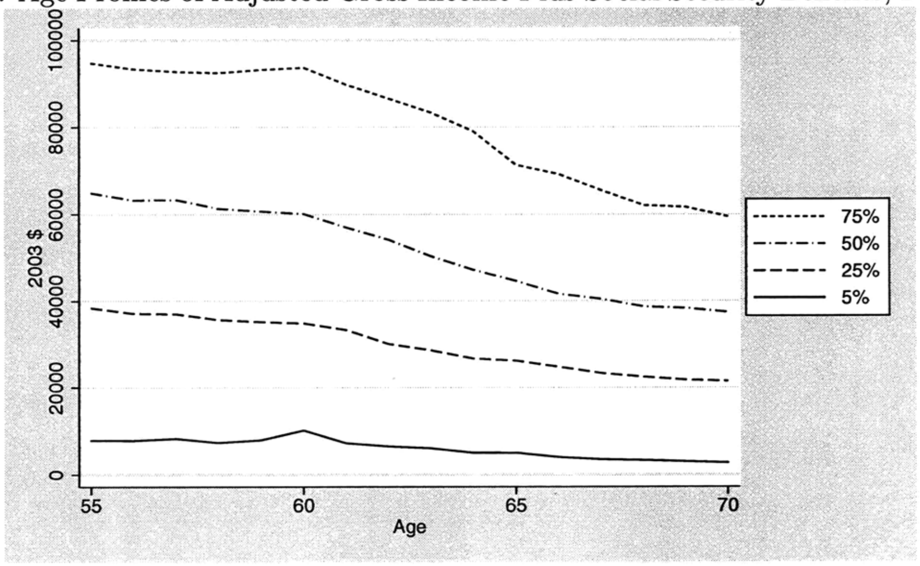


Figure 1.3: Age Profiles of Taxable Income, Full Sample

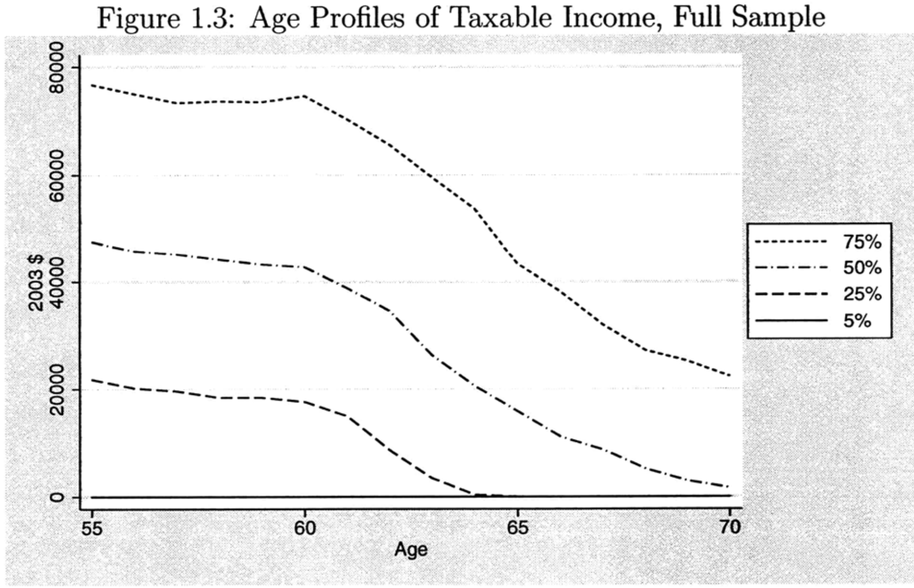


Table 1.1: Characteristics of Types of Tax-Favored Accounts

	IRA	401(k)	Roth IRA	Roth 401(k)
Associated with an Employer?	No	Yes	No	Yes
Contributions Tax Deductible?	Yes, if AGI< $83,000; Partially, if AGI< $103,000	Yes	No	No
Distributions Taxable?	Yes, except basis of taxable contributions	Yes	No	No
Penalty on Distributions Before Age 59 $\frac{1}{2}$?	Yes	Yes	Yes, on accrual No, on contributed basis	Yes
Minimum Distribution Required After Age 70 $\frac{1}{2}$?	Yes	Yes	No	Yes
Contribution Limit for those				
Under 50?	$4,000	$15,500	$4,000	$15,500
Over 50?	$5,000	$20,500	$5,000	$20,500
Income Eligibility Limit?	None	None	Ineligible if AGI> $166,000; Phase out starts at $156,000	None
Possibility of Loan against Assets?	No	Yes	No	Yes

Note: Numbers in this table are based on the 2007 tax code, and reflect a filing status of married filing jointly. Single filers phase out of tax-deductible IRA contributions between $52,000 and $62,000, and out of Roth IRA eligibility between $99,000 and $114,000. For additional details, see IRS Publication 590.

Table 1.2: Value of Tax-Favored Accounts

	A. 6% Rate of Return, 15% Capital Income Tax					
	$t = 5$			$t = 12$		
MTR	Taxable Balance	Roth/TDA Balance	Equivalent MTR	Taxable Balance	Roth/TDA Balance	Equivalent MTR
0	1.290	1.350	4.4%	1.844	2.054	10.2%
10	1.161	1.215	14.0%	1.660	1.849	19.2%
15	1.097	1.147	18.7%	1.567	1.746	23.7%
25	0.968	1.012	28.3%	1.383	1.541	32.7%
28	0.929	0.972	31.2%	1.328	1.479	35.4%
33	0.865	0.904	35.9%	1.236	1.376	39.9%
35	0.839	0.877	37.9%	1.119	1.335	41.7%
	B. 10% Rate of Return, 15% Capital Income Tax					
	$t = 5$			$t = 12$		
MTR	Taxable Balance	Roth/TDA Balance	Equivalent MTR	Taxable Balance	Roth/TDA Balance	Equivalent MTR
0	1.530	1.649	7.2%	2.773	3.320	16.5%
10	1.377	1.484	16.5%	2.496	2.988	24.8%
15	1.300	1.401	21.1%	2.357	2.822	29.0%
25	1.147	1.237	30.4%	2.080	2.490	37.4%
28	1.101	1.187	33.2%	1.997	2.390	39.9%
33	1.025	1.105	37.8%	1.858	2.224	44.0%
35	0.994	1.072	39.7%	1.803	2.158	45.7%

Note: "Taxable Balance" indicates the after-tax balance in a taxable account of a \$1 pre-tax contribution after t years, with a nominal rate of return of $r = 6\%$ in Panel A and 10% in Panel B. This is computed as $(1 - t_i^0)Ce^{r(1-t_r)T}$, with t_i^0, the marginal tax rate faced at the time of making a contribution to the account, corresponding to the value in the first column, and t_r set equal to 15%. Similarly, "Roth/TDA Balance" is the after-tax balance in a Roth account of a \$1 pre-tax contribution after t years, as given by $(1 - t_i^0)Ce^{rT}$, or equivalently, the balance in a tax-deferred account if withdrawn after t years, for a household facing the marginal rate in the first column in year t: $(1 - t_i^t)Ce^{rT}$. The "Equivalent MTR" is the marginal tax rate on distributions that would equalize the after-tax value of the balance in a tax-deferred account distributed after t years to that of a taxable account with contributions subject to the MTR in the first column. this is calculated as $t_i^{T*} = 1 - (1 - t_i^0)/e^{rt_rT}$.

Table 1.3: Summary Statistics

A. Full Sample (1640 Observations)				
	Male Age 57		Male Age 67	
% Married	100		94	
Mean Number of Dependents	0.07		0.09	
Mean Number over 65	0.01		1.35	
	Fraction > 0	Conditional Mean	Fraction > 0	Conditional Mean
Primary Wages	0.79	$ 49,681	0.29	$ 22,710
Secondary Wages	0.63	$ 26,742	0.34	$ 22,222
Dividends	0.52	$ 1,573	0.29	$ 2,532
Other Property Income	0.43	$ 26,700	0.70	$ 26,381
Pension Income	0.06	$ 24,124	0.53	$ 23,190
Social Security Income	0.07	$ 8,962	0.83	$ 14,563
Non-taxable Transfers	0.04	$ 10,838	0.10	$ 12,263
Rent Paid	0.07	$ 7,915	0.07	$ 6,210
Property Tax Payments	0.81	$ 2,025	0.68	$ 16,955
Deductible Medical Expenses and Charitable Contributions	0.55	$ 3,763	0.47	$ 4,012
Unemployment Benefits	0.01	$ 3,060	0.01	$ 3,354
Mortgage Interest Payments	0.43	$ 4,075	0.29	$ 4,656
B. Sample with Tax-Deferred Accounts (1206 Observations)				
	Male Age 57		Male Age 67	
% Married	100		95	
Mean Number of Dependents	0.07		0.08	
Mean Number over 65	0.01		1.37	
	Fraction > 0	Conditional Mean	Fraction > 0	Conditional Mean
Primary Wages	0.85	$ 55,769	0.30	$ 25,074
Secondary Wages	0.69	$ 30,484	0.38	$ 23,117
Dividends	0.60	$ 1,667	0.35	$ 2,513
Other Capital Income	0.45	$ 28,821	0.87	$ 33,077
Pension Income	0.07	$ 26,274	0.56	$ 25,360
Social Security Income	0.05	$ 8,808	0.83	$ 15,182
Non-taxable Transfers	0.03	$ 11,586	0.08	$ 12,946
Rent Paid	0.04	$ 347	0.05	$ 7,415
Property Tax Payments	0.85	$ 2,226	0.71	$ 16,286
Deductible Medical Expenses and Charitable Contributions	0.62	$ 3,961	0.53	$ 4,280
Unemployment Benefits	0.01	$ 3,221	0.01	$ 3,737
Mortgage Interest Payments	0.45	$ 4,296	0.29	$ 5,023

Note: The full sample consists of couples in the HRS cohort with the male born between 1926 and 1935, married at the time the male is age 57 and not experiencing a divorce before the male reaches age 69, both alive in 1992, and both linked to Social Security Administration earnings histories. Wages and Social Security benefits are taken from SSA records. Other variables are derived from the 1992-2004 waves of the HRS or extrapolated as explained in the text. "Primary Wages" are the wages of the male if both members of the couple are surviving, or of the surviving widow(er). "Other Capital Income" includes interest, rental, and business income. "Mortgage Interest Payments" are calculated by multiplying reported mortgage debt by the average annual interest rate paid on a 30-year loan, according to HSH associates.

Table 1.4: Marginal Tax Rate Distributions at Selected Ages

	A. Full Sample: First Dollar Marginal Tax Rate					
MTR:	0 %	10 %	15 %	25 %	28 %	33 % or above
Age 57	11.0%	10.4%	40.5%	29.2%	5.9%	2.9%
Age 62	16.7%	14.9%	36.2%	23.4%	5.7%	3.1%
Age 65	30.9%	17.1%	25.5%	16.2%	7.3%	2.8%
Age 69	45.7%	13.0%	21.4%	9.1%	8.6%	2.1%
	B. Sample with Tax-Deferred Accounts: Last Dollar Marginal Tax Rate					
MTR:	0 %	10 %	15 %	25 %	28 %	33 % or above
Age 57	5.8%	7.5%	39.5%	34.4%	7.6%	5.2%
Age 62	8.7%	11.1%	35.2%	31.0%	8.6%	5.5%
Age 65	19.1%	14.9%	27.3%	23.0%	10.9%	4.8%
Age 69	32.2%	12.7%	23.6%	14.7%	13.3%	3.4%

Note: Marginal Tax Rates on contributions to or distributions from tax-deferred accounts as computed by NBER's TAXSIM program, using the real 2003 tax code adjusted to incorporate the real value of the Social Security benefit taxability thresholds in each year. "First Dollar" refers to the marginal rate on the first dollar contributed to or distributed from a tax-deferred account, and "Last Dollar" refers to the marginal rate on an additional contribution/distribution beyond the empirically observed amount.

Table 1.5: Distributions of First Dollar Marginal Tax Rates by Age 57 MTR

Age 57 MTR:	0 %	10 %	15 %	25 %	28 %	33 % or above
Age 57 Distribution:	11.0%	10.4%	40.5%	29.2%	5.9%	2.9%
Age 62 MTR						
0 %	54.1%	21.1%	12.6%	8.1%	2.9%	6.5%
10 %	21.6%	33.2%	14.8%	8.2%	9.5%	5.4%
15 %	18.9%	36.3%	50.8%	27.9%	22.0%	10.1%
25 %	3.1%	9.0%	16.5%	45.8%	34.0%	20.7%
28 %	2.0%	0.0%	4.3%	7.2%	22.8%	15.3%
33 % or above	0.4%	0.5%	1.0%	2.8%	8.9%	42.0%
Age 65 MTR						
0 %	59.7%	36.7%	30.0%	18.9%	19.6%	12.2%
10 %	15.6%	27.5%	20.5%	12.1%	9.3%	6.1%
15 %	17.1%	24.5%	28.1%	26.6%	26.5%	16.6%
25 %	5.4%	8.0%	14.5%	25.4%	27.1%	22.0%
28 %	1.4%	2.5%	5.8%	13.2%	10.5%	12.6%
33 % or above	0.9%	0.8%	1.1%	3.8%	7.0%	30.6%
Age 69 MTR						
0 %	66.8%	55.4%	47.8%	31.9%	27.8%	35.0%
10 %	10.1%	10.9%	16.1%	12.2%	8.3%	9.7%
15 %	11.9%	21.8%	19.5%	28.8%	23.7%	14.5%
25 %	6.1%	6.5%	6.4%	12.7%	16.8%	18.7%
28 %	4.7%	5.2%	9.1%	11.2%	19.7%	5.4%
33 % or above	0.4%	0.3%	1.0%	3.3%	3.7%	16.8%

Note: Marginal Tax Rates on contributions to or distributions from tax-deferred accounts as computed by NBER's TAXSIM program, using the real 2003 tax code adjusted to incorporate the real value of the Social Security benefit taxability thresholds in each year. "First Dollar" refers to the marginal rate on the first dollar contributed to or distributed from a tax-deferred account.

Table 1.6: First Dollar Preferences for Roth or Taxable Accounts Over Tax-Deferred Accounts

A. Percentages that Prefer a Roth Account to a Tax-Deferred Account

Age 57 MTR	Age 62	Age 65	Age 69
0 %	45.9%	40.0%	32.6%
10 %	48.1%	38.2%	34.5%
15 %	25.2%	23.9%	19.3%
25 %	14.8%	21.0%	16.7%
28 %	13.8%	10.3%	9.5%
33 % or above	13.8%	17.5%	9.5%
All	25.8%	25.3%	20.7%

B. Percentages that Prefer a Taxable Account to a Tax-Deferred Account Assuming a 6% Nominal Rate of Return

Age 57 MTR	Age 62	Age 65	Age 69
0 %	45.9%	39.6%	32.6%
10 %	45.8%	13.4%	11.8%
15 %	21.7%	21.4%	14.4%
25 %	5.7%	3.8%	2.9%
28 %	8.9%	7.0%	0.3%
33 % or above	2.9%	0.0%	0.0%
All	20.9%	15.9%	11.5%

C. Percentages that Prefer a Taxable Account to a Tax-Deferred Account Assuming a 10% Nominal Rate of Return

Age 57 MTR	Age 62	Age 65	Age 69
0 %	45.5%	24.5%	11.0%
10 %	11.9%	11.3%	8.0%
15 %	21.7%	14.6%	3.1%
25 %	2.6%	3.8%	0.0%
28 %	8.9%	1.2%	0.0%
33 % or above	2.9%	0.0%	0.0%
All	16.4%	11.0%	3.3%

Note: Households are said to prefer a Roth account if the MTR faced at a later age is higher than the MTR faced at age 57. Similarly, households are said to prefer a taxable account if the MTR faced at a later age is greater than the equivalent MTR associated with their age 57 MTR and the appropriate rate of return.

Table 1.7: Sample with Tax-Deferred Accounts: Distributions of Last Dollar Marginal Tax Rates by Age 57 MTR

Age 57 MTR:	0 %	10 %	15 %	25 %	28 %	33 % or above
Age 57 Distribution:	5.8%	7.5%	39.5%	34.4%	7.6%	5.2%
Age 62 MTR						
0 %	24.0%	10.7%	10.2%	6.0%	1.1%	2.7%
10 %	25.1%	22.0%	12.0%	7.7%	5.3%	3.3%
15 %	44.3%	50.9%	49.6%	22.2%	13.1%	10.5%
25 %	4.7%	14.9%	23.5%	46.4%	41.6%	23.0%
28 %	1.0%	0.8%	3.7%	13.7%	21.9%	18.3%
33 % or above	0.9%	0.8%	1.1%	4.0%	17.0%	42.2%
Age 65 MTR						
0 %	25.3%	25.6%	22.7%	15.0%	8.8%	8.1%
10 %	29.9%	22.3%	17.8%	9.9%	2.7%	5.0%
15 %	30.1%	33.6%	29.1%	25.2%	28.8%	13.4%
25 %	6.4%	15.7%	19.8%	28.6%	34.6%	33.2%
28 %	5.4%	2.7%	9.5%	15.6%	14.2%	12.0%
33 % or above	2.9%	0.0%	1.2%	5.8%	10.9%	28.4%
Age 69 MTR						
0 %	49.1%	42.2%	38.6%	21.3%	19.5%	20.6%
10 %	17.1%	14.4%	13.9%	13.9%	7.8%	4.7%
15 %	17.4%	29.2%	21.8%	26.5%	20.9%	19.6%
25 %	8.1%	6.9%	10.7%	19.7%	25.0%	23.1%
28 %	7.4%	7.0%	13.9%	14.8%	16.7%	18.6%
33 % or above	0.9%	0.5%	1.1%	3.7%	10.1%	13.4%

Note: Marginal Tax Rates on contributions to or distributions from tax-deferred accounts as computed by NBER's TAXSIM program, using the real 2003 tax code adjusted to incorporate the real value of the Social Security benefit taxability thresholds in each year. "Last Dollar" refers to the marginal rate on an additional contributions or distributions beyond the empirically observed or simulated amount.

Table 1.8: Sample with Tax-Deferred Accounts: Last Dollar Preferences for Roth or Taxable Accounts Over Tax-Deferred Accounts

A. Percentages that Prefer a Roth Account to a Tax-Deferred Account

Age 57 MTR	Age 62	Age 65	Age 69
0 %	76.0%	74.5%	50.9%
10 %	69.5%	53.5%	42.8%
15 %	32.1%	33.6%	29.6%
25 %	23.0%	25.7%	20.5%
28 %	18.5%	13.7%	17.1%
33 % or above	15.5%	19.9%	8.9%
All	32.4%	32.5%	26.6%

B. Percentages that Prefer a Taxable Account to a Tax-Deferred Account Assuming a 6% Nominal Rate of Return

Age 57 MTR	Age 62	Age 65	Age 69
0 %	76.0%	73.8%	49.0%
10 %	67.4%	19.5%	14.1%
15 %	28.3%	30.3%	22.3%
25 %	10.1%	5.8%	3.4%
28 %	17.0%	9.5%	1.8%
33 % or above	2.1%	0.0%	0.0%
All	25.5%	20.4%	14.0%

C. Percentages that Prefer a Taxable Account to a Tax-Deferred Account Assuming a 10% Nominal Rate of Return

Age 57 MTR	Age 62	Age 65	Age 69
0 %	75.1%	44.8%	16.4%
10 %	17.6%	17.1%	11.9%
15 %	28.3%	21.9%	3.9%
25 %	3.5%	5.8%	0.3%
28 %	17.0%	2.8%	0.0%
33 % or above	2.1%	0.0%	0.0%
All	19.4%	14.7%	3.5%

Note: Households are said to prefer a Roth account if the MTR faced at a later age is higher than the MTR faced at age 57. Similarly, households are said to prefer a taxable account if the MTR faced at a later age is greater than the equivalent MTR associated with their age 57 MTR and the appropriate rate of return.

Table 1.9: Distributions of Taxable Income by Age 57 Tax Bracket

Age 57 Tax Bracket:	0 %	10 %	15 %	25 %	28 %	33 % or 35 %
Taxable Income:	Below $0	$1 - $14,000	$14,001 - $56,800	$56,801 - $114,650	$114,651 - $174,700	Above $174,701
Age 57 Distribution:	11.3%	4.6%	15.7%	40.0%	23.4%	5.0%
Age 62 Tax Bracket						
0 %	54.0%	25.6%	13.7%	12.1%	6.3%	3.6%
10 %	11.7%	16.1%	9.3%	7.2%	2.4%	7.0%
15 %	18.8%	37.0%	67.5%	18.9%	9.7%	3.7%
25 %	11.7%	19.3%	26.0%	45.2%	33.6%	20.1%
28 %	2.7%	2.1%	5.2%	14.8%	41.6%	25.4%
33 % or 35 %	1.1%	0.0%	1.3%	1.9%	6.5%	40.2%
Percent in Higher Tax Bracket at Age 62	46.0%	58.4%	32.5%	16.7%	6.5%	9.2%
Age 65 Tax Bracket						
0 %	58.8%	43.8%	32.3%	26.6%	18.7%	12.1%
10 %	8.5%	20.3%	15.2%	12.4%	7.3%	3.9%
15 %	20.7%	25.2%	31.5%	25.0%	18.3%	25.1%
25 %	7.1%	9.1%	14.8%	24.9%	32.2%	21.9%
28 %	3.4%	0.0%	5.6%	8.5%	16.9%	28.3%
33 % or 35 %	1.5%	1.7%	0.2%	2.6%	6.6%	24.7%
Percent in Higher Tax Bracket at Age 62	41.3%	36.0%	20.7%	11.1%	6.6%	10.3%
Age 69 Tax Bracket						
0 %	66.8%	64.7%	51.4%	44.0%	32.8%	37.8%
10 %	8.2%	10.9%	13.2%	13.0%	9.8%	5.5%
15 %	14.1%	18.6%	22.3%	24.0%	24.4%	13.2%
25 %	8.8%	5.8%	10.2%	13.2%	19.8%	14.7%
28 %	1.7%	0.0%	1.9%	4.1%	9.7%	19.8%
33 % or 35 %	0.4%	0.0%	0.9%	1.7%	3.5%	9.1%
Percent in Higher Tax Bracket at Age 62	33.2%	24.4%	13.1%	5.8%	3.5%	5.7%

Note: Taxable income was computed by NBER's TAXSIM program, then converted to the appropriate tax bracket using the real 2003 tax code.

Table 1.10: Selected Household Characteristics, by Age and Sample

A. Percentage of Households with at least One Wage-Earner				
Age	All Households	Higher MTR	MTR > 6% Equivalent	MTR > 10% Equivalent
62	77.4%	84.2%	82.8%	84.5%
65	60.1%	71.6%	71.5%	72.4%
69	42.9%	58.7%	60.9%	50.3%
B. Percentage of Households with Two Wage-Earners				
Age	All Households	Higher MTR	MTR > 6% Equivalent	MTR > 10% Equivalent
62	37.3%	44.4%	40.9%	42.0%
65	21.7%	33.1%	30.3%	29.9%
69	10.4%	19.0%	20.5%	18.7%
C. Percentage of Households Widowed				
Age	All Households	Higher MTR	MTR > 6% Equivalent	MTR > 10% Equivalent
62	1.52%	0.51%	0.45%	0.46%
65	3.58%	1.62%	1.80%	1.95%
69	7.54%	4.14%	4.25%	2.23%

Note: "All Households" is the full HRS sample analyzed in this paper, couples with males born between 1926 and 1935, observed as married at male age 57 and in 1992, and not experiencing a divorce before male age 69. The "Higher MTR" sample are those households experiencing a higher marginal rate at the given age than at age 57, who would have fared better with a Roth Account rather than a TDA. Similarly, the "MTR > X% Equivalent" samples are those households facing a marginal rate at later ages that exceeds the equivalent rate associated with their Age 57 MTR and the specified rate of return.

Table 1.11: Distributions of Social Security Taxability: Households Receiving Social Security Benefits

A. Age 62

Taxability Classification:	Benefits Not Taxable	Phase in to 50% Taxability	Benefits 50% Taxable	Phase in to 85% Taxability	Benefits 85% Taxable
Effect on MTR:	No Effect	$MTR * 1.5$	No Effect	$MTR * 1.85$	No Effect
Sample					
All Households	46.1%	3.6%	25.8%	2.3%	22.3
Higher MTR	22.6%	10.7%	22.5%	9.6%	34.5
MTR > 6% Equivalent	24.7%	12.9%	22.8%	7.8%	31.8
MTR > 10% Equivalent	21.3%	15.9%	18.2%	9.6%	35.0

B. Age 65

Taxability Classification:	Benefits Not Taxable	Phase in to 50% Taxability	Benefits 50% Taxable	Phase in to 85% Taxability	Benefits 85% Taxable
Effect on MTR:	No Effect	$MTR * 1.5$	No Effect	$MTR * 1.85$	No Effect
Sample					
All Households	46.8%	8.5%	13.3%	6.1%	25.3
Higher MTR	12.6%	15.7%	10.4%	22.5%	38.9
MTR > 6% Equivalent	13.5%	21.9%	8.5%	18.2%	38.0
MTR > 10% Equivalent	4.5%	8.5%	12.2%	27.1%	47.7

C. Age 69

Taxability Classification:	Benefits Not Taxable	Phase in to 50% Taxability	Benefits 50% Taxable	Phase in to 85% Taxability	Benefits 85% Taxable
Effect on MTR:	No Effect	$MTR * 1.5$	No Effect	$MTR * 1.85$	No Effect
Sample					
All Households	49.3%	12.2%	3.7%	8.8%	26.1
Higher MTR	6.6%	13.1%	5.0%	35.0%	40.3
MTR > 6% Equivalent	8.6%	6.8%	3.2%	34.4%	47.1
MTR > 10% Equivalent	6.8%	0.0%	0.0%	42.0%	51.2

Note: Social Security taxability classifications were determined by calculating AGI (excluding Social Security benefits) using the NBER's TAXSIM, based the real 2003 tax code, and then adding half of Social Security benefits and comparing the total to the real thresholds for Social Security benefit taxability that apply in a given year. See the note to Table 1.10 regarding the different samples.

Appendix: Tax-Favored Savings Accounts

The first type of tax-favored account made available in the United States was the Keogh Plan in 1962, allowing self-employed individuals and unincorporated businesses to set up pensions paralleling any approved employer-sponsored pension plan. Thus those that qualified for a Keogh pension could set up a tax-deferred savings account patterned after a money-purchase plan or profit-sharing plan, or even a defined benefit plan. Such plans were subject to the same rules and contribution limits as the comparable employer-sponsored plans.

Tax-deferred savings at the individual level was then offered to all tax-payers through Individual Retirement Accounts, or IRAs, which were introduced by tax code amendments that were part of the Employee Retirement Income Security Act (ERISA) of 1974. As additional types of IRAs have proliferated in subsequent years, the original IRA has come to be designated a traditional IRA.[21] These accounts can be set up at almost any financial institution, and can contain almost any type of asset.[22] Anyone can set up an account and in 2007, contribution limits are the lesser of the individual's earnings or \$4,000, and \$5,000 if over age 50. Contributions can no longer be made after an individual has reached age $70\frac{1}{2}$. For those with tax-filing status of married filing jointly (single) and a modified adjusted gross income[23] (MAGI) less than \$83,000 (\$52,000), contributions are fully tax-deductible. The deductibility of contributions is gradually phased out until MAGI reaches \$103,000 (\$62,000). No tax is levied on any financial accrual that takes place within the account, and when funds are distributed from the account, distributions are taxed as ordinary income, with an adjustment for the basis of taxable contributions. Distributions taken before the

[21] For more details on IRA tax rules, see IRS *Publication 590* (2007).

[22] Some types of real estate, including residences, are excluded.

[23] The MAGI that applies for IRA eligibility is calculated by adding non-taxable interest, excluded foreign income/housing and several deductions back into the adjusted gross income calculated on an individual's 1040 tax form. Deductions that must be added back into MAGI include deductible IRA contributions, interest on student loans, tuition payments, and adoption benefits.

account holder reaches age $59\frac{1}{2}$ are subject to an additional penalty tax of 10%, with some exceptions for disability, medical expenditures, and the purchase of a first home. Starting at age $70\frac{1}{2}$, the account holder must take annual minimum distributions or be subject to a 50% tax on the amount of the required distribution. The minimum distribution is equal to some percentage of the account balance, determined by the age of the account holder and sometimes her spouse. The primary attraction of an IRA is its tax-favored status. In effect, this type of account eliminates taxation of capital income as well as deferring taxation of ordinary income until retirement.

In 1978, Congress amended the tax code by adding section 401(k), which allowed employers to provide tax-deferred retirement savings accounts for employees. The offering of such plans gradually increased after the rules were clarified in 1981, and similar plans have been added to the tax code to make tax-deferred savings available to employees of non-profit corporations such as educational institutions and hospitals (section 403(b)) and employees of state and local governments (section 457). In contrast to IRAs, these plans are offered and managed by the employer, who is responsible for choosing investment options and negotiating fees. Investment options typically include various mutual funds with different percentages of stocks, bonds, and money market funds, and often company stock as well. Employees then choose how to allocate their account balances across the available investment options. Employees can elect to have some part of their wages paid directly into the account, and many employers also contribute to the accounts, either by making a fixed contribution or by matching some percentage of the employee's contribution. All funds are non-taxable at the time of contribution, unless contributed to a designated Roth account, as will be explained below. Generally any employee is eligible to contribute to a 401(k) if the employer offers such a plan, making tax-deferred savings available to many that are disqualified from tax-deferred contributions to an IRA because of high income. In addition, the contribution limits are significantly higher than the contribution limits to an IRA: $15,500 per employee under 50 years old in 2007, and $20,500 for employees over 50 years of age. Distributions from 401(k) accounts are taxable as ordinary income and subject to similar rules as IRAs-penalty taxes are levied on most distributions before age $59\frac{1}{2}$, and minimum distributions are required after age $70\frac{1}{2}$ unless the account holder remains an employee of the company providing the plan. One significant difference is that many 401(k) plans offer participants the ability to make a loan to oneself against the assets for a period of up to five years and at a specified interest rate. However, default on such a loan is treated as a distribution and thus subject to both regular and penalty taxes, as applicable. When an employee with a 401(k) account leaves the firm, she has several options: she can leave the money in the firm's 401(k) but no longer make contributions, she can "roll over" the account into an IRA, or she can roll over the account into a 401(k) offered by her new employer. Defined contribution plans such as 401(k)s, 403(b)s and 457s have become increasing popular among both firms and employees, to firms because of their administrative simplicity, and to employees because they provide large scope for tax-deferred savings. In addition, the tax code now makes available specialized IRAs to the self-employed and small businesses, SEP IRAs and Simple IRAs, further extending the reach of tax-deferred savings opportunities.

Another amendment to the tax code was sponsored by Senator William Roth in 1998, creating a tax-favored IRA that is not tax-deferred. Contributions to a Roth IRA are not tax-deductible, but neither accrual within the account nor distributions from the account are taxable. Because funds contributed to the accounts have already been subject to tax, the principal invested, though not the accrual, can be withdrawn without facing a penalty tax at any time after the account has been open for five years, or "seasoned." In addition, Roth IRAs are never subject to minimum distribution requirements, and contributions can be made at any age. The opportunity to contribute to a Roth IRA is limited by income. For those married filing jointly (single), eligibility begins to phase out at a MAGI of $156,000 ($99,000) and is fully phased out when MAGI reaches $166,000 ($114,000). Also, the sum of annual contributions to traditional IRAs and Roth IRAs must not exceed the annual limits specified for IRAs. In spite of the relatively low contribution limits, Roth IRA accounts may be an important component of retirement savings for many households because a 401(k) or traditional IRA can be rolled over into a Roth IRA. This has the consequence of incurring tax liability for the funds rolled over in the year of the rollover. After a seasoning period of five years, contributions that have been rolled over can be withdrawn without penalty, just like regular Roth IRA contributions. Roth IRA accounts have become popular among those who expect a higher marginal tax rate in retirement, either because of low current income, large deductions, or the expectation that future statutory rates will increase.

The popularity of Roth IRAs led to the addition of a Roth 401(k) option in 2006. Under the new law, firms may choose to give their employees the option of creating a designated Roth account within the 401(k) plan, to which after-tax employee contributions, but not employer contributions, may be directed. These funds are not taxable upon withdrawal, but in other respects the accounts are similar to tax-deferred 401(k)s: they have the same contribution limits and the same rules regarding the ages at which distributions avoid penalty taxes and at which minimum distributions are required.[24] At the current time, few companies have made such plans available, partly because they increase the administrative burden on the firm by potentially doubling the number of accounts the firm must track. However, because of the attractiveness of Roth-style tax-favoring to employees, it is likely that Roth 401(k) offerings will increase over time.

[24]See IRS Publication 4530.

Chapter 2

Bequests and Tax-Favored Assets in the U.S.

2.1 Introduction

Individual tax-favored retirement accounts became widely available in the U.S. in 1974, in the form of Individual Retirement Arrangements (IRAs).[1] IRAs were followed by employer-sponsored 401(k), 503(b), and 457 plans, SEP and Simple IRAs for the self-employed, Roth IRAs, and most recently, Roth 401(k) accounts. Retirement accounts have accordingly received a great deal of attention from economists. Questions studied include whether or not contributions to these accounts represent new savings,[2] how the substitution of these accounts for traditional pensions will affect consumption and security in retirement,[3] and how the accounts interact with various features of the tax system.[4] Almost all of the papers

[1]Keogh plans for the self-employed appeared even earlier, in 1962.

[2]See Engen, Gale and Scholz (1996), Poterba, Venti and Wise (1996), and Engen and Gale (2000).

[3]See Poterba, Rauh, Venti, and Wise 92007), Samwick and Skinner (2004), and Schrager (2006).

[4]Gokhale, Kotlikoff and Neumann (2001) and Butricia, Smith and Toder (2008) discuss how tax-favored accounts affect Social Security benefit taxation. Bowen Bishop (2008) investigates the tradeoff between Roth

address these issues within the context of the life-cycle savings model. However, tax-favored accounts can also be used to leave bequests, and in practice, such bequests are not uncommon. This paper explores the tax incentives associated with bequeathing tax-favored accounts and calculates the available tax benefits using a simulation model. The benchmark model calculates that the tax savings associated with a tax-deferred account (TDA) that is used to optimally bequeath assets exceeds the tax savings of a TDA used to produce a steady stream of retirement income by 27.2%. Use of a Roth account for the bequest raises tax savings by an additional 32% over a bequeathed TDA.

In a regular taxable account, investments are made with after-tax dollars, interest and dividend payments are taxed upon accrual, and any capital gains are taxable upon realization. Contributions to Roth accounts are also made with after-tax dollars, but neither accruals within the account nor distributions from the account are subject to taxation. In contrast, contributions to TDAs are tax-deductible, accruals are not subject to taxation while remaining in the account, but distributions from the account are taxed as ordinary income. If marginal income tax rates do not change over time, assets withdrawn from tax-deferred accounts will have the same after-tax value as a comparable investment in a Roth account, and both Roth and TDAs effectively eliminate the taxation of capital income. When marginal income tax rates change over time, TDAs can also change the applicable marginal tax rates that apply to distributions from the account.[5] With respect to bequests, assets outside of tax-favored accounts are taxed relatively more lightly than during life, because bequeathed assets experience a basis step-up at death, eliminating tax liability for capital gains between the time of purchase and the time of the bequest. Though this reduces the tax burden on the return to such assets, generally it is at most equivalent to the tax treatment

and tax-deferred accounts across the income distribution, and Kotlikoff, Marx and Raphson (2008) looks at how expectations about the future of the tax code affect the trade-off between Roth and tax-deferred accounts.

[5]See Bowen Bishop 2008 for a more formal presentation of these effects.

of assets in Roth accounts.[6] In comparison to TDAs, the same is true if the beneficiary does not face a higher MTR than the owner would have paid.[7] This suggests that leaving bequests in the form of tax-favored assets provides an opportunity for tax-savings in many cases.

A large fraction of retirees expect to leave a bequest. Hurd and Smith (2002) report that at least two-thirds of each retiree cohort in the Health and Retirement Study (HRS) expect to leave a bequest of \$10,000 or more, and 38-46% expect to leave a bequest exceeding \$100,000. These bequests are likely to include assets held in tax-favored accounts. However, to date only one paper has looked at how tax-favored savings might affect bequests. Munnell et al. (2002) predicted that the switch from defined benefit to defined contribution pension plans would lead to an \$28 billion increase in aggregate wealth holdings of 2004 decedents. This increase reflects rises in both intentional and unintentional bequests because elderly households are more reluctant to spend assets than income. The implications of Munnell et al. (2002) are based the switch from annuity retirement income to assets, and do not focus on the tax-favored nature of defined contribution savings plans.

The incentives that retirement accounts offer for the composition of bequests, the quantity of bequeathed assets in tax-favored accounts, and the magnitude of the associated tax savings should inform economic and political discussions of these accounts. None of these issues have been considered in the previous literature on bequests or tax-preferred savings accounts. The object of this paper is to remedy that deficiency.

[6]If all of the return to an investment comes in the form of capital gains, the investment is sold at the time of the bequest, and the capital gain is not reinvested elsewhere, then the basis-step-up associated with the bequest eliminates all capital income taxation. If any of the return comes in the form of interest payments or dividends, or if the asset continues to appreciate in value before being sold, the tax-burden will be greater for the taxable account than for a Roth account. Only if an asset loses value after the basis-step up, triggering a capital loss, and the heir has other taxable capital gains against which such losses can be deducted, could a bequeathed taxable account offer a tax-advantage over a Roth account.

[7]If the beneficiary's MTR is higher, whether the taxable account outperforms the TDA will depend on the size of the MTR differential relative to the competing benefits of the TDA.

This paper proceeds in the next section by outlining the institutional rules that govern the bequest of tax-favored accounts. Section 3 reviews the evidence on the quantity of annual flows of bequests of tax-deferred assets. This is followed by a theoretical investigation of the incentives facing households with tax-favored accounts that will be used as bequests. The fifth section of the paper presents simulation models that calculate the potential tax savings associated with bequeathed tax-favored accounts, and the final section concludes.

2.2 Tax Rules Governing Bequeathed Assets

Tax-favored accounts can be broadly categorized along two dimensions. The first dimension is whether the account functions as a pension plan offered by an employer, such as a 401(k), or is a stand-alone individual account, such as an IRA. SEP and Simple IRAs for the self-employed occupy the middle ground between these poles. For the purposes of this paper, such distinctions are mostly unimportant, and will not be emphasized. The second dimension is whether the account features tax-deductible contributions, as does a traditional IRA, or tax-exempt distributions, as does a Roth IRA. A major difference between Roth and tax-deferred accounts is the timing of income taxation, and as a result, possible differences in the marginal tax rate that applies. In addition, Roth accounts are subject to different distribution rules, and thus slightly different tax benefits.

During the account holder's lifetime, tax-favored accounts are subject to rules on contribution eligibility and limits, penalty taxes on non-qualified distributions before age $59\frac{1}{2}$, and in some cases, required minimum distributions (RMDs) after age $70\frac{1}{2}$. Roth IRAs are not subject to any RMDs during the account holder's lifetime. For tax-deferred accounts and Roth 401(k)s,[8] RMDs are calculated by multiplying the account balance at the end of the previous year by one over the distribution factor associated with the account owner's age at the end of the current year, as shown in Table 2.1.[9] In the year of the account owner's death, the applicable RMD, if any, must be taken by some combination of the decedent, the decedent's estate, and the beneficiary.[10] In subsequent years, rules for the inherited account depend on the type of account and the identity of the beneficiary.

Providers of 401(k)s, 503(b)s, 457s and similar plans are not expected to manage assets for heirs indefinitely. Upon the death of the plan participant, assets in such plans are required by federal laws to be removed within five years. In some cases, individual plan rules are more restrictive and require funds to be distributed within one year. If distributions from an inherited, tax-deferred 401(k) or similar plan are withdrawn and not rolled over into an IRA, they are subject to ordinary income taxation in that year and receive no future tax advantages, though no penalty taxes for early withdrawal are levied. Similarly, assets withdrawn from a Roth account within the plan will no longer be exempt from capital income taxation unless rolled over into a Roth IRA. Originally, only plans with a spouse as the designated beneficiary could be rolled over into an IRA. In such cases, the IRA is in the spouse's name and subject to the same rules regarding distributions as any other IRA owned by the spouse. The Pension Protection Act of 2006 tried to give a similar option to other beneficiaries by allowing assets left to a non-spouse beneficiary to be rolled over into an inherited IRA in the beneficiary's name, subject to the rules that will be described below.

[8]Roth accounts within a 401(k) plan are subject to the same rules regarding distributions as other accounts in the 401(k) plan except for the tax treatment. Thus distributions from Roth 401(k)s before age $59\frac{1}{2}$ are subject to a penalty tax, and RMDs are required after age $70\frac{1}{2}$. See IRS publication 4530. This creates an incentive to roll over Roth 401(k) balances into a Roth IRA after leaving a job that offered a Roth 401(k) account.

[9]See the appendix of Bowen Bishop (2008) for a summary of the rules for such accounts during the owner's lifetime. Details of all rules regarding IRAs for each tax year can be found in IRS Publication 590 for that year.

[10]The required beginning date for distributions is April 1 of the year after the account holder reaches age $70\frac{1}{2}$. If the account owner dies after reaching age $70\frac{1}{2}$ but before this date, there is no RMD for the year of death.

However, the IRS ruled in 2007 that plans were not required to offer this option, and few plans did so. As a result, a provision of the Worker, Retiree, and Employer Recovery Act of 2008 makes it mandatory for plans to offer this option as of January 1, 2010.[11]

2.2.1 Minimum Distributions from Inherited IRAs

Rules for inherited IRAs vary depending upon whether the beneficiary is the account owner's spouse, some other individual, or a non-individual, such as the decedent's estate or a charitable organization.[12] Any type of beneficiary can elect to remove all assets from the account within five years after the account owner's death. In this case, the beneficiary is exempt from the annual distributions that would otherwise be required.

If the sole beneficiary of an Individual Retirement Arrangement (IRA) is the spouse of the account holder, the spouse has the option of being treated as the owner of the account, of rolling the account over into her own IRA, or of being treated as a non-spouse beneficiary. The IRA is deemed to belong to the spouse only if the spouse makes contributions to the IRA or fails to take a distribution that would be required of a beneficiary. A spouse that receives a distribution from an IRA but is not the sole beneficiary may also roll the distribution over into her own IRA. Once the IRA is rolled over or owned by the spouse, it is subject to the same rules regarding contributions, rollovers, and distributions as any other IRA she owns.

Non-spouse beneficiaries of inherited IRAs are required to take RMDs each year after the year in which the account owner dies.[13] They cannot make contributions to the account

[11]See "New Rollover Rules for 401(k) Heirs," *Wall Street Journal*, Feb. 15, 2009.

[12]If the beneficiary of the account is an irrevocable trust with transparent beneficiaries, the account is subject to the rules that would apply if the account had been left directly to those individuals.

[13]An exception is a spouse that chooses to be treated as a beneficiary of an account with an owner that died before reaching the date when distributions are required to begin. In this case RMDs are not required until the year that the owner would have reached age $70\frac{1}{2}$.

or roll it over into another account unless the other account is also inherited from same decedent. If the IRA has multiple beneficiaries, RMDs are based on the beneficiary with the shortest life expectancy. The amount of the RMD depends on the age of the decedent, the age of the beneficiary, and whether the account was a traditional or Roth IRA.

If the account is a Roth IRA, or a traditional IRA and the owner died before reaching the date at which distributions must begin, there is no RMD for the year of the owner's death. If the beneficiary is not an individual, the entire account balance must be withdrawn within five years, but there are no annual distribution requirements. If the beneficiary is an individual, each subsequent year the RMD is equal to the balance of the account at the end of the previous year multiplied by 1 over a distribution factor. The distribution factor in the first year is the beneficiary's life expectancy as shown in Table 2.2. In each subsequent year, the distribution factor is reduced by one. For example, suppose Alice died in 2007 and the beneficiary of her account is her son Bob. In 2008, Bob is 46, so his distribution factor for 2008 is equal to his life expectancy of 37.9 years. In 2009, his distribution factor will be reduced by one to 36.9.

If the account is a traditional IRA and the owner died after reaching the date at which distributions must begin, the RMD for the year of the owner's death is the same as the distribution that would have been required if the owner had not died. As in the previous case, in subsequent years the beneficiary must take RMDs determined by a distribution factor. If the beneficiary is an institution, the distribution factor is the life expectancy from Table 2.2 that corresponds to the age of the owner at the end of the year of death less one for every year after the year of death. For example, if account owner died in 2007 at age 88, the distribution factor for 2008 is 5.3, corresponding to a life expectancy of 6.3 years reduced by one. If the beneficiary of this account is an individual, the distribution factor is the larger of the factor that would apply to an institution and the factor based on the beneficiary's life expectancy. In subsequent years, the distribution factor that applied in the first year is reduced by one for each year that has passed since the account owner's death.

2.2.2 Estate Taxation

The final set of tax rules that are important for thinking about bequests of tax-favored accounts are those relating to the estate and gift tax. The estate and gift taxes are integrated by a unified credit that exempts taxation of estates up to a certain size. This credit may be used against taxable gifts while alive,[14] and any remaining credit is applied to the estate at death. In recent years, estate tax rules have been in flux because the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA 2001) gradually increased the unified credit and reduced the top marginal rates, and will abolish the tax in 2010. However, this act is set to "sunset" in 2011, when estate tax rules will revert to those established under prior law. I will first discuss estate tax rules existing before EGTRRA 2001, and then note the changes temporarily accomplished by this act.

To calculate the tax due on a decedent's estate, the size of the taxable estate must first be determined. The adjusted taxable estate is the gross value of the estate, including the value of any assets in tax-favored accounts, plus any taxable gifts given during the decedent's lifetime, less deductions such as funeral expenses, charitable contributions, property left to a spouse, and fees for administering the estate.[15] The tentative estate tax is then calculated from the adjusted taxable estate using a series of progressive tax tables with marginal rates ranging from 18% to 60%.[16] The net estate tax due is the difference between this amount

[14]In 2008, gifts of more than $12,000 to any individual are taxable. Each member of a married couple may give such a gift to the same individual before incurring tax liability. See IRS Publication 950.

[15]A few other deductions aim to avoid triggering the liquidation of a small family farm or business.

[16]The top rate is the sum of the 55% marginal rate on estates greater than $3 million plus a 5% surcharge on estates with an adjusted value between $10 million and $17,184,000 that phases out the progressivity of the rates. See Noto (2006) for more details and tax tables for each year since 2001.

and the unified credit, less other credits for state and foreign estate taxes paid. Until 1998, the maximum exemption under the unified credit was $600,000, but the Tax Reform Act of 1997 scheduled a gradual increase in the exemption to reach $1 million in 2006. Thus estates that would be subject to the lowest marginal rates actually pay no tax because of the unified credit. The lowest marginal rate paid by estates large enough to exceed the credit was 37% in 2001, and will be 41% in 2006 and beyond. In addition, a generation-skipping transfer tax is added to gifts or bequests that exceed the exemption level and are made to individuals more than one generation younger than the donor. The unified credit and other estate tax credits are not refundable.

Under EGTRRA 2001, the unified credit exempts taxation of combined taxable gifts and estates of $1.5 million in 2003-2005, $2 million in 2006-2008, and $3.5 million in 2009. The law also gradually decreases the top marginal rate, set at 50% in 2002 and dropping to 45% in 2007. In 2007-2009, the estate tax is a flat tax of 45% on estates larger than the exemption value. As mentioned previously, the estate tax is repealed in 2010, but the expiration of EGTRRA 2001 means that the unified credit will revert to $1 million in 2011 with marginal rates ranging from 41% to 60%, as set by TRA 1997. Before EGTRRA 2001 was passed, approximately 2.1% of adult deaths resulted in a taxable estate. In 2004, the latest year for which data are available, 0.82% of adult deaths led to a taxable estate. Had the exemption amount been $3.5 million in 2004, only 0.26% of adult deaths would have incurred the estate tax.[17] Because of the high exemption levels, the estate tax will not be of concern to a large subset of individuals planning to leave a bequest.

[17]See Raub (2008) and SOI Historical Table 17 at `http://www.irs.gov/taxstats`.

2.3 Flows of Tax-Favored Bequests

Because local probate records vary in format and content, and are generally not digital, comprehensive data on bequest flows in the United States are difficult to obtain. Two types of data exist, both with flaws. In spite of these shortcomings, this paper reviews some existing evidence of both types.

First, the Internal Revenue Service (IRS) collects data on bequests from estate tax returns and reports the results in the Statistics of Income (SOI). Raub (2007) calculates the quantities of total assets and retirement assets reported in estate tax returns filed between 2001 and 2007.[18] Total flows of retirement assets held by decedents filing estate tax returns during this period range from $12 to $18 billion per year, comprising 6.5% to 8.5% of total estate assets. The SOI category of retirement assets includes IRAs, defined contribution plans such as 401(k)s, annuities, and the taxable portion of survivor benefits from defined benefit pension plans. Tax-favored savings accounts make up much, but not all of this number.[19]

A large fraction of the assets appearing in estate tax returns are left to a spouse and may be of less interest in the context of analyzing household bequest decisions. Because assets left to a spouse are exempt from estate taxation, analysis of assets bequeathed by taxable estates may be more relevant to understanding the size of transfers of tax-favored assets to future generations.[20] Retirement assets make up a smaller fraction of these estates,

[18]Estate tax returns are due nine months after the date of death, but six-month extensions are commonly allowed, as well as some longer extensions. Thus estate tax returns filed in any given year correspond to deaths in several previous years. The SOI Estate Tax Tables can be found at `http://www.irs.gov/taxstats/indtaxstats/article/0,,id=96442,00.html`.

[19]Note that because the estate tax exemption level has changed frequently over this time period, time trends observed in this data are not likely to be meaningful.

[20]Assets reported in taxable estates are not guaranteed to bequeathed to a future generation. For example, they might be left to the decedent's sibling. In addition, it is possible that some taxable estates belong to decedents with a living spouse, perhaps not the parent of the decedent's children, that will inherit some portion of the assets. Finally, some assets are bequeathed to charitable or other institutions that cannot properly be assigned to a generation.

4.3% to 5.5%. A few reasons for this may be that the account owners are older and have had to take more RMDs out of tax-favored accounts, or that survivor benefits from defined benefit pension plans are often only available to a surviving spouse. Annual transfers of retirement accounts in these estates total approximately $4.5 to $6.5 billion.

Estate tax data is highly detailed and comprehensively accounts for the assets of decedents at the time of death, but is only available for those required to file an estate tax return. Because distributions of wealth holdings are highly skewed, estate tax returns include a larger fraction of total asset flows than the fraction of decedents that file a return.[21] However, limits on eligibility and the size of contributions to tax-favored accounts suggest that the distribution of tax-favored assets is likely to be less skewed than the distribution of total assets.[22]

Table 2.3 compares the distribution of asset holdings reported in estate tax returns with assets held by households in the Survey of Consumer Finances (SCF). As expected, retirement assets make up a larger fraction of assets for the general population than for decedents filing estate tax returns, because contribution limits to TFAs are more likely to be binding for households with the greatest net worth. Another explanation for this result is that the age distribution of SCF households differs from the age distribution of decedents. Because access to tax-favored savings vehicles has increased over the past few decades, younger households are more likely to have made greater use of these accounts.[23]

The second type of data is household wealth data available from various surveys of the general population. By applying probabilities of death to various types of households,

[21]See Table 4 of Bucks et al. (2007), for example, showing net worth in the 2007 Survey of Consumer Finances.

[22]Suggestive evidence on this point is that the 2007 Survey of Consumer Finances found that 51.7% of households with a household head between the ages of 65 and 74 held some assets in a retirement account, while only 19.9% held stocks outside of these accounts (Table 6 of Bucks et al. 2007).

[23]Table 2.3 also shows that personal residences, another asset class that receives advantageous tax treatment, are similarly under-represented in the estate tax returns. Capital gains on a primary residence of up to $250,000 for singles and $500,000 for married couples are exempt from taxation.

this data can be used to calculate estimates of asset flows of decedents.[24] Analysis of the SOI also provides some data of this type: from a sample of tax returns, Bryant (2008) estimates aggregate IRA balances in the U.S. population in 2004.[25] These are presented in Table 2.4, along with death rates calculated from the 2004 Period Life Table published by the Social Security Administration.[26] The death rates for each age range are weighted means of the age- and gender-specific death rates. In total, the estimated bequests of IRA assets in 2004 exceeds $58 billion, or 1.76% of the sum of IRA balances.[27]

This second approach produces estimates of IRA bequest flows that should be highly representative, but suffers from other disadvantages. First, it can only capture asset values at some moment during life, rather than at the time of death, when wealth may be different. In particular, it is likely that in some cases end-of-life medical expenses will have caused the decedent's net worth to decrease substantially. Second, the estimates are biased inasmuch as the mortality rates of owners of IRAs differ from the mortality rates of the general population. Because IRA ownership is positively correlated with income and wealth,[28] which are negatively correlated with mortality, the above calculation is likely to overstate the annual flow of IRA bequests. More generally, mortality rates produced by the National Center for Health Statistics can control for age, race, and sex,[29] but mortality is also correlated with education, income, wealth, and health status. Death probabilities that do not account for all of these factors will lead to estimates that over- or underestimate true bequest flows.

[24]Kotlikoff and Summers (1981) were the first to apply this method.

[25]Expanded versions of the tables in Bryant (2008) are available at `http://www.irs.gov/taxstats/indtaxstats/article/0,,id=129406,00.html`.

[26]See SSA (2009).

[27]These figures include IRA assets transferred to a spouse. Eligibility limits on IRA contributions suggest that only a small fraction of these assets overlap with the assets reported in estate tax returns. Also note that this calculation does not include assets in 401(k) and similar plans, so it understates the total annual flow of tax-favored retirement assets.

[28]See Engen and Gale (2000).

[29]See Arias (2007), for example.

2.4 Incentives for Bequests of Tax-Favored Accounts

As mentioned in the introduction, economists have previously studied the question of whether the availability of tax-favored savings vehicles increases household and aggregate savings levels, often without distinguishing whether savings are used for future consumption or for bequests.[30] Tax-favored savings accounts make future consumption more attractive because they lower the price associated with future consumption. With less than full annuitization, an increase in desired future consumption levels will also lead to an increase in unintended bequests. In the same manner, tax-favored savings accounts reduce the price of intentional future bequests, whether bequests are modeled in an altruistic dynasty model or a warm-glow of bequests model.[31] Because bequests necessarily take place after retirement consumption, and because tax-favored accounts offer some tax-advantaged treatement even after the bequest occurs, the reduction in the relative price of bequests will exceed the reduction in the price of future consumption by the account holder. This suggests that the availability of tax-favored savings vehicles should increase intended bequests as well.

Account owners face an additional question after accumulating the desired level of wealth: how should tax-deferred, Roth, and other assets be utilized to minimize tax burdens? In some cases, the answer to this question will need to take into account the minimization of estate tax liability, but let us first consider the issues facing households that expect to leave a bequest smaller than the estate tax exemption. Account owners have two primary levers by which they can affect the marginal income tax rate paid on assets in tax-favored accounts and the allowed time that assets remain in the accounts. The first is the allocation of different types of assets to different beneficiaries, and the second is the division of assets held for bequests between tax-deferred and Roth accounts.

[30]See Engen, Gale and Scholz (1996), Poterba, Venti and Wise (1996), Engen and Gale (2000), and Munnell et al. (2002).

[31]For an overview of various models of intergenerational transfers, see Gale and Slemrod (2001).

Whether the beneficiary of a tax-favored account is an individual or an institution can affect both the duration of tax-favored treatment and the marginal tax rate paid on distributions from TDAs. Institutional beneficiaries of both Roth and TDA accounts face more stringent RMDs than do individuals. Designating the decedent's estate as the beneficiary of such an account, instead of specific individuals, thus reduces the available tax benefit. If a decedent desires to leave a bequest to a taxable institution and holds some assets outside of tax-favored accounts, the institutional bequest should be made out of these assets. In contrast, if a portion of the bequest is intended for a charitable organization that is not subject to income taxation, the tax-minimizing strategy will be to keep the bequest intended for this beneficiary in the TDA.

The optimal division of assets between Roth and TDAs depends upon several considerations. Because of eligibility and contribution limits on Roth IRAs, and because Roth pension accounts are relatively new and not widely available, the bulk of tax-favored assets accumulated by current account holders are likely to be held in TDAs. As a result, often the operative question facing account owners is whether and when to roll over these assets into Roth accounts. An optimal decision will consider the relative MTRs of the account owner and the intended beneficiary, the expected path and uncertainty of future MTRs during the account holder's lifetime, and the lack of RMDs for Roth accounts.

Because taxable income tends to decrease in retirement and because beneficiaries are likely to be in their prime earnings years at the time of the bequest, in many cases it will be optimal to roll over TDA funds into a Roth account while the account owner is alive. However, if the beneficiary is sufficiently less affluent than the account owner, it may be optimal to use a TDA for the bequest.

If a Roth conversion is desired, the optimal strategy will carry it out in a year or years with low marginal tax rates.[32] In planning the timing of a roll over, the account owner should take into account expected future wages, capital income streams that may decline as assets are depleted, the timing of social security benefit claiming, and expectations about future tax regimes. Because future income and MTRs are uncertain, it will often be optimal for account owners to delay rolling over part of a TDA balance to hedge against the possibility of a future year with unexpectedly low marginal rates. This might occur if the account owner realizes large capital losses or takes large medical deductions related to nursing home care.

Another benefit of a roll over into a Roth IRA is that this account is not subject to RMDs while the account owner is living. Accordingly, Roth assets can be sheltered from capital income taxation for a longer period of time than assets in a TDA. This creates an advantage to rolling TDAs over earlier, rather than later, which may be in tension with lower marginal tax rates available at older ages and the desire to hedge against future uncertainties.

2.4.1 Estate Tax Considerations

Households that expect to incur estate taxation must also consider that tax-deferred accounts will inflate the size of the estate because the balance consists of pre-tax dollars. When the balance of the tax-deferred account is distributed to the beneficiary, the beneficiary may take a deduction for estate taxes paid on the account, but this is not enough to neutralize the disadvantage relative to a Roth account.[33] If an account holder makes a Roth contribution of $1 - \tau_i$, where τ_i is the marginal income tax rate on the contribution, earns a constant annual return of r, and passes away after t years facing a marginal estate tax rate of τ_e, the

[32]Until 2010, the tax code also precludes conversions from tax-deferred accounts in years in which the account owner's AGI is more than $100,000.

[33]See IRS Publication 559.

estate tax owed will be $(1-\tau_i)(1+r)^t\tau_e$. If this tax is paid out of the Roth account and the remaining balance is withdrawn after T additional years, the final withdrawal will be equal to $(1-\tau_i)(1+r)^{t+T}(1-\tau_e)$. Note that the analysis would be the same if the original contribution was one dollar to a tax-deferred account which was rolled over into a Roth account sometime after age $59\frac{1}{2}$, but before the account owner's death, with τ_i representing the marginal income tax rate that applied at the time of the roll over.[34]

In contrast, consider a one dollar contribution that remains in a tax-deferred account until the account owner's death. For simplicity, I assume that the applicable marginal income tax rate does not change over time. The estate tax would be $(1+r)^t\tau_e$, and as before I assume that this tax is paid out of the TDA.[35] In this case, making a withdrawal to pay the estate tax will also incur income tax liability, increasing the size of the necessary withdrawal. The amount of income tax due, TAX, is recursively defined by the equation $TAX = \tau_i(\tau_e(1+r)^t + TAX)$. Solving for TAX yields $(1+r)^t\frac{\tau_e\tau_i}{1-\tau_i}$, which is the familiar effective tax rate of $\frac{\tau}{1-\tau}$ that results from paying tax on money withdrawn to pay the tax. The remaining account balance is $(1-\tau_e-\frac{\tau_e\tau_i}{1-\tau_i})(1+r)^t$, and appreciates for T years to equal $(1+r)^{t+T}(1-\tau_e-\frac{\tau_e\tau_i}{1-\tau_i})$. After taking the deduction for the estate taxes paid, the income tax due on the withdrawal of this balance is $((1+r)^{t+T}(1-\tau_e-\frac{\tau_e\tau_i}{1-\tau_i})-(1+r)^t\tau_e)\tau_i$ and the after-tax distribution is equal to $((1+r)^{t+T}(1-\tau_e-\frac{\tau_e\tau_i}{1-\tau_i})(1-\tau_i))+(1+r)^t\tau_e\tau_i$. This distribution is less than the Roth distribution by $((1+r)^t\tau_e\tau_i((1+r)^T-1)$.[36] The amount lost is thus the future appreciation of the estate tax paid on the amount of income tax deferred.[37] This result is related to that of Poterba (2001), which found that transferring

[34]This assumes that the income tax due at the time of the rollover was paid out of the account balance. This case is analyzed here because it allows a straightforward comparison without the need to consider effects on other asset balances. When possible, it will be advantageous to pay income taxes out of other assets, which would be equivalent to paying the taxes out of the account and making an additional Roth contribution in the amount of the tax bill. This point is discussed in Dammon, Spatt and Zhang (2007).

[35]Again, it would be optimal to pay the taxes out of other assets where possible.

[36]The result is similar but somewhat more complicated when assets are distributed gradually, or when RMDs must be taken from the TDA before the time of the bequest.

[37]The result is similar if in both cases the estate tax is paid out of other assets, rather than the tax-favored

wealth via taxable gifts dominates leaving a taxable estate in part because the taxes paid on gifts are thus removed from the measured size of the estate.

A straightforward implication of this outcome is that households that anticipate estate taxation should more strongly prefer Roth accounts to tax-deferred accounts than those not facing the estate tax. Through the end of 2009, many households that leave large estates will have had little access to Roth savings vehicles, as eligibility to make contributions or roll overs into a Roth IRA is dependent on modified AGI,[38] and Roth 401(k) plans are a very recent development. However, under current law, the income limits for conversions to Roth accounts will disappear in 2010 and thereafter.[39] Thus in the future, households that expect to face estate taxation should have the option of rolling a TDA over into a Roth account to the extent this is desired.

As in the case of households not facing the estate tax, an exception to the incentive to convert TDAs into Roth accounts is if the account owner wishes to leave a bequest to a non-profit entity. In this case, the tax-optimal behavior is to make this institution the beneficiary of a TDA. The charitable contribution is deductible from the estate, which eliminates the extra estate tax burden, and the tax-exempt status of the beneficiary avoids income taxation of distributions from the account.

account. After accounting for changes in other wealth, the difference between holding a Roth and a TDA is $((1+r)^t \tau_e \tau_i ((1+r(1-\tau_k))^T - 1)$, where τ_k is the marginal tax rate on capital income.

[38]In 2008, married (single) households cannot contribute to a Roth IRA if their modified AGI is greater than \$169,000 (\$116,000). Households cannot roll over a tax-deferred IRA or employer pension plan into a Roth IRA if their modified AGI is greater than \$100,000. See IRS Publication 590 for more details.

[39]In the year 2010 only, those rolling over TDAs into Roth accounts will have the option of including half of the converted amount as taxable income in 2011 and half in 2012. In all other years, the converted amount must be included as taxable income in the year that the conversion occurs.

2.5 Simulation of Advantages of Tax-Favored Bequests

To understand the magnitude of the tax advantage offered to bequests of tax-favored accounts, this paper simulates models quantifying the tax benefits. Although the tax savings associated with optimally timing the income taxation of contributions to tax-favored accounts may be substantial,[40] the simulation models focus on tax savings related to the preferential treatment of asset accruals, which is less idiosyncratic. Thus the models all assume a marginal income tax rate of 25%. The models address two questions. First, on average, how long does a dollar contributed to a tax-favored account remain in the account? Second, for a given pattern of contributions, how large are the tax savings associated with these accounts?

I focus my analysis on comparisons of three benchmark scenarios: a tax-deferred account with the owner taking 5% distributions each year after reaching age 65,[41] a tax-deferred account with the owner taking only RMDs each year, and a Roth account with no distributions taken until after the account owner's death. A comparison of the first two models will show the tax advantages associated with using TDAs for bequests rather than retirement consumption. Similarly, comparison of the TDA and Roth accounts will demonstrate the additional advantage associated with the lack of RMDs for Roth accounts.

The benchmark simulation models assume an account owned by a female with a beneficiary twenty-five years younger than herself.[42] Each year after the account owner's death, the beneficiary withdraws only the RMD from the account. Gender- and age-specific mortality rates come from the 2004 Period Life Table published by the Social Security

[40] See Bowen Bishop (2008).

[41] Starting at age 79, the account owner must take an RMD which is greater than 5%.

[42] Because the relevant tax laws are gender neutral, the choice of a female account owner only affects mortality rates. A female owner represents the intermediate case between a male owner with lower life expectancy and an account owned by a married couple that will be transferred to the beneficiary after both have died.

Administration.[43] In calculating tax savings, the benchmark assumptions are 2% inflation, real asset returns of 4%, marginal income tax rates of 25%, and a capital income tax rate of 15%. Throughout this section, the accounts are never sufficiently large to trigger the estate tax on their own, so the estate tax is not considered in the analysis.

2.5.1 Duration of Tax-favored Treatment

The amount of time a contribution to a tax-favored account remains in the account depends on the age at which the contribution was made, the age at which the bequest occurs, and the pattern of distributions from the account. Table 2.5 shows the average years of tax deferral for selected ages of contributions and bequests for each of the three benchmark models. To calculate the average years a contribution remains in the account, one must determine what fraction of the contribution is distributed in each year. I assume that each distribution consists of a proportional fraction of all contributions made to date. That is, the fraction of a contribution withdrawn in a given year is determined by multiplying the RMD factor for that year by the fraction of the contribution remaining in the account. For example, if C_1 was contributed at age t_1 and C_2 at age t_2, then at age 70, the account balance is equal to $C_1(1+r)^{70-t_1} + C_2(1+r)^{70-t_2}$. If the first RMD occurs in this year, the distribution factor is one over 27.4, or 0.0365 and the distribution is applied proportionally to the two contributions. The remaining balance is $(1-0.0365)C_1(1+r)^{70-t_1}+(1-0.0365)C_2(1+r)^{70-t_2}$. In the following year, the distribution factor of 0.0378 is again applied proportionally to the remaining fraction of each contribution. So 0.0365 of C_1 experienced $70-t_1$ years of tax-advantaged treatment, and $(1-0.0365)\times(0.0378) = 0.0364$ of C_1 experienced $71-t_1$ years. After the full account balance has been distributed, the weighted sum of years determines the average length of the tax-preference associated with the given ages of contribution and

[43] See SSA (2008).

death.

In Panel A, the expected duration of tax preference increases with the age of death only until age 65, when the owner begins taking distributions larger than those that would be required of a beneficiary. Similarly in Panel B, before the account owner is subject to annual RMDs, an increase in the age of death increases the average years of tax preference. After age $70\frac{1}{2}$ the RMD for an account owner is larger than the RMD for a beneficiary, so the average duration of tax deferral decreases as the age of death rises beyond this age. In Panel C, there are no RMDs until after the account holder's death, so the average duration of tax-favored treatment is always increasing in the age of death.

The last line of each panel of Table 2.5 calculates the expected length of time contributions made at various ages will remain in the tax-deferred account, weighting the average duration for each year of death by the probability of death at that age, given that the account owner is alive at the age when the contribution is made. A comparison of the first two panels shows that bequeathing assets in a TDA rather than consuming them during retirement increases the expected duration of the tax deferral by 4.5 to 4.8 years, or by 10% to 22%. Comparing Panels B and C shows that a Roth account with no RMDs before the account owner's death further increases the expected duration of tax-favored treatment by approximately 9.5 to 10.25 years, or 21% to 39% over the TDA.

The expected years of tax deferral for contributions made to a TDA at age 50 are shown in Table 2.6 for some additional cases. Because male account owners have a shorter life expectancy than female owners, a larger expected fraction of the account awaits distribution at the time of a male account owner's death. Thus, although the expected duration of tax deferral is similar for male and female account owners when beneficiaries take annual RMDs, male owners get a greater benefit from the tax-favored treatment of inherited accounts. The reverse is true for an account owned by a married couple and transferred after both have passed away.[44] Bequests of tax-deferred assets to institutional heirs are subject to larger RMDS, and accordingly receive fewer years of benefit. These results confirm the reasoning in section 2.4 that bequeathing tax-favored assets to a taxable institution cedes potential savings.

Consider a regime that wished to incentivize retirement savings while minimizing the resulting incentives to leave bequests. This regime might impose a policy that the full balance of a TDA must be withdrawn within five years after the death of the account owner. The last line of Table 2.6 models this case. Compared to the benchmark TDA with RMDs, the policy reduces the expected years of tax deferral available to bequests by about seven years, or 19.2%. Alternatively, this can be interpreted as the tax deferral forfeited by a beneficiary that chooses to take a lump sum distribution from an inherited account.

2.5.2 Magnitude of Potential Tax Savings

Each year that contributions to tax-favored accounts remain in the account, the assets receive advantageous tax treatment. However, the value of this treatment depends on the size of the account balance and the available return. The next set of models will calculate dollar values of the tax savings associated with tax-favored bequests.

The benchmark models are as before, with a female account owner and a beneficiary twenty-five years her junior. From ages 40-65 she makes a annual contribution of $5,000 in real terms;[45] after her death, the beneficiary withdraws the RMD each year. The real return available on her contribution is 4%, with 2% inflation. Her marginal income tax rate is 25% in all years, and capital income is taxed at a 15% rate. My models impose certain death and

[44]The model assumes that both spouses are of the same age to simplify calculation of RMDs. Because both spouses face the same RMD at any age, the RMD for each year does not depend on whether one or both spouses are still alive.

[45]In 2008, $5,000 was the maximum allowed contribution to an IRA.

immediate withdrawal of any remaining tax-favored balance at age 120, or 80 years after the simulations begin. For each age of death, the pattern of contributions and RMDs determines the account balance and the distribution taken each year. The stream of future distributions is converted to its present discounted value (PDV), using the nominal after-tax return as the discount factor. If all distributions are reinvested in a taxable account and included in the bequest, this same calculation is also the PDV of the value of the bequeathed assets 80 years after the first contribution.

The PDVs at selected ages appear in the third column of Table 2.7 for each of the three benchmark scenarios. In the fourth column, each panel also shows the PDV of the balance of a taxable account that has received corresponding after-tax contributions, which are equal in each of the three scenarios. Because this account accrues returns at the same rate as the discount factor, the PDV of the balance is equivalent to the PDV of the stream of contributions made before the bequest occurs. Thus this value is constant for ages of death greater than age 65, when the last contribution is made. The last column of each panel calculates the difference between the PDV of the appropriate tax-favored account and the taxable account, which is the PDV of the tax savings associated with that account. Alternatively, if all distributions are reinvested into a taxable account and included in the bequest, this number is the PDV of the difference between the balance of this account and the balance of a taxable account that received the original contributions. At ages 45 and 55, the tax savings is identical across all three scenarios, because in all cases, no distributions have been taken from the account before the account owner's death. As owner distributions are taken, starting at age 65 in the first panel and age 70 in the second panel, the tax savings associated with these scenarios falls short of the tax savings available to a Roth account owner that takes no distributions during her lifetime.

The last line of each panel presents the expected values of each calculation. The first panel shows that the expected tax savings from using the TDA for retirement consumption is 29.2% of the PDV of contributions to a taxable account. Comparing Panels A and B shows that if the assets are used for bequests instead, the tax savings increase substantially: the expected savings in Panel B is 27.2% larger than in Panel A. In Panel C, use of a Roth account for bequests further increases the tax benefits by 32.2% over a TDA. The total savings associated with a Roth account is $32,455.57, so the PDV of an estate left in a Roth account is 49.1% greater than the PDV of a bequest of a taxable account that received the same contributions. This figure can be broken down into $19,306.63 in savings when 5% annual distributions are taken to finance retirement consumption, an additional $5,243.56 from only taking RMDs, and $7,905.38 more from the elimination of RMDs before the time of the bequest.

In contrast to section 2.5.1, the results presented in Table 2.7 depend on economic parameters such as interest rates, inflation rates, and marginal tax rates, as well as the pattern of contributions to the account. Table 2.8 shows how results are affected by parameter changes.[46] Each of the parameters helps to determine the discount rate, as can be seen by focusing on the PDV: Taxable column. An increase in the real interest rate raises the after-tax return and thereby the discount rate, so the stream of future contributions to the taxable account has a lower PDV. In contrast, an increase in the marginal tax rate on capital income lowers the after-tax return and raises the PDV. Increased inflation both raises the return and inflates the nominal size of future contributions for a theoretically ambiguous effect on the PDV of the contributions.

In addition, each parameter affects the value of avoiding capital income tax on asset returns. Increases in the nominal interest rate increase capital tax liability and the value of eluding taxation. This is reflected by an increase in the ratio of the TDA to the taxable

[46]Changes in the marginal income tax rate affect all three accounts in a parallel way, and so are not presented here.

account in Table 2.8 as the nominal interest rate rises. Increasing the marginal rate of capital income taxation also raises the value of the tax-favored account. None of these parameter changes differentially affect the benefit of tax-favored status of bequeathed assets relative to the more general benefit of tax-favored accounts.

Using the benchmark values of the parameters, Table 2.9 presents tax savings results for the additional scenarios analyzed in the last section. As before, the lower life expectancy of male account owners, and the greater longevity of couples, respectively increase and decrease the savings associated with tax-favoring of bequeathed assets. And again, the stringent RMDs on tax-favored assets inherited by taxable institutions lead such beneficiaries to lose almost all of the benefits of the tax-advantage after death. The fourth line of the table models is a new scenario: an account owner that makes much larger tax-favored contributions, \$15,000 each year rather than \$5,000.[47] Although the total level of savings increases in this case, the relative advantage is unchanged: the tax savings associated with the TDA is still 37.1% of the present value of contributions.

The final case presented in Table 2.9 again models a TDA with the balance fully withdrawn five years after the death of the account owner. In this case, the PDV of tax savings is \$19,159.94, a decrease of 22.0% compared to the a beneficiary that takes RMDs. This is roughly equal to the decline in tax savings associated with 5% annual distributions during the account owner's lifetime as calculated previously. However, if this same rule is applied that pattern of distributions, the expected tax savings also drops by 22.0% to \$15,020.75. Thus while this policy reduces the absolute tax savings available to bequests of TDAs, it does not change the incentive to use the account for bequests rather than retirement consumption. Finally, another implication of this result is that if the account owner expects that the beneficiary will take a lump sum distribution from an inherited account rather than

[47]In 2008, the maximum contribution to a 401(k) plan for individuals under age 50 was \$15,500.

annual RMDs that maximize tax advantages, only 22% of the tax savings will be lost.

2.6 Conclusion

Much of the economic research surrounding tax-favored accounts has focused on the incentives and empirical effects within the life-cycle model. This paper has shown that the tax benefits available to bequeathed assets substantially exceed those for assets consumed in retirement: for a contribution to a TDA at age 50, taking annual RMDs from a tax-deferred account extends the average length of the tax-deferral by approximately 4.5 years relative to taking annual 5% distributions after age 65. In the benchmark models, maximizing the duration of the tax-deferral increases the tax savings associated with a TDA by 21.4%, and switching from a TDA to a Roth account increases tax savings by an additional 32.2%. These results demonstrate that optimal planning of retirement consumption and bequests should include efforts to preserve the tax advantages associated with tax-favored retirement accounts.

In addition to the tax savings available from increasing the length of time assets retain tax-favored status, account owners should weigh several other considerations in order to optimize their after-tax wealth. The first is timing rollovers from TDAs into Roth accounts to minimize the marginal income tax rate that applies, which may include delaying some rollovers to hedge against years with large tax deductions. The second is considering how to allocate assets across desired heirs: bequests to non-profit institutions should consist of TDAs, and bequests to taxable institutions should be last in line for the use of tax-favored assets. Finally, some account owners must think about minimizing estate tax liability by converting TDA assets into Roth assets to the extent possible.

Further work remains to be done on the intersection between tax-favored savings and bequests. Better estimates of the quantity of bequeathed retirement assets would be informative. Furthermore, this paper has not touched the question of how inherited accounts might affect the savings behavior of beneficiaries. Do heirs respond to receiving tax-favored bequests by offsetting their own savings? The answer to this question has implications as to whether a public policy that offers tax advantages to bequeathed retirement accounts will be able to increase aggregate savings in the economy.

Table 2.1: Distribution Period for Use by IRA Owners

Age	Distribution Period	Age	Distribution Period
70	27.4	93	9.6
71	26.5	94	9.1
72	25.6	95	8.6
73	24.7	96	8.1
74	23.8	97	7.6
75	22.9	98	7.1
76	22.0	99	6.7
77	21.2	100	6.3
78	20.3	101	5.9
79	19.5	102	5.5
80	18.7	103	5.2
81	17.9	104	4.9
82	17.1	105	4.5
83	16.3	106	4.2
84	15.5	107	3.9
85	14.8	108	3.7
86	14.1	109	3.4
87	13.4	110	3.1
88	12.7	111	2.9
89	12.0	112	2.6
90	11.4	113	2.4
91	10.8	114	2.1
92	10.2	$\geq$ 115	1.9

Source: IRS Publication 590, Appendix C Table III. An owner of an IRA generally must take an RMD equal to the account balance at the end of the previous year multiplied by one over the distribution period associated with the age of the owner at the end of the current year. If the owner has a spouse that is more than 10 years younger who is the sole beneficiary of the IRA, a different set of distribution factors applies, depending on the age of both the owner and the spouse. For details, see IRS Publication 590. Roth IRAs do not have any RMD during the lifetime of the account owner. Generally, 401(k) and similar plans require RMDs using the same factors as IRAs, even if the plan includes a Roth account.

Table 2.2: Single Life Expectancy for Use by IRA Beneficiaries

Age	Life Expectancy	Age	Life Expectancy	Age	Life Expectancy	Age	Life Expectancy
0	82.4	28	55.3	56	28.7	84	8.1
1	81.6	29	54.3	57	27.9	85	7.6
2	80.6	30	53.3	58	27.0	86	7.1
3	79.7	31	52.4	59	26.1	87	6.7
4	78.7	32	51.4	60	25.2	88	6.3
5	77.7	33	50.4	61	24.4	89	5.9
6	76.7	34	49.4	62	23.5	90	5.5
7	75.8	35	48.5	63	22.7	91	5.2
8	74.8	36	47.5	64	21.8	92	4.9
9	73.8	37	46.5	65	21.0	93	4.6
10	72.8	38	45.6	66	20.2	94	4.3
11	71.8	39	44.6	67	19.4	95	4.1
12	70.8	40	43.6	68	18.6	96	3.8
13	69.9	41	42.7	69	17.8	97	3.6
14	68.9	42	41.7	70	17.0	98	3.4
15	67.9	43	40.7	71	16.3	99	3.1
16	66.9	44	39.8	72	15.5	100	2.9
17	66.0	45	38.8	73	14.8	101	2.7
18	65.0	46	37.9	74	14.1	102	2.5
19	64.0	47	37.0	75	13.4	103	2.3
20	63.0	48	36.0	76	12.7	104	2.1
21	62.1	49	35.1	77	12.1	105	1.9
22	61.1	50	34.2	78	11.4	106	1.7
23	60.1	51	33.3	79	10.8	107	1.5
24	59.1	52	32.3	80	10.2	108	1.4
25	58.2	53	31.4	81	9.7	109	1.2
26	57.2	54	30.5	82	9.1	110	1.1
27	56.2	55	29.6	83	8.6	$\geq$ 111	1.0

Source: IRS Publication 590, Appendix C Table I. In the first year after an account owner's death, a beneficiary of an inherited IRA generally must take an RMD equal to the account balance at the end of the previous year multiplied by one over the life expectancy associated with the age of the beneficiary at the end of the current year. In subsequent years, the RMD is one over this same number less the number of years that have passed. Different rules apply to a beneficiary that is the decedent's spouse or to beneficiaries that are not individuals. See the text for more details.

Table 2.3: Distributions of Asset Holdings for Selected Populations, 2004

Asset Class	2004 Decedents with Estate Tax Returns	2004 Decedents with Taxable Estate Tax Returns	2004 SCF Households
Stocks/Mutual Funds	28.2	34.1	11.5
Bonds	13.9	16.1	2.1
Cash assets	9.4	10.4	6.0
Personal Residence	8.5	7.4	32.3
Other Real Estate	15.3	12.5	11.1
Retirement Assets	6.8	4.4	11.4
Business Equity	11.0	9.5	16.7
Other	6.8	5.6	8.9

Calculated from SOI Estate Tax Tables found at `http://www.irs.gov/taxstats/indtaxstats/article/0,,id=96442,00.html` and SCF 2004 Tables from Bucks et al. (2006), also found at `http://www.federalreserve.gov/pubs/oss/oss2/2004/scf2004home.html`. Percentages represent total holdings of an asset type as a percentage of total asset holdings for each population. Cash assets include all liquid assets, such as actual cash, bank accounts, certificates of deposit (CDs), and money market accounts. Retirement Assets include assets held in IRAs or defined contribution plans such as 401(k)s. The estate tax filings also include annuities and the taxable portion of survivor benefits from defined benefit pension plans as retirement assets.

Table 2.4: Flow of IRA Bequests, 2004

Age	Mean IRA Balance	Number of IRA Accounts	Total Balance (Thousands)	Pr(Death)	Bequests (Thousands)
Under 15	$14,116.96	29,592	$417,749	0.0002	$76.7
15 under 20	$6,580.21	100,470	$661,114	0.0007	$432.7
20 under 25	$4,477.62	589,915	$2,641,417	0.0009	$2,442.8
25 under 30	$5,956.49	1,620,545	$9,652,752	0.0009	$9,168.1
30 under 35	$10,737.74	2,722,574	$29,234,284	0.0011	$31,247.7
35 under 40	$24,916.69	4,681,839	$116,655,931	0.0015	$175,711.2
40 under 45	$28,226.82	5,071,123	$143,141,666	0.0023	$330,412.3
45 under 50	$38,394.19	6,200,359	$238,057,778	0.0035	$838,191.6
50 under 55	$54,325.82	6,663,442	$361,996,921	0.0051	$1,853,499.9
55 under 60	$78,669.21	6,450,892	$507,486,580	0.0074	$3,759,327.3
60 under 65	$100,872.67	5,503,054	$555,107,774	0.0115	$6,356,795.1
65 under 70	$128,933.11	4,136,243	$533,298,669	0.0174	$9,294,172.7
70 under 75	$133,919.79	3,239,670	$433,855,922	0.0273	$11,834,636.9
75 under 80	$106,068.69	2,352,067	$249,480,659	0.0429	$10,711,949.8
80 and over	$74,157.05	1,583,650	$117,438,806	0.1094	$12,844,529.5
Total IRA Bequest Flow					$58,042,594.3

Calculated from SOI Tax Tables found at `http://www.irs.gov/taxstats/indtaxstats/article/0,,id=129406,00.html`. See also Bryant (2008). Except for mean balances, amounts are reported in thousands of dollars. Death probabilities are calculated from the Social Security Administration's Period Life Table for 2004 published in the 2008 Annual Statistical Supplement. These are mean death rates for the ages spanned, weighted by the age and gender distribution.

Table 2.5: Duration of Tax Advantage for Contributions to Tax-Favored Accounts

Bequest Age	Pr(Death)	Age of Heir	Heir Distribution Period	Age 40 Contribution	Age 50 Contribution	Age 60 Contribution
Panel A: Tax-Deferred Account, 5% Annual Voluntary Distributions				Average Years of Tax Advantage:		
45	0.0022	20	62.1	36.55		
55	0.0045	30	52.4	41.70	31.70	
65	0.0103	40	42.7	45.76	35.76	25.76
75	0.0216	50	33.3	42.38	32.38	22.38
85	0.0373	60	24.4	41.19	31.19	21.19
95	0.0230	70	16.3	40.44	30.44	20.44
105	0.0010	80	9.7	40.16	30.16	20.16
Expected Values				**41.61**	**31.72**	**21.72**
Panel B: Tax-Deferred Account, RMDs				Average Years of Tax Deferral:		
Bequest Age	Pr(Death)	Age of Heir	Heir Distribution Period	Age 40 Contribution	Age 50 Contribution	Age 60 Contribution
45	0.0022	20	62.1	36.55		
55	0.0045	30	52.4	41.70	31.70	
65	0.0103	40	42.7	46.85	36.85	26.85
75	0.0216	50	33.3	47.89	37.89	27.89
85	0.0373	60	24.4	46.35	36.35	26.35
95	0.0230	70	16.3	45.30	35.30	25.30
105	0.0010	80	9.7	44.91	34.91	24.91
Expected Values				**46.09**	**36.30**	**26.52**
Panel C: Roth Account, RMDs				Average Years of Tax Deferral:		
Bequest Age	Pr(Death)	Age of Heir	Heir Distribution Period	Age 40 Contribution	Age 50 Contribution	Age 60 Contribution
45	0.0022	20	62.1	36.55		
55	0.0045	30	52.4	41.70	31.70	
65	0.0103	40	42.7	46.85	36.85	26.85
75	0.0216	50	33.3	52.15	42.15	32.15
85	0.0373	60	24.4	57.70	47.70	37.70
95	0.0230	70	16.3	63.66	53.66	43.66
105	0.0010	80	9.7	70.36	60.36	50.36
Expected Values				**55.63**	**46.05**	**36.74**

Author's calculations based on rules outlined in IRS Publication 590. I assume that the account owner is a female with a beneficiary twenty-five years younger than herself, and that the beneficiary withdraws only the RMD each year after the account owner's death. Panel A models 5% annual distributions during the account owner's lifetime, beginning at age 65. In Panel B, the owner instead withdraws only the RMD each year. Panel C models contributions to a Roth account that has no distributions until after the account owner's death. Each line of each panel represents the outcome if the account owner dies at the stated age. Pr(Death) is the probability of death occurring at this age, given that the account owner is alive at age 40, based on the Period Life Table for 2004 published by the Social Security Administration. The heir distribution period begins the year after the calendar year in which the death occurs and determines the RMD for the beneficiary in all subsequent years as explained in Table 2.2. Average years of tax advantage are the mean number of years a contribution made at the given age remains in the account before distribution, weighted by the fraction of the contribution withdrawn each year. See text for more details.

Table 2.6: Expected Years of Tax-Deferral for Various Cases, Contribution at Age 50

	Expected Years of Tax-Deferral	Expected Fraction Distributed After Bequest
Female	36.30	0.54
Male	36.41	0.64
Couple	36.23	0.42
Institutional Heir	29.88	0.54
Non-TDA Bequests	29.36	0.54

Author's calculations based on rules outlined in IRS Publication 590. All cases assume an owner that makes a contribution to a tax-deferred account at age 50, takes only the RMD each year, and with a beneficiary twenty-five years younger. The couple account owners are both age 50, with the transfer to the beneficiary taking place only when both have passed away. Institutional heir shows results for a female account owner with a beneficiary that is a taxable institution, such as the decedent's estate. Non-TDA Bequests shows results for a beneficiary that is required to withdraw all assets from the TDA within five years of the account owner's death. The first column shows the expected years of tax advantage, weighted by the fraction of the contribution withdrawn each year, assuming the beneficiary takes annual RMDs. The fraction withdrawn each year is determined by multiplying the distribution factor for that year by the fraction of the contribution remaining in the account. The expected fraction distributed after death is the expected fraction of the contribution remaining in the account at the time of the bequest.

Table 2.7: Savings Associated with Tax-Favored Bequests

Age	Pr(Death)	PDV: TFA	PDV: Taxable	PDV: Tax Savings
Panel A: Tax-Deferred Account, 5% Annual Voluntary Distributions				
45	0.0022	$28,367.70	$20,872.10	$7,495.59
55	0.0045	$65,698.29	$48,176.32	$17,521.97
65	0.0103	$91,012.36	$68,285.55	$22,726.82
75	0.0216	$88,456.11	$68,285.55	$20,170.56
85	0.0373	$87,511.17	$68,285.55	$19,225.63
95	0.0230	$86,871.80	$68,285.55	$18,586.25
105	0.0010	$86,617.27	$68,285.55	$18,331.73
Expected Values		**$85,451.81**	**$66,145.18**	**$19,306.63**
Panel B: Tax-Deferred Account, RMDs				
Age	Pr(Death)	PDV: TFA	PDV: Taxable	PDV: Tax Savings
45	0.0022	$28,367.70	$20,872.10	$7,495.59
55	0.0045	$65,698.29	$48,176.32	$17,521.97
65	0.0103	$93,943.33	$68,285.55	$25,657.78
75	0.0216	$94,743.04	$68,285.55	$26,457.49
85	0.0373	$93,485.66	$68,285.55	$25,200.12
95	0.0230	$92,577.28	$68,285.55	$24,291.73
105	0.0010	$92,215.66	$68,285.55	$23,930.11
Expected Values		**$90,695.38**	**$66,145.18**	**$24,550.19**
Panel C: Roth Account, RMDs				
Age	Pr(Death)	PDV: TFA	PDV: Taxable	PDV: Tax Savings
45	0.0022	$28,367.70	$20,872.10	$7,495.59
55	0.0045	$65,698.29	$48,176.32	$17,521.97
65	0.0103	$93,943.33	$68,285.55	$25,657.78
75	0.0216	$98,125.29	$68,285.55	$29,839.74
85	0.0373	$102,779.77	$68,285.55	$34,494.23
95	0.0230	$108,088.75	$68,285.55	$39,803.20
105	0.0010	$114,469.47	$68,285.55	$46,183.92
Expected Values		**$98,600.75**	**$66,145.18**	**$32,455.57**

Author's calculations based on rules outlined in IRS Publication 590. I assume that the account owner is a female with a beneficiary twenty-five years younger than her. From ages 40-65 she makes a annual contribution of $5,000 in real terms. She faces a 4% real return, 2% inflation, a 25% marginal income tax rate, and a 15% capital income tax rate. Panel A models annual 5% distributions beginning at age 65, and RMDs taken by the beneficiary. In Panel B, the owner instead withdraws only the RMD each year. Panel C models contributions to a Roth account that has no distributions until after the account owner's death. Each line of the table represents outcomes if the account owner dies at the stated age. Pr(Death) is the probability of death occurring at this age, given that the account owner is alive at age 40, and is taken from the Period Life Table for 2004 published in the Social Security Administrations Annual Statistical Supplement for 2008. PDV: TFA is the sum of the present discounted value of distributions from the tax-favored account, with the after-tax nominal return as the discount factor. PDV: Taxable is the PDV of the final balance of a taxable account that has received an analogous pattern of deposits in after-tax dollars, or equivalently, the PDV of the sum of the after-tax contributions. The last column is the difference between these two calculations.

Table 2.8: Expected Tax Savings of Tax-Deferred Bequests, Selected Parameters

Real Return	Inflation	Capital Tax Rate	PDV: TDA	PDV: Taxable
2%	2%	15%	$97,716.51	$79,459.15
4%	2%	15%	$90,695.38	$66,145.18
6%	2%	15%	$85,834.15	$56,031.36
4%	6%	15%	$117,451.99	$70,086.72
4%	2%	25%	$119,751.28	$70,393.41

Author's calculations based on rules outlined in IRS Publication 590. All cases assume a female tax-deferred account owner with a beneficiary twenty-five years younger than her, and a 25% marginal income tax rate. From ages 40-65 she makes a annual contribution of $5,000 in real terms; after reaching age $70\frac{1}{2}$, she withdraws the RMD each year. The beneficiary also withdraws the RMD each year after the account owner's death. PDV: TDA is the sum of the present discounted value of distributions from the tax-deferred account, with the after-tax nominal return as the discount factor. PDV: Taxable Account is the final balance of a taxable account that has received an analogous pattern of deposits in after-tax dollars.

Table 2.9: Expected Tax Savings of Tax-Favored Bequests, Selected Circumstances

	PDV: TDA	PDV: Taxable Account	PDV: Tax Savings
Female	$90,695.38	$66,145.18	$24,550.19
Male	$89,010.29	$64,760.60	$24,249.69
Couple	$93,122.32	$68,079.24	$25,043.08
Institutional Heir	$85,638.95	$66,145.18	$19,493.76
High Contributions	$272,086.13	$198,435.55	$73,650.58
Non-TDA Bequests	$85,305.12	$66,145.18	$19,159.94

Author's calculations based on rules outlined in IRS Publication 590. Unless otherwise specified, each case assumes a female account owner with a beneficiary twenty-five years younger than her. From ages 40-65 she makes a annual contribution of $5,000 in real terms; after age $70\frac{1}{2}$, she withdraws the RMD each year. PDV: TDA is the sum of the present discounted value of distributions from the tax-favored account, with the after-tax nominal return as the discount factor. PDV: Taxable Account is the final balance of a taxable account that has received an analogous pattern of deposits in after-tax dollars. This calculation is equivalent to the PDV of the after-tax contributions. The last column shows the savings associated with a TDA over a taxable account. The couple account owners are both age 50, with the transfer to the beneficiary taking place only when both have passed away. The fourth line shows results for an account with an institutional beneficiary that is subject to taxation, such as the decedent's estate. High contributions assumes the annual real contribution is $15,000. The last case assumes that the beneficiary withdraws all assets from the TDA within five years of the account holder's death. All cases assume a 4% real return, 2% inflation, a 25% marginal income tax rate, and a 15% capital income tax rate.

Chapter 3

Reverse Mortgages: A Closer Look at HECM Loans (joint with Hui Shan)

3.1 Introduction

One of the most important questions facing researchers and policy makers is whether Americans are saving enough for retirement. The answer to this question depends crucially on how housing wealth should be treated - are elderly homeowners willing and able to consume their housing equity in retirement? Housing wealth is often the largest non-pension wealth component for many elderly homeowners. For example, the 2004 Survey of Consumer Finances (SCF) data suggest that for 27.8% of homeowners aged 62 or above, housing wealth represents at least 80% of their total wealth. In addition, 13.3% of homeowners aged 62 or above have a house-value-to-income ratio of at least 10. Economists believe that reverse mortgages have the potential to increase consumption of house-rich but cash-poor elderly homeowners while allowing them to continue living in their homes.

Reverse mortgages are a financial product that is similar to home equity loans except that the borrower does not pay back the loan until she dies or permanently moves out of the house. They were first introduced about 20 years ago. The most common type of reverse mortgage loans is the Home Equity Conversion Mortgage (HECM), insured by the Federal Housing Administration (FHA) and constituting over 90% of all reverse mortgage loans originated in the U.S. market. Despite its economic appeal, using reverse mortgages to finance consumption after retirement has been the exception rather than the rule among elderly homeowners. From its inception in 1989 to the end of 2007, out of tens of millions of eligible homeowners, only about 400,000 loans have been originated through the HECM program. A number of factors have been suggested in explaining the small size of the reverse mortgage market, including but not limited to high costs, regulatory and legal barriers, moral hazard and adverse selection, financial awareness and literacy, perception of housing equity as a safety net for large medical expenses, bequest motives, and the difficulties associated with reverse mortgage securitization. Unfortunately, we have little evidence on to what extent each of these factors has prevented reverse mortgages from being more common among eligible homeowners.

On the other hand, the reverse mortgage market in recent years has experienced significant growth. In the early 1990s, only a few hundred HECM loans were originated each year. In contrast, over 100,000 reverse mortgage loans were originated through the HECM program in 2007 alone. Is the rapid growth due to higher house values, lower interest rates, increasing awareness of the product, or something else? Is the expansion transitory or will the trend continue in the coming years? Addressing these questions is not only essential to understanding elderly homeowners' desire to consume housing wealth, but also provides supporting evidence for regulators to conduct cost-benefit analysis and to design more efficient policies.

In this paper, we examine all HECM loans that were originated between 1989 and

2007. The first part of the paper presents descriptive analysis of these HECM loans, focusing on showing the differences between borrowers and non-borrowers and between early borrowers and recent borrowers. The second part illustrates the effect of termination and housing price risks on the FHA insurance program using numerical simulations. Such a analysis is a key step toward understanding who reverse mortgage borrowers are and how various macroeconomic factors such as housing prices and termination rates may impact the reverse mortgage market and the profitability of the FHA insurance program. In addition, current policy makers are concerned that the premiums charged to insure HECM loans are excessive. The well publicized Housing and Economic Recovery Act of 2008 will reduce such insurance premiums for HECM borrowers. Our results will offer insight into how this reduction may impact the long-term viability of the HECM program.

To our knowledge, this is the first paper using all 18 years of HECM loan data to present systematic evidence on borrower and loan characteristics over time. It is also the first paper that performs simulations on 2007 HECM loans. Such features of this study enable us to draw conclusions that are more accurate and more relevant than previous literature. According to the Census Bureau, the number of persons above age 65 will increase to 40 million in 2010 and further to 81 million in 2040. The questions addressed by this paper will become increasingly important with the population aging and baby-boomers' entering retirement age.

The rest of this paper proceeds as follows: Section 2 gives an overview of the existing literature on reverse mortgages and introduces the HECM program in detail. In section 3, we describe the loan-level data that we analyze in this paper. We then show the characteristics of HECM loans and HECM borrowers observed in our data, with an emphasis on how these characteristics have changed over time. In section 5, we perform numerical simulations to assess the impact of termination and housing value appreciation risks on the long-term viability of HECM loans. The last section concludes and points out future research directions.

3.2 Background

3.2.1 Review of Existing Studies

The question of whether Americans are financially prepared for retirement has inspired heated debates in the literature.[1] When evaluating retirement saving adequacy, economists and financial planners have to decide whether housing equity should be included as consumable wealth. Because housing is both a consumption good and an investment good, the correct treatment of housing equity may not be obvious in the retirement saving context. For example, while Mitchell and Moore (1998) add housing equity to household net worth, Bernheim et al. (2000) exclude it in their calculation. More recently, Sinai and Souleles (2008) suggest that the fraction of "consumable housing equity" ranges from 60% to 99% for elderly homeowners depending on their age.

To what degree we should consider housing equity as retirement savings depends on to what degree elderly homeowners are willing and able to consume their housing wealth. It is well known that many seniors prefer staying in their homes for as long as they can. For example, in a survey sponsored by the American Association of Retired Persons (AARP), 95% of persons 75 and older agreed with the statement "What I'd really like to do is stay in my current residence as long as possible."[2] A series of studies by Venti and Wise (e.g. Venti and Wise (1989, 1990, and 2004)) show that elderly homeowners do not reduce their housing wealth in the absence of precipitating events such as the death of a spouse or entry

[1]See Skinner (2007) for a review on this topic.
[2]See Bayer and Harper (2000).

to a nursing home. If elderly homeowners have strong psychological attachment to their homes, then reverse mortgages, which generate additional income and liquid wealth for elderly homeowners while allowing them to continue living in their homes, may be welfare-improving for many households.

A number of studies have estimated the potential size of the reverse mortgage market. Venti and Wise (1991) analyze the 1984 Survey of Income and Program Participation (SIPP) data and find that a reverse mortgage in the form of annuity payments would substantially affect the income of the single elderly who are very old. Merrill et al. (1994) use the 1989 American Housing Survey (AHS) data to show that out of the 12 million elderly homeowners who own their homes free and clear, 800,000 could benefit substantially from reverse mortgages. Instead of looking only at the median household and focusing on the income-increasing aspect of reverse mortgages, Mayer and Simons (1994) examine the whole distribution of elderly households and consider both income increases and debt reductions as benefits of reverse mortgages. As a result, they find a much larger potential market for reverse mortgages than previous studies: over 6 million homeowners in the U.S. could increase their effective monthly income by at least 20%.

In practice, the reverse mortgage market is much smaller than expected. For example, the HECM program represents 90% of the U.S. reverse mortgage market. During the first ten years since its inception, less than 40,000 loans were originated through the HECM program. On the demand side, a number of factors may have prevented reverse mortgages from becoming more popular among elderly homeowners. First, elderly homeowners with strong bequest motives may not find reverse mortgages attractive because reverse mortgages reduce the amount of wealth they can leave to their estates. However, Mayer and Simons (1994) estimate that more than 1.3 million homeowners have no children. For these homeowners, bequest motives are less likely to explain the lack of demand for reverse mortgages.

Second, the probability of shouldering large medical expenses increases over time for the elderly. In the absence of other forms of protections such as Long-Term Care Insurance (LTCI), many elderly homeowners use their housing equity to self-insure. Using a survey conducted on 2,673 homeowners aged 50-65, Munnell et al. (2007) report that nearly half of the respondents who claim they are not planning to tap their housing equity in retirement list "insurance against living and health expenses" as the reason. Davidoff (2008) present a model suggesting that such behavior may even be optimal. This self-insurance mechanism may explain why the elderly do not want to purchase the annuity type of reverse mortgages, but it does not explain why they do not want to purchase the Line of Credit (LOC) type of reverse mortgages. Third, certain features of the HECM program and its interaction with other welfare programs may be undesirable. For example, a HECM loan usually requires large upfront costs, the amount of home equity against which one can borrow is capped by the FHA mortgage limit, and the additional income received from a HECM loan may disqualify one from public assistance such as Supplemental Security Income (SSI) or Medicaid. Fourth, reverse mortgages are complex financial products and can be particularly challenging for elderly homeowners. Conversations with people in the industry suggest that many senior homeowners have misconceptions about reverse mortgages. Lastly, the elderly may value owning their homes free and clear so much that they are averse to the idea of borrowing against their homes.

On the supply side, lenders face various obstacles as well. First, reverse mortgages are significantly different from traditional "forward" mortgages. Lenders with little experience in the reverse mortgage market often confront unfamiliar documentation requirements. For example, lenders who are accustomed to forward mortgages have to prepare different documents for reverse mortgages to satisfy the Truth-in-Lending Act requirements. As a result, lenders must designate reverse mortgage specialists among their employees. Because the HECM program caps origination fees charged by lenders, such a move is only profitable if there is a sufficient volume of HECM loan origination. Another consideration is that different states have different regulations with respect to reverse mortgages. To comply with such regulations, lenders who operate in multiple states have to bear additional costs. In addition, due to the unconventional cash-flow pattern, reverse mortgages are difficult to securitize and finance. In fact, according to Szymanoski et al. (2007), HECM loans were not securitized until August 2006. Finally, the Fair Housing Act prohibits pricing loans based on sex, despite the fact the males and females impose very different mortality risks.

Besides the factors discussed above, economists have also recognized that reverse mortgage markets may suffer from adverse selection and moral hazard problems. Because reverse mortgage loans are not due until the borrower dies, sells the house, or permanently moves out, people who know they are likely to stay in their homes for a long time will find reverse mortgages more attractive than others. However, Davidoff and Welke (2007) find advantageous selection in the HECM program. In other words, HECM borrowers appear to exit their homes at a faster pace than the general population. The authors suggest that higher discount rate among the borrowers combined with housing price appreciation may explain observed advantageous selection. Furthermore, economists are concerned that the moral hazard problem of home maintenance would make lenders think twice before entering the reverse mortgage market. Davidoff (2006) uses AHS data to show that homeowners over 75 spend less on routine maintenance than younger owners of similar homes. However, in practice, the moral hazard problem is mitigated because borrowers are the residual claimant of the house, and because lenders are insured against the risk that the proceeds from a home sale fall short of the loan balance.

Overall, most of the studies on reverse mortgages do not have loan-level data and therefore, have to rely on hypothetical borrowers (e.g. Venti and Wise (1991), Merrill et al. (1994), Mayer and Simons (1994), Sun et al. (2006), and Sinai and Souleles (2008)). Among the few studies that do look at loan-level data, Davidoff (2006) and Szymanoski et al. (2007) focus only on termination rates of HECM loans, and Case and Schnare (1994) and Rodda et al. (2000) analyze only the data from earlier years of the HECM program. Given that 88% of all HECM loans originated between 1989 and 2007 were taken out after 2000, the field calls for research using more recent data. This paper aims to fill the gap. It contributes to the existing literature in two ways. First, this paper performs comprehensive analysis on all HECM loans originated before the end of 2007. The evidence shown here provide useful information on how HECM borrowers are different from the general population and how the characteristics of these borrowers have changed over time. Second, we use numerical simulations to project outcomes of the loans taken out in 2007. Our simulation results demonstrate how insurance claims, HECM profitability and borrower costs depend on loan termination rates, housing price appreciation, and payment schedules. The high sensitivity of these outcomes to the underlying assumptions advocates caution on the part of those designing future HECM reforms.

3.2.2 Background on the HECM Program

Congress established the Home Equity Conversion Mortgage (HECM) program in 1987 and authorized the Department of Housing and Urban Development (HUD) to administer the program. The first HECM loan was made in 1989. Since then, the HECM program has been the dominant reverse mortgage product in the United States.[3]

A HECM loan is a reverse mortgage secured by the borrower's home equity. In a forward mortgage, the borrower's home equity increases over time and her mortgage debt decreases over time. In a reverse mortgage, on the other hand, the borrower's home equity

[3]Other reverse mortgage products in the U.S. include the Home Keeper program offered by Fannie Mae and jumbo reverse-mortgage loans offered by Financial Freedom Senior Funding Corporation.

declines and her mortgage debt grows over time. To be eligible for a HECM loan, first, borrowers have to be 62 years of age or older. Second, the prospective borrower's property must be a one-unit dwelling. Third, borrowers have to own their homes free and clear, or have liens not exceeding the amount of HECM loans that they can receive. Unlike conventional home equity loans, a HECM loan does not have a fixed maturity date. The loan becomes due and payable only after the borrower dies or the borrower no longer occupies the property as a principal residence. Moreover, a HECM loan is a "non-recourse" loan. This means that the borrower and her estate will never owe more than the value of the property and no other assets can be seized to repay the loan. While traditional home equity loans often require borrowers to have sufficient income and credit worthiness, HECM loans do not have such requirements.[4] Therefore, house-rich but cash-poor elderly homeowners who cannot obtain home equity loans may find HECM loans particularly attractive.

The amount that the borrower can receive from a HECM loan is determined by the principal limit. To calculate the principal limit, the Maximum Claim Amount (MCA) needs to be determined first. The MCA is the lesser of the appraised value of the property or the FHA mortgage limit in that area for a one-family residence under Section 203 (b) of the National Housing Act. The limit for any given area is usually set at 95% of the median house value in that area. However, there exist both ceiling and floor caps, creating nationwide maximum and minimum values for the FHA mortgage limit. For example, the ceiling was $312,895 in 2005 and $362,790 in 2006 and 2007, and the floor was $172,632 in 2005 and $200,160 in 2006 and 2007. This limit effectively reduces the amount of housing equity the borrower can use to purchase reverse mortgages. Figure 3.1 compares the MCA and the appraised housing value of HECM loans originated between 1989 and 2007. The solid line indicates the fraction of loans with housing values exceeding MCA. The vertical bars shows the median housing-value-to-MCA ratio among loans with the housing value

[4]However, borrowers who have delinquent or defaulted federal debt may not be eligible for HECM loans.

exceeding MCA. For example, 28.6% of HECM loans made in 2007 have housing values greater than the area-specific FHA mortgage limit. Among these loans, the median housing-value-to-MCA ratio is 1.2, meaning that the housing value is 20% above the FHA mortgage limit.

Once the MCA is determined, the "Initial Principal Limit" can be calculated by multiplying the MCA by a factor that lies between zero and one. The magnitude of this factor depends on the age of the borrower and the "expected interest rate" at the time of loan closing. For married couples, only the age of the younger borrower is taken into consideration. The expected interest rate, a proxy for future interest rate, equals the sum of the ten-year Treasury rate and the lender's margin. The lender's margin is typically between 1 and 2 percentage points. These principal limit factors are designed such that, under certain assumptions, the loan balance reaches the MCA at the time when the loan becomes due.[5] As a result, the factor increases with the borrower's age and decreases with the expected interest rate. For example, the factor equals 0.281 for a 65-year old at a 10 percent expected rate, and it equals 0.819 for a 85-year old at a 5 percent expected rate. Figure 3.2 displays the median expected rate and the ten-year Treasury rate between 1989 and 2007. Over the 18-year sample period, expected rates on HECM loans declined significantly, largely due to the decreases in the ten-year Treasury rate.

The "Net Principal Limit", which is the amount the borrower can take as a lump-sum at closing, is then calculated by subtracting from the initial principal limit the initial Mortgage Insurance Premium (MIP), closing costs, and a set-aside for monthly servicing fees. The initial MIP is set at 2% of the MCA. In addition to the initial MIP, HUD also charges a monthly MIP that equals to 1/12 of the annual rate of 0.5% of the outstanding balance. By charging MIPs, HUD insures the borrower against the risk that the lender can

[5]See Szymanoski (1994) for detailed discussions on the assumptions that HUD makes to calculate the principal limit factors.

no longer make the contracted payments. It also insures the lender against the risk that the loan balance exceeds the property value. Closing costs include origination fees and other third-party fees such as appraisal fees, credit report fees, and title insurance fees. Origination fees are set at $2,000 or 2% of the MCA, whichever is greater. A servicing-fee set-aside is the present value of the monthly servicing fees charged by the lender, assuming that the loan becomes due when the borrower turns 100. For example, if the lender charges $30 per month as servicing fees, the set-aside would be $4,467 at an expected interest rate of 6 percent for a 75-year old borrower. The initial MIP, closing costs, and the set-aside for servicing fees can all be financed rather than paid by the borrower out of pocket. Figure 3.3 summarizes the steps described above in calculating the net principal limit.

Note that HECM loans are priced on age, interest rate, and housing value. They are not priced on gender or marital status. Because females have longer life expectancy than males and because borrowers who are couples do not repay their mortgages until the last person dies or moves out, HECM loans may be worth more to couples and single females than to single males. Figure 3.4 shows the fraction of single male, single female, and couple borrowers by HECM loan origination year. It is perhaps unsurprising that couples and single females constitute the majority of HECM borrowers. However, the fraction of single male borrowers has been increasing over time and the fraction of single female borrowers has been declining.

After the net principal limit is determined, HECM borrowers choose from five payment plans to receive the mortgage proceeds. Under the *Tenure* plan, the borrower will receive equal monthly payments from the lender for as long as the borrower lives and continues to occupy the property as her principal residence. This payment plan is also called a "reverse annuity mortgage" in the literature due to its resemblance to an annuity product. Under the *Term* plan, the borrower will receive equal monthly payments from the lender for a fixed period of months selected by the borrower. Note that even though payments stop at the end of the selected term, the loan is not due until the borrower dies or moves out of her home. Under the *Line of Credit* plan, the borrower will receive the mortgage proceeds in unscheduled payments or in installments, at times and in amounts of the borrower's choosing, until the line of credit is exhausted. This is the most popular payment plan among HECM borrowers. In addition, the *Modified Tenure* plan allows the borrower to combine a line of credit with monthly payments for as long as she is alive and continues to live in the house. The *Modified Term* plan allows the borrower to combine a line of credit with monthly payments for a fixed period of months. Moreover, borrowers may change their payment plan throughout the life of the loan at a small cost.[6] Among the HECM loans made in 2007, 3.7% borrowers chose tenure plans, 1.5% chose term plans, 87.0% chose line-of-credit plans, 4.5% chose modified-tenure plans, and 3.3% chose modified-term plans.

For term or tenure plans, monthly payments are determined by the future value of the net principal limit, the length of the payment term in months, and the compounding rate. The length of the payment term in months for term plans is simply the number of payment years multiplied by 12. For tenure plans, it is 100 minus the age of the borrower multiplied by 12. Borrowers 95 years of age and above are treated as if they were 95 for the purpose of this calculation. The compounding rate is 1/12 of the sum of the expected rate and the annual rate of 0.5% for the monthly MIP. With the term length and the compounding rate, the future value of the net principal limit can be easily calculated. For term plans, a constant monthly payment is determined such that the future value of all payments will equal the future value of the net principal limit at the end of the term. For tenure plans, a constant monthly payment is determined such that the future value of all payments will equal to the future value of the net principle limit at the time when the borrower becomes 100 years of

[6]Anecdotal evidence suggests that most of the payment-plan changes are adding a line-of-credit option to existing term or tenure policies.

age. For a hypothetical borrower with an MCA of \$200,000, table 3.1 shows the principal limit factor, net principal limit, the monthly payment under a tenure plan, and monthly payment under a ten-year term plan, given reasonable assumptions about closing costs and servicing fees. Everything else equal, the older the borrower is, the larger the payment she receives. Although the net principal limit decreases monotonically with the expected interest rate, the relationship between the expected interest rate and the monthly payment is not necessarily monotonic because a higher expected interest rate increases both loan balance and future value of the net principal limit at the end of the payment term.

Figure 3.5 plots the distribution of monthly payments for HECM loans made in 2007 that have a term or tenure component. The vertical lines indicate the median monthly payments for term and tenure policies respectively. Because tenure plans are relatively more back-loaded and payments stretch out over a longer period of time, monthly payments of term loans are typically higher than tenure loans. It is interesting to observe that monthly payments appear to bunch at round numbers such as \$500 and \$1,000, suggesting that some borrowers may have a "target" income level in mind when choosing payment plans and term length.

The HECM program insures both fixed-rate loans and adjustable-rate loans. In practice, virtually all HECM loans are adjustable-rate loans because Fannie Mae, the only agency that buys HECM loans from lenders, does not purchase fixed-rate loans. Adjustable-rate loans include annually-adjusted loans or monthly-adjusted loans. During the earlier years of the HECM program, most borrowers took out annually-adjusted loans. Since 1994, the vast majority of HECM loans have been monthly-adjusted loans. For instance, 99.5% of the HECM loans originated in 2007 are monthly-adjusted. The "current interest rate" for monthly-adjusted loans is the sum of the treasury rate and the lender's margin. This current interest rate plus the on-going MIP charge of 0.5% is the rate at which loan balances actually grow over time. If realized current rates are lower than expected rates, then the net principal limit will grow faster than the loan balance, which means that borrowers who have chosen a line-of-credit option will be able to withdraw more equity out of their homes.

With regard to the FHA insurance program, HUD allows lenders to choose between an "assignment option" and a "shared premium option". Under the assignment option, lenders remit to HUD both the initial MIP of 2% of the MCA and the monthly MIP of an annual rate of 0.5% of the loan balance. In exchange, lenders can assign loans to HUD when the loan balance reaches 98% of the MCA. Moreover, in the event that the proceeds from the sale of the property are not sufficient to pay the outstanding loan balance, lenders who have chosen the assignment option but have not assigned the mortgage to HUD can submit a claim for insurance benefits up to the MCA. Thus, the assignment option fully protects lenders from potential losses. Under the shared premium option, lenders retain a portion of the MIP but do not have the option to assign the mortgage to HUD. In practice, the shared premium option is not used because Fannie Mae does not purchase such loans. Other provisions designed to protect lenders include a mandatory appraisal that ensures the property meets a minimum standard of maintenance, and borrowers are required to maintain flood insurance coverage if the property is subject to flood hazard.

The HECM program also has provisions designed to protect borrowers. Because reverse mortgages are a complex financial product that elderly homeowners may not be familiar with, HUD requires borrowers to receive mandatory counselling from an HUD-approved independent agency. Such counselling is provided regardless of whether a person is in contact with a lender, and counsellors are urged to invite the participation of the children and other advisors of the borrower. In the event that lenders can no longer make payments to borrowers, HUD will continue making the payments.

3.3 Data Description

The data that we analyze in this paper are the loan-level HECM data provided by HUD. We have all HECM loans made between 1989 and 2007, a total of 388,416 records, in the raw data. For each of these loan records, we have information on the age of the borrower, age of the co-borrower (when applicable), gender and marital status of the borrower, the appraised value of the property, location of the property (i.e. state and zip code), MCA, expected interest rate, initial principal limit, interest rate type (i.e. fixed-rate, annually-adjusted, or monthly-adjusted), choice of payment plan, monthly payment amount (when applicable), loan termination date, loan assignment date, whether a claim was filed to HUD by the lender, and the nature of the claim.

Such administrative data are essential for studying the reverse mortgage market because reverse mortgage borrowers are a tiny fraction of the general population and they are unlikely to be captured by public surveys. Nevertheless, there are a number of caveats associated with our data. First, similar to many administrative datasets, we do not know very much about these borrowers beyond the characteristics that are used in the HECM pricing model. For example, we do not know the income and financial wealth of these borrowers, nor do we know demographic characteristics such as race, eduction, and number of children. Second, according to the staff member at HUD who shared the data with us, our data come from a snapshot at the end of 2007. Because borrowers are allowed to change their payment plans at a small cost, it is possible that the payment plan we observe is not the original payment plan chosen by the borrower.

In the process of data cleaning, we dropped irregular observations such as loans with borrower age below 62, loans with expected interest rates of zero or above 20 percent, and one loan originated before 1989. We also dropped borrowers from places other than continental U.S. because the FHA mortgage limit for Alaska, Guam, Hawaii and the Virgin Islands is very different from the rest of the country. We have a final sample of 383,158 after data cleaning.

3.4 Analysis of HECM Borrowers and Loans

In this section, we analyze the loan-level HECM data provided by HUD. We first present evidence on trends in loan origination, age of borrowers, house value of borrowers, and initial-principal-limit to-house-value ratios. Then we compare characteristics of HECM borrowers with other elderly homeowners. Lastly, we use a proportional hazard model to study the termination pattern of these loans.

3.4.1 Changes in HECM Borrower and Loan Characteristics

Figure 3.6 shows the number of HECM loans originated each year between 1989 and 2007. In the early years of the program, only a small number of elderly homeowners took out HECM mortgages. In contrast, loan origination has grown substantially in recent years. For instance, the number of loans made in 2007 is ten times the number in 2001. One of the potential explanations for such significant growth is that elderly homeowners have become more comfortable taking equity out of their homes and taking on debt in general. To test the plausibility of this explanation, we use the 1989-2004 Survey of Consumer Finances (SCF) data and plot the fraction of homeowners aged 62 or above who have credit card debt, debt secured by primary residence, or any type of debt in figure 3.7. The fraction of elderly homeowners with credit card debt trended slightly up over the 15-year sample period. The fraction of elderly homeowners with mortgages, home equity loans, or home equity lines of credit increased steadily from 22% in 1989 to 34% in 2004. The fraction with any type of debt rose from 44% to 56%. Overall, the SCF data suggest that a increasing number of elderly homeowners feel comfortable taking on debt secured by their homes. However, such a shift in financial attitude is unlikely to fully explain the unusually large increase in reverse mortgage origination. Other factors may also contribute to the growth of the HECM program, including the 2000-2005 housing market boom, lower interest rates in recent years, and elderly homeowners becoming more aware of the reverse mortgage product.

In figure 3.8, we show how the distribution of HECM borrower age evolved between 1989 and 2007.[7] Two time trends shown in this figure are worth mentioning. First, the distribution of borrower age shifts to the left over time, meaning that recent borrowers are younger than early borrowers. Second, the spike at age 62 becomes more prominent over time, suggesting that there may be homeowners of ages less than 62 who would want to take HECM loans if allowed. Such patterns imply that the reverse mortgage market has been growing most rapidly among younger elderly homeowners.

Figure 3.9 displays histograms of appraised house values at the time of loan origination. All dollar amounts are converted to 2007 dollars. Over time, the distribution of house values shifts to the right and becomes more dispersed. Such changes may be due to the overall housing price appreciation in the early 2000s. To determine whether housing price appreciation alone can explain the time trend of the histograms, we take the 1989-1999 house value distribution and inflate it with national-level OFHEO housing price indexes. We then impose the kernel density of these inflated 1989-1999 distributions on the histograms of actual HECM loan house values. If housing price appreciation accounts for all the change in the distribution of HECM loan house values, then the kernel density curves should exactly match the histograms. We find that by and large, the histograms and the kernel density curves mirror each other, although the histograms in later years have fatter tails than the

[7]We break down the sample into four time periods, 1989-1999, 2000-2003, 2004-2006, and 2007, so that each time period has enough observations to plot a stable distribution.

kernel density curves. This suggests that more homeowners at the top and bottom of the housing value distribution are acquiring HECM loans.

It has been argued in the literature that the HECM program may not be attractive to potential borrowers because of limitations on the fraction of housing equity one can borrow. In figure 3.10, we plot the distribution of the Initial Principal Limit (IPL) to house value ratio for HECM loans. Recall that the IPL is the product of MCA and a factor that increases in age and decreases in expected interest rate. It represents the present value of all payments that may be received by the borrower plus costs associated with providing such payments. Before 2000, the IPL on average was about 50-60% of the house value. Since then, IPL-to-house-value ratios have increased to between 0.6 and 0.7, presumably due to low interest rates in the 2000s. Higher IPL-to-house-value ratios mean that borrowers are able to transform a larger fraction of their illiquid housing equity into income and liquid assets.

3.4.2 Comparison of HECM Borrowers with the Overall Population of Elderly Homeowners

Elderly homeowners choosing HECM loans account for a very small fraction of the eligible population. How are borrowers different from the rest of elderly homeowners? To address this question, we compare HECM borrowers in our data with homeowners 62 years of age and older in the 1989-2004 SCF. Table 3.2 illustrates differences in median age and median house value between the HECM sample and the SCF sample. In general, HECM borrowers tend to be older than non-borrowers, but the gap has narrowed in recent years. For example, the median age of the 1989 HECM sample is 77.2 and the median age of the 1989 SCF sample is 71. Over the years, the HECM program has attracted younger borrowers, and the median elderly homeowner has become older in the general population. In the 2004 samples, the median HECM borrower age decreased to 73.7 while the median SCF respondent age increased to 73. Moreover, HECM borrowers appear to own more expensive houses than non-borrowers, reflecting that house-rich but cash-poor homeowners may benefit most from reverse mortgages. While the median house value of the SCF sample increased steadily from 1989 to 2004, the median house value in the HECM sample declined in the 1990s before rising considerably since 1998.

To identify geographic areas with HECM borrowers, we use the zip code information in our HECM dataset to merge with 2000 Census statistics at the zip code level. Approximately 60% of all zip codes in the U.S. had HECM loans originated between 1989 and 2007. Table 3.3 compares the characteristics of the zip codes with and without HECM loans. Areas with HECM loans appear to have more black and fewer Hispanic residents than areas with no HECM loans originated. For instance, zip codes with HECM loans are 12.5% black on average and zip codes without HECM loans are 8.3% black. Second, HECM borrowers are from areas with a better-educated population. For example, 16.2% of the people in zip codes with HECM loans have college or post-graduate degrees, but only 10.2% of the people in zip codes without HECM loans have such degrees. Lastly, HECM borrowers live in places with higher median household income and house value. The median house value is $100,632 in zip codes without HECM loans, while it is 43% higher in zip codes with HECM loans. These differences are consistent with the findings of Case and Schnare (1994) and Rodda et al. (2000) that HECM borrowers are mostly from metropolitan areas. Table 3.4 displays the twenty MSAs that originated the most HECM loans. For instance, 20,249 loans were made in Los Angeles-Long Beach-Glendale, CA, approximately 5% of all HECM loans originated between 1989 and 2007.

3.4.3 Termination Outcomes of HECM Loans

A HECM loan is terminated when the borrower dies or permanently moves out the house. Understanding termination outcomes of HECM loans is essential for the FHA insurance program and the long-term viability of the HECM program. As mentioned earlier in this paper, HECM loans are not priced on gender or marital status. Because couples and single females have longer life expectancy, we may observe different termination outcomes for different groups. Figure 3.11 plots the loan survival curves for single male, single female, and couple borrowers respectively. The survival curve of couple borrowers lies above that of single females which in turn lies above that of single males. This pattern suggests that couples have the longest loan life and single males have the shortest loan life. Figure 3.12 shows the termination hazard rates corresponding to the survival curves plotted in Figure 3.11. These hazard rates appear to have an inverse-U shape. In other words, termination hazard is low in years immediately after origination and then increases with time. However, for loans that have not been terminated within 10 years, termination hazard declines with time, suggesting that borrowers who have not died or moved out after 10 years may stay for a very long time.

The above analysis does not control for age and origination year. To separate the gender and marital status effect from the age and year effect, we estimate the following proportional hazard model:

$$\lambda_t = \lambda_0 * exp(\beta_1 SingleFemale_i + \beta_2 Couple_i + \delta_{it} + \theta_t) \tag{3.1}$$

where λ_0 is the baseline hazard, δ_{it} are age fixed effects, and θ_t are year fixed effects. If single females and couples have lower termination hazard than single males conditional on age and origination year, we would expect β_1 and β_2 to be negative. Table 3.5 displays our estimation results. Estimates of β_1 and β_2 are both negative and statistically significant, suggesting that single males indeed have the highest termination risk and couples have the lowest. To help interpret the magnitude of our estimates, we also show the hazard ratios implied by our estimates. On average, the termination hazard for single females is 75.2% of that for single males. The termination hazard for couples is even lower, 57.1% of that for single males. These results highlight the significant differences in termination risks across different groups.

3.5 Simulation of HECM Program Profits

3.5.1 HUD Insurance Pricing Model

In establishing a pricing scheme for HECM loans, HUD faces imperatives both to establish a self-financing system and to keep prices low so as to maximize market participation and avoid overcharging elderly homeowners in difficult financial circumstances. However, when the program was first established in 1987, there was no past experience with HECM loans upon which to base cash-flow estimates. As explained in Szymanoski (1994), the designers of the HECM program made modeling assumptions to address uncertainty about the inflows and outflows associated with an insured loan, and then set program parameters to satisfy a zero-profit condition. To address interest rate uncertainty, the original HUD model uses the ten-year Treasury rate plus the lender's margin as a risk-adjusted expected interest rate for the life of the loan. Future house prices are expected to follow a geometric Brownian motion process, with average nominal increases of 4% and a standard deviation of 10%. Loan termination rates are crudely approximated by multiplying age-specific female mortality rates by a factor of 1.3.[8] This model determined the age and interest-rate specific principal limit factors, or the fraction of the MCA available at origination, for all HECM loans in the FHA insurance program.

Recent comparisons of empirical loan outcomes to the model suggest that the original assumptions about loan termination and HECM profits may be too conservative. The 2003 HUD evaluation of the HECM program estimates net expected profits as $1,039 per HECM loan.[9] Similarly, Szymanoski et al (2007) shows that actual loan terminations have occurred at a significantly faster rate than the HUD model anticipated. Further, an AARP survey found that large up-front costs contributed to many homeowners' decisions to forego taking out a HECM loan.[10] The conception that the HECM program has produced positive profits thus far has resulted in pressure to reduce the costs of HECM insurance, as reflected in the Housing and Economic Recovery Act of 2008's mandate to lower FHA premiums for HECM loans. However, the available HECM data on both profits and terminations come from a period of generally rising home values and relatively low and stable interest rates. In addition, changes in the composition of the pool of HECM borrowers suggest that extrapolating from past outcomes may not be appropriate for forecasting the long-term financial health of the HECM program. Our simulations attempt to better understand how different assumptions about house price appreciation, HECM loan termination, and payment schedules affect long-term profitability.

[8] Mortality rates come from the 1979-1981 decennial life tables published by the U.S. National Center for Health Statistics.

[9] See Rodda et al. (2003).

[10] See Redfoot et al. (2007).

3.5.2 Simulation Model

Instead of calculating a principal limit factor that results in zero profits for a given age and expected interest rate, our simulation model takes all program parameters as given and calculates numerous expected outcomes for the sample of HECM loans originated in 2007 with stochastic interest rates, house values, and loan terminations. We simulate 1000 paths of future interest rates and house values over a period of 44 years. This allows the youngest borrowers in the sample to reach age 105, the upper bound for loan termination in our model. Then for each household in our sample and each interest rate path, we calculate borrower payments, loan balances, and MIP premiums in each year of the simulation. We use a matrix of age- and group-specific loan termination rates to randomly draw a termination year for each loan. We then are able to generate termination-year outcomes for each borrower in our sample. For each of these calculations, we compute averages across all simulations and within three groups of borrowers: males, females, and couples. The HECM outcomes we calculate include whether or not a loan results in an FHA insurance claim because the final loan balance exceeds the final house value, the amount of the claim, the present discounted value of MIP paid to HUD, and the profit or loss to the HECM program associated with the loan. We also make two calculations from the point of view of the borrower: first, the present discounted value of all loan costs, including MIP premiums, closing costs, and loan servicing fees. Second, we calculate the ratio of these costs to the net principal limit, which is the maximum lump sum payment that could be received by the borrower at the time of closing.

In calculating insurance claims, our simulation model focuses on actual losses to the HECM program, rather than technical claims. Historical FHA claim rates for HECM loans are reported in Table 3.6. Note that claims result from one of three events: a foreclosure on the property that does not cover the outstanding loan balance,[11] a sale that does not cover the outstanding loan balance, or the balance on an active loan reaching 98% of the MCA and prompting the lender to assign the loan to HUD. In the first two cases, the claim amount is the difference between the sale value and the outstanding balance. However, in the last case, the claim is for the total loan balance, and HUD will later recover much or all of the value of the claim when the house is sold. Our simulated claim rate omits loans assigned to HUD that later experience a full recovery. We only consider a loan to result in a claim if the loan balance exceeds the house value in the year the loan is terminated. As a simplification, our model also ignores the possibility of foreclosure, except in its contribution to historical termination rates.

Like any simulation model, our calculations reflect assumptions about payment schedules, loan termination rates, and future interest rates and house prices. Our benchmark models assume an initial lump-sum distribution of maximum size and annual interest rates drawn from the historical distribution of treasury bill rates from 1926 to 2007,[12] plus the lender's margin. In our sample of 2007 HECM loans, the lender's margin is typically very close to 1%. In light of the recent concern that existing models used to forecast future house prices are inadequate,[13] our benchmark assumption for house price appreciation is simple – we assume that real house prices are constant over time. Each year the nominal house value appreciation rate equals the inflation rate experienced in the year corresponding to the interest rate drawn from the historical distribution. In future extensions of this paper, we hope to consider the effects of more complex assumptions about house price appreciation, including area and borrower level variation. We offer both high and low benchmark assumptions for age-specific loan termination rates, each measured separately for the three groups of borrow-

[11]Most HECM foreclosures are due to nonpayment of home-owner's insurance or property taxes.

[12]The Treasury rate associated with each year is the annualized return on Treasury securities for that year, as reported in Ibbotson Associates (2008). Inflation rates come from the same source. Between 1926 and 2007, Treasury rates average 3.8%, and inflation rates average 3.1%.

[13]See Wheaton and Nechayev (2008), for example.

ers. For the high termination mode, we use the historical termination rates for HECM loans originated between 1989 and 2006.[14] Because these termination rates may be endogenously related to the house-price appreciation of that period, as suggested by Davidoff and Welke (2007), we also calculate results using age-specific mortality rates from the 2004 life tables produced by the National Center for Health Statistics.[15] Because of the possibility of adverse selection, mortality rates are not a lower bound on age-specific termination rates in general, but Davidoff and Welke's (2007) results suggest that they may be considered as such in the context of some models. For all three groups of borrowers, the termination rates used in the original HUD model lie between the empirical termination rate and the 2004 mortality rate except at very old ages.[16] Graphs of the group-specific historic termination rates and mortality rates appear in Figure 3.13. Note that the graph of historical termination rates is not a standard survival function because loans originate at different ages. For example, households appearing in the pool of age 75 borrowers might not be in the pool of age 62 borrowers.

We also provide results based on various alternatives to our benchmark assumptions. First, to facilitate comparison with the HUD model, we let nominal house prices increase by a constant 4% each year and also calculate results for the sub-sample of 2007 loans with initial house values below the area-specific FHA mortgage limits. Second, to measure potential HECM losses resulting from a bursting of the housing bubble, we implement an assumption that half of the MSA-specific real house price appreciation between 1998 and 2007 is lost in the first year, with house prices remaining at a constant real value thereafter.[17] Lastly,

[14]Calculation of empirical termination rates requires grouping all observations beyond a certain age because of small sample sizes. Thus the male termination rates are constant after age 98, female rates after 99, and couple rates after 94. In our simulations, we ensure that all loans have a termination year by setting the age 105 termination rate to 100% in both the empirical and mortality termination conditions.

[15]See Arias (2007).

[16]For females, the HUD model termination rate falls below the empirical rate at ages 94 and above. In addition, because the empirical rate becomes a constant after some age, the HUD model termination rate eventually exceeds this rate for males and couples.

[17]The real increase in house prices is calculated using MSA-level OFHEO housing price indexes for 1998

to consider the profits that result when households do not initially withdraw the maximum lump sum, we present results assuming that households elect instead to receive equal monthly payments under the tenure plan.

3.5.3 Simulation Results

The top panel of Table 3.7 shows the FHA insurance claim rate in our simulation models. The claim rate predicted by our benchmark model using empirical termination rates, 12.6%, is about one-third lower than the historic non-foreclosure related claim rate for loans that originated by 1997 of 18.6%. This is likely due both to the difference in definitions and to demographic differences between the sample of 2007 borrowers and earlier borrowers. The low termination benchmark, which corresponds to longer average loan duration, predicts much higher claim rates than the high termination benchmark. This occurs because in our model, the interest rate paid on loan balances is higher on average than the rate of house price appreciation.[18] Thus the longer the duration of the loan, the more likely it is that the loan balance surpasses the house value. This intuition also explains why claim rates are higher for loans issued to couples and to females than for loans issued to males. Panel B shows the average claim amount, which also is increasing in the expected duration of the loan. Note that this is an empirical result; theoretically, the effect on average claim size is indeterminate. The marginal effect of longer loan duration will depend on the magnitude of the increase in claim size for existing claims, as well as the relative density of marginal claims. In the high (low) termination mode, the average claim is 9.3% (12.3%)of the median house value in the 2007 HECM sample of $222,000.

and 2007, adjusted for inflation as measured by the CPI.

[18]The effective interest rate for the borrower is the Treasury rate, averaging 3.8%, plus a lender's margin of around 1%, plus the 0.5% MIP paid to HUD. The average rate of house price appreciation is simply the average inflation rate of 3.1%.

Table 3.8 shows the average profits per HECM loan in our simulated models. The profit on a loan is the present discounted value of the difference between premiums paid and the loss at termination, if any. HECM profits are large and positive for our benchmark models, though these results may change after implementing more complex assumptions about house price appreciation. For similar reasons, we refrain from commenting about cross-subsidization across groups. Our results demonstrate that profitability is not necessarily monotone in expected loan duration, as average profits on loans issued to female borrowers are less than profits on loans issued to either males or couples in both our high and low termination simulations. This occurs because increasing loan duration increases both MIP payments and the probability of a claim. Thus calls for MIP decreases because of high historic termination rates may be premature, as the effect of higher termination rates on expected profits is an empirical question.

In Table 3.9, we calculate the average costs faced by households that take out HECM loans, including closing costs, MIPs, and monthly servicing fees. These costs do not depend on house price appreciation rates and increase with the expected loan duration. In both the high and low termination modes, as expected, borrower costs are high relative to the costs of a conventional forward mortgage. According to information provided in the Federal Reserve Board's Consumer Guide to Mortgage Settlement Costs, closing costs related to a mortgage on a house purchase for $222,000 with a down payment of twenty percent are expected to total between $4,700 and $10,200.[19] Our calculation of borrower costs on HECM loans are much higher, $18,340 ($24,670)in the high (low) termination mode. Ratios of borrower costs to the net principal limit at origination, which is the maximum lump sum that could be immediately withdrawn, are similarly much higher than ratios of closing costs to loan values for forward mortgages: 13.5% (18.4%) in the high (low) termination mode for reverse

[19]Authors' calculations based on information provided in the Federal Reserve Board's online publication, available at `http://www.federalreserve.gov/pubs/settlement/default.htm`

mortgages compared to no more than 6% for forward mortgages. The most important factor contributing to the difference in costs between reverse mortgages and forward mortgages is the need to purchase FHA insurance.

At this point, the reader may wonder why our simulations produce positive profits from parameters chosen to satisfy zero-profit conditions. Our simulations differ from the original HUD assumptions in several ways. First, we use different termination rates, though this is unlikely to be the only factor because our simulations generate large positive profits using two different sets of assumptions about termination rates. Second, our assumption of constant real housing values allows for less variance in housing price appreciation than the original HUD model. Because profits depend on house price appreciation in a non-linear way, increasing the variance could either increase or decrease our calculations of expected profits. We hope to investigate this effect in future extensions of this paper. Furthermore, our distribution of house price appreciation has a lower mean than in the HUD model. The second model listed in Tables 3.7 and 3.8 shows the impact of raising the mean value of nominal house price appreciation from 3.1% to 4% to match the HUD model, while reducing variance to zero. This lowers claim rates by 71 to 81% and increases profits at least 20%, even doubling them in some cases of the low termination mode. The large size of this effect illustrates the importance of the choice of expected house price appreciation and the need for better understanding of house price dynamics. Finally, our simulations differ from the HUD model as a result of the presence of borrowers with appraised house values that exceed the maximum claim amount. The HUD model implicitly ignores such borrowers in setting principal limit factors, so these borrowers enter the HECM pool with a cushion of expected profits resulting from their extra equity. Results for simulations of our benchmark model on the sample of 2007 HECM borrowers with appraised house values less than the local MCA are reported in the third line of the tables. This sample produces claim rates that are approximately 20% (16%) higher than in the full sample under high (low) termination rates.

Profits decline by about 25% (45%). The extra profits generated by the sample including borrowers with high house values suggest that the current HECM program is likely to produce positive profits in the long run under most assumptions.

In the short run, the recent decline in housing prices across the country raises the question of how the HECM program might be affected. Might the bursting of the housing bubble wipe out the expected profits from earlier cohorts? We address this question by simulating a model in which initial house values drop sharply before maintaining a constant real value. This has the effect of calculating net principal limits based on a value that is higher than the long term real value of the house, as is likely to have occurred for HECM borrowers that took out loans near the peak in national housing prices. We calibrate the house price drop to equal half of the real increase in house prices since 1998, specific to each MSA. Results of this simulation appear in the fourth rows of Tables 3.7 and 3.8: insurance claims soar and the program loses money on the cohort of loans experiencing the drop in housing prices, regardless of which termination profile is used. The per loan losses are larger than the projected profits in the 2003 HECM evaluation. Because recent cohorts of loans are so large in comparison to the existing stock, the current housing decline may lead to cash flow shortfalls, even if the long-term financial health of the program is sound.

Our final alternative model examines the effects of the borrower's choice of payment schedules. The HUD model is formulated to calculate the maximum lump sum payment associated with a zero profit condition, and then stipulates that borrowers may choose any payment schedule that has a present value less than or equal to this lump sum. Though such a rule may seem reasonable on its face, it neglects to recognize that changing a payment schedule affects the stream of premiums paid for FHA insurance, making it possible to devise a payment stream that conforms to HECM rules, but results in negative expected profits. For example, instead of taking the maximum lump sum immediately, a borrower could wait five years and then take the the original sum plus interest. Thus the borrower has the same balance after five years, but has avoiding paying monthly premiums throughout that time. We illustrate this effect by simulating a model in which the borrower chooses to take tenure payments rather than a lump sum withdrawal, such that the borrower receives a monthly payment determined by HECM rules until the loan is terminated. Table 3.9 shows that the lower monthly insurance premiums cause borrower costs to be lower by about 18% on average.[20]. Although tenure payments reduce MIP payments, the full effect of this change on HECM profits depends also on how it affects insurance claims. As can be seen in Table 3.7, insurance claim rates are uniformly lower under tenure payments, but average claim amounts are substantially larger.[21] The net effect on profits appears in Table 3.8: across the board, average profits-per-loan are much lower for the model of tenure payments. This empirical outcome is important because early explanations of the HECM pricing model surmised that borrowers taking less than the maximum payment would generate long-term profits to the program Szymanoski (1994).

3.6 Conclusion

The HUD-sponsored HECM program accounts for most reverse mortgages originated in the United States. Over the past decade, the number of HECM loans made each year has been growing substantially. In this paper, we perform analysis on all HECM loans originated between 1989 and 2007. We find that borrowers in the HECM program have become younger over time. The recent housing market boom may have induced house values

[20]Note that all other components of our cost measure–closing costs, the initial MIP, and monthly servicing fees–are unaffected by the change in payment schedule.

[21]Under the rules that determine the size of tenure payments, it is possible for the loan balance to grow larger than the balance for the equivalent lump sum if the borrower lives beyond age 100. Thus under low termination rates, it is theoretically possible for tenure payment assignment rates to exceed the benchmark rates.

to increase among HECM loans. The IPL to house value ratio, which indicates the fraction of housing equity a borrower can use to purchase a HECM loan, has also been increasing over time. HECM borrowers appear to be from areas with higher income and house values, a better-educated population, and more minority residents. Additionally, we find that single males in the HECM program have the highest termination hazard and couples have the lowest.

We also conduct numerical simulations to show how termination risks, housing price appreciation, and choices of payment schedules may affect the profitability of the HECM program. Our results suggest that profits are sensitive to assumptions made about termination rates and housing price appreciation rates. In addition, we find that profits fluctuate with payment schedules chosen by borrowers, even when changes in payment schedules do not affect the present value of all future payments. Furthermore, even though the HECM program has positive expected profits in the long run, our simulations show that a significant drop in housing prices for the recent borrower cohort may cause considerable losses in the short run. Therefore, it may be premature to call for reductions in HECM insurance premiums before assessing the impact of such reductions.

There have been various misconceptions about how the HECM program works among researchers and potential borrowers. For example, some people think once a borrower enters the HECM program, she relinquishes her house entirely to the lender. In fact, the borrower pays back the lesser of the loan balance or proceeds from the property sale. Hence, the borrower remains the residual claimant on the value of the property and the moral hazard problem on home maintenance may not be as severe as many people believe. Another common misconception about the HECM program is that the tenure payment plan, which gives borrowers equal monthly payments for as long as they are alive and continue living in their homes, is equivalent to an annuity. For immediate life annuities, insurance against outliving one's assets is provided by pooling mortality risks across a group of people. However, the tenure plan of HECM loans involves little risk-pooling: if a borrower dies shortly after her HECM loan is originated, she pays back only the loan balance, which presumably is small. HUD does not inherit this borrower's entire housing equity to pay another borrower who lives to be over 100 years old. Thus, the longevity insurance aspect of a tenure HECM loan is very limited. Furthermore, many people believe the high costs associated with HECM loans indicate that these loans are a bad deal for elderly homeowners. One reason why a reverse mortgage costs more than a regular forward mortgage is the MIP charged by HUD to insure both the lender and the borrower. Precisely because there is little risk-pooling in the HECM program, insurance premiums have to be high for HUD to break even. As a result, one may have to change the fundamental structure of the HECM program in order to cut the MIP significantly. We hope that the descriptions and analysis presented in this paper help correct these misconceptions.

Although we have taken the first step to investigate how the characteristics of HECM loans and borrowers have evolved over time and how the profitability of HECM loans respond to stochastic risks, numerous questions remain unanswered and more studies are called for. For example, how might the HECM program be modified to involve more risk-pooling? What is the optimal division of the HECM insurance premium between initial and monthly payments? How much demand will there be once the market for reverse mortgages matures? How does the reverse mortgage market interact with the annuity market, the Long-Term Care Insurance market, and government redistribution programs? We plan to address these questions in future work.

Figure 3.1: MCA and Appraised Housing Value

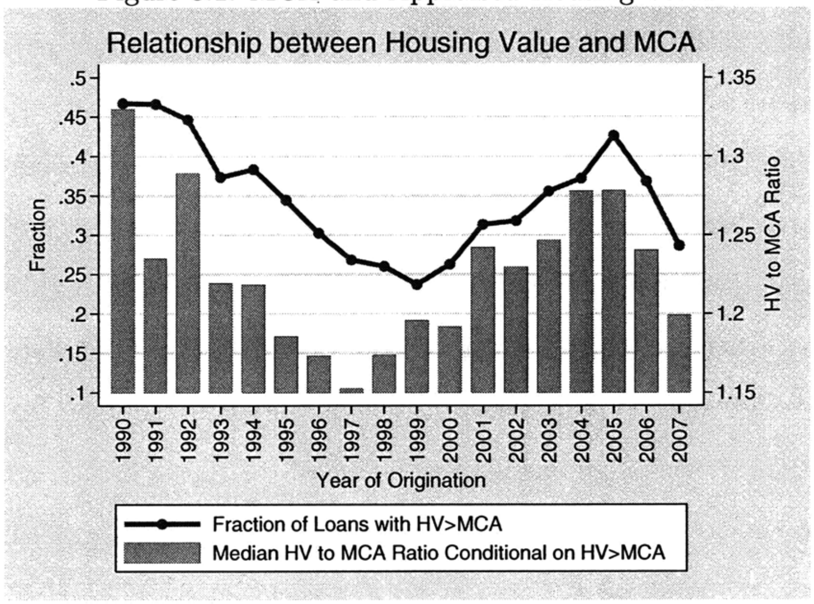


Figure 3.2: Median Expected Interest Rate Charged on HECM Loans and Ten-Year Treasury Rates

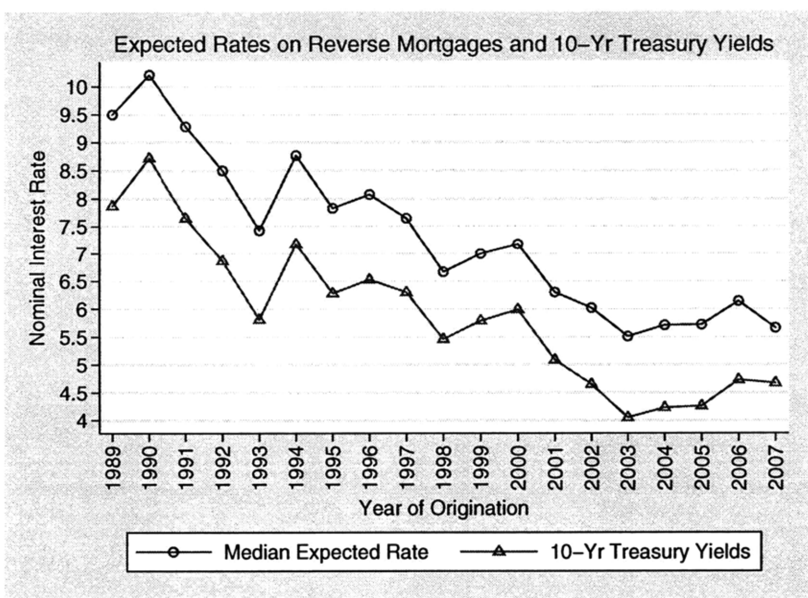


Figure 3.3: Calculating the Principal Limit

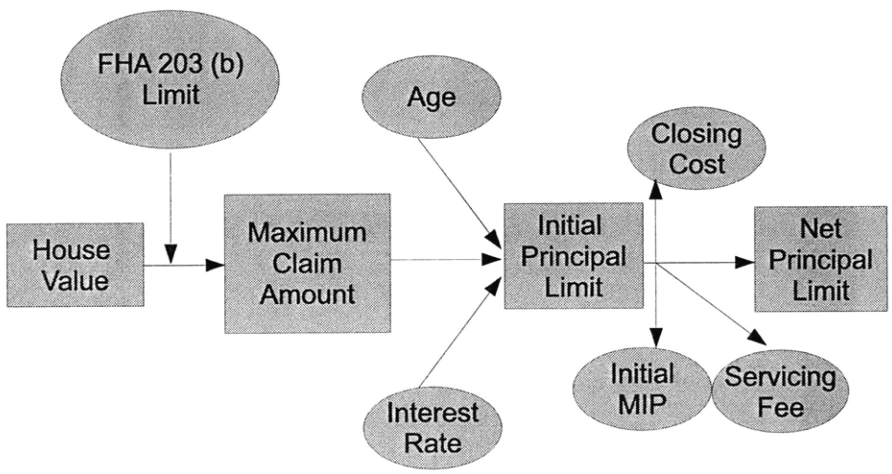


Figure 3.4: Distribution of HECM Borrower Gender and Marital Status by Loan Origination Year

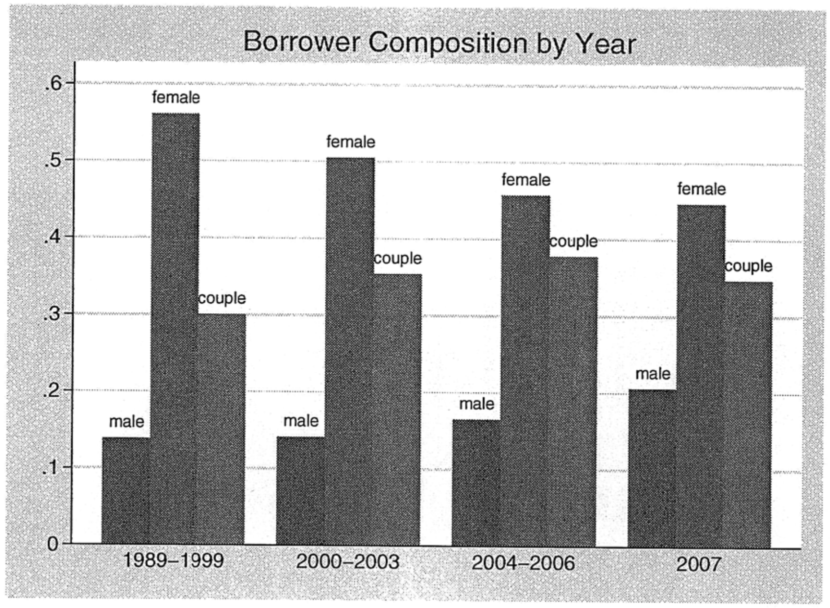


Figure 3.5: Distribution of Monthly Payments for HECM Loans Originated in 2007 that Have a Term or Tenure Component

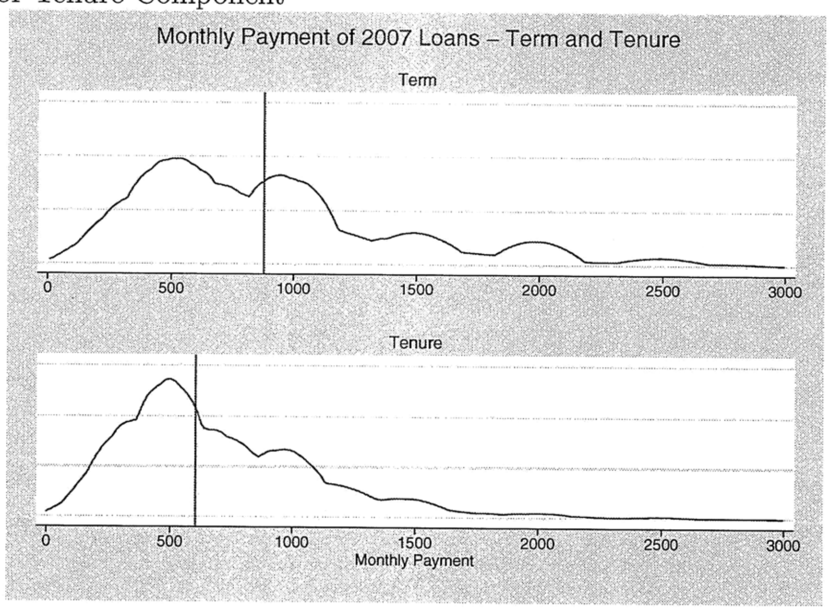


Figure 3.6: Growth in HECM Loans 1989-2007

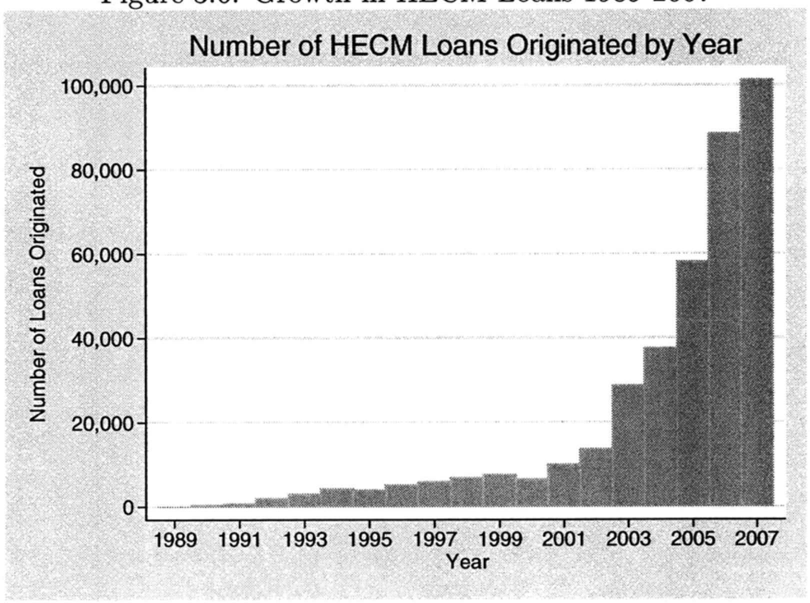
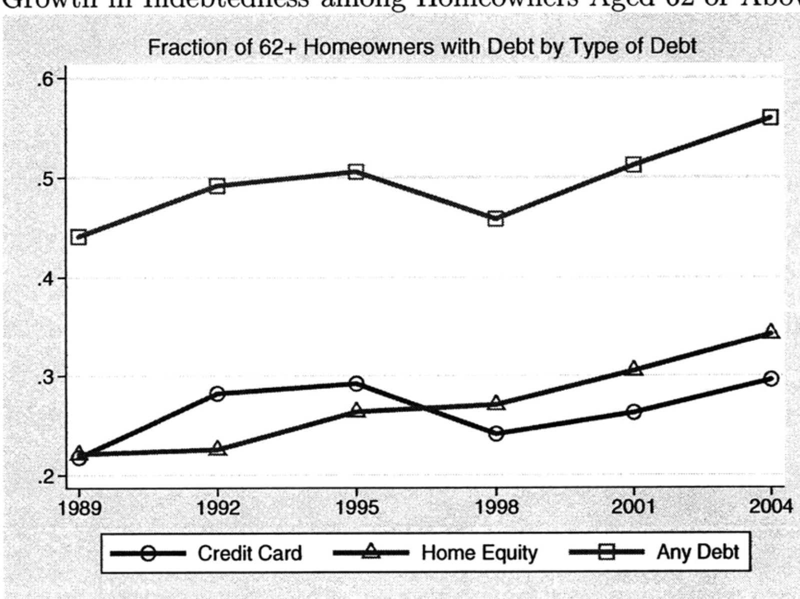


Figure 3.7: Growth in Indebtedness among Homeowners Aged 62 or Above 1989-2004



Note: Data are from 1989, 1992, 1995, 1998, 2001, and 2004 Survey of Consumer Finances.

Figure 3.8: Distribution of HECM Borrower Age by Loan Origination Year

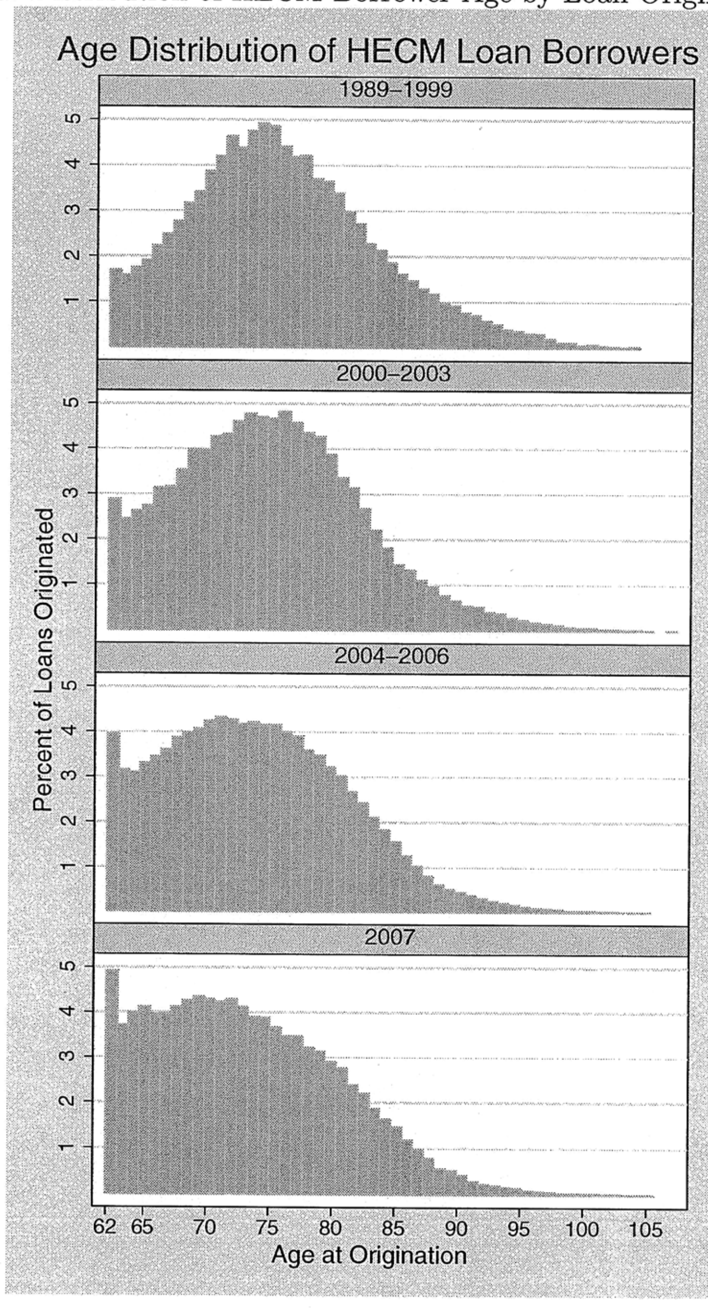
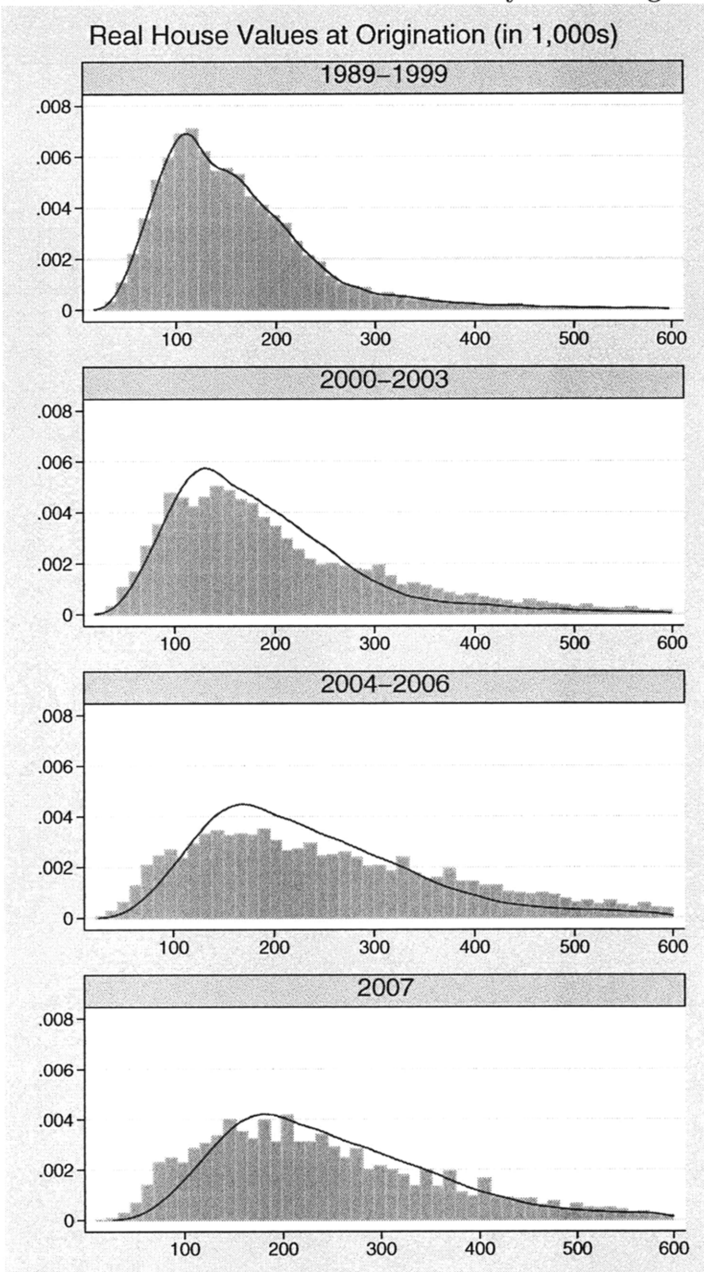
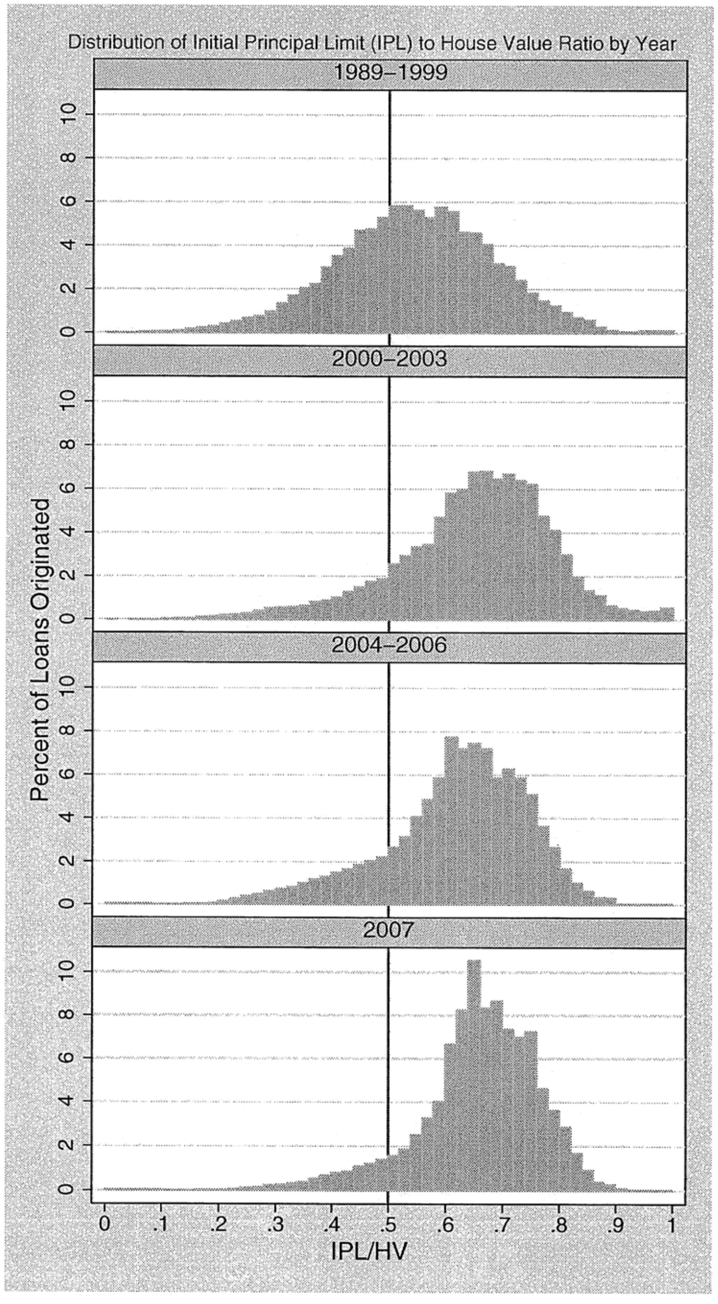


Figure 3.9: Distribution of Real House Values by Loan Origination Year



Note: The histograms are the actual house values of HECM borrowers at the time of loan origination. The kernel density curves refer to what the house values of 1989-1999 HECM borrowers would be in later years projected by OFHEO housing price indexes.

Figure 3.10: Distribution of the Initial Principal Limit (IPL) to House Value Ratio by Loan Origination Year



Note: The vertical lines mark the 0.5 IPL to House Value Ratio.

Figure 3.11: Survival Curves of HECM Loans for Single Males, Single Females, and Couples

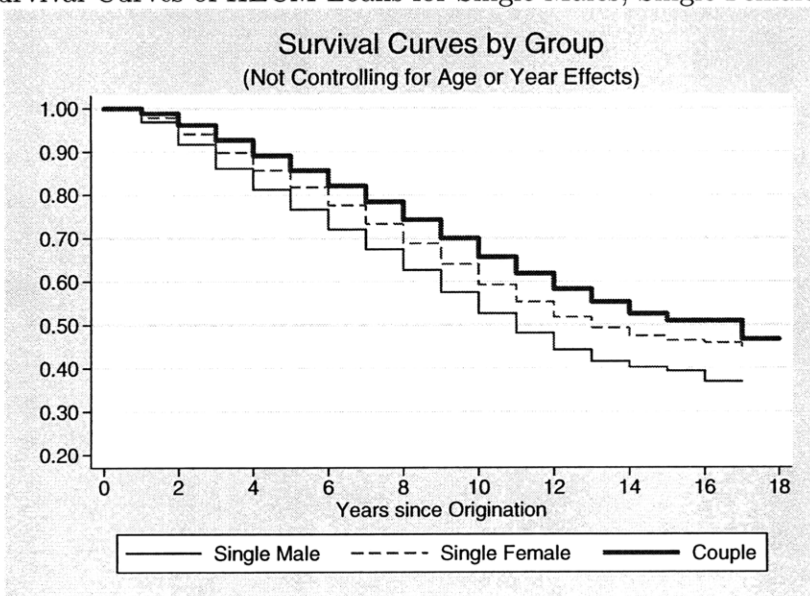


Figure 3.12: Termination Hazard Rates of HECM Loans for Single Males, Single Females, and Couples

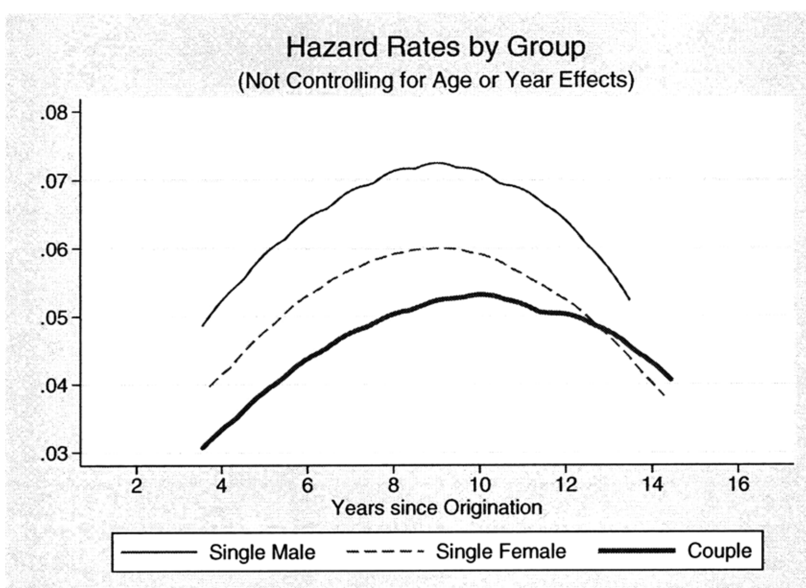
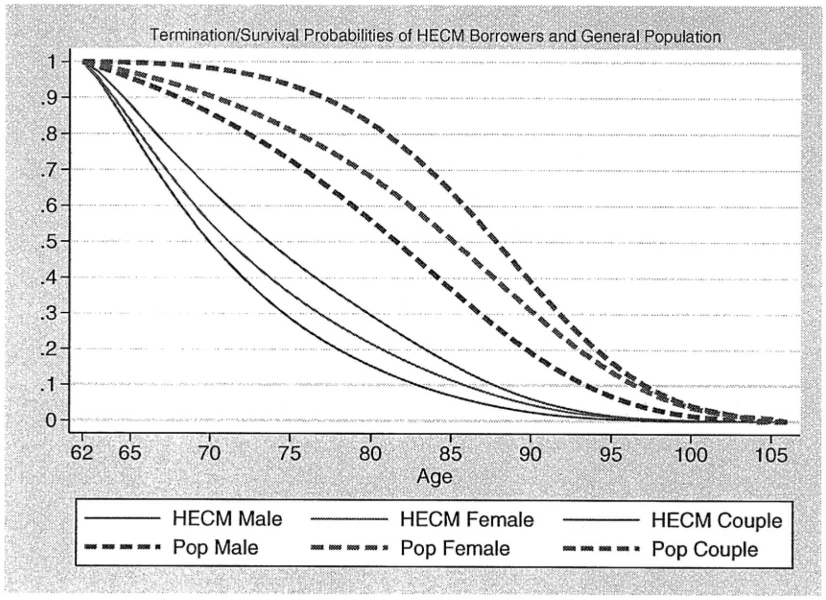


Figure 3.13: Termination Rates of HECM Borrowers and Survival Probabilities of the General Population



Note: Termination rates of HECM borrowers are based on 1989-2007 loan level data. Survival probabilities of the general population are based on 2004 National Center for Health Statistics (NCHS) mortality tables.

Table 3.1: HECM Payments for a Hypothetical Borrower

A. Principal Limit Factor

Expected Rate	Age=65	Age=75	Age=85
0.05	0.649	0.732	0.819
0.06	0.591	0.689	0.792
0.07	0.489	0.609	0.738

B. Net Principal Limit

Expected Rate	Age=65	Age=75	Age=85
0.05	$114,188	$131,492	$150,112
0.06	$103,207	$123,333	$144,937
0.07	$83,323	$107,715	$134,344

C. Tenure Plan Monthly Payment

Expected Rate	Age=65	Age=75	Age=85
0.05	$610	$804	$1,221
0.06	$620	$828	$1,256
0.07	$558	$791	$1,238

D. 10-Year Term Plan Monthly Payment

Expected Rate	Age=65	Age=75	Age=85
0.05	$1,234	$1,421	$1,622
0.06	$1,166	$1,393	$1,637
0.07	$983	$1,271	$1,585

Note: MCA=$200,000, closing costs = $6,000, monthly servicing fee = $30

Table 3.2: Median Age and House Value of HECM Borrowers and Elderly Homeowners in Survey of Consumer Finances

Year	Median Age		Median House Value	
	HECM	SCF	HECM	SCF
1989	77.2	71	$110,337	$100,307
1992	75.4	71	$158,098	$103,428
1995	75.1	72	$144,185	$108,819
1998	74.8	72	$137,352	$114,460
2001	75.0	72	$166,215	$140,463
2004	73.7	73	$208,507	$164,611

Note: Median house values are in 2007 dollars.

Table 3.3: Characteristics of Zip Codes with and without HECM Loans

	Zip Code w/ HECM Loans	Zip Code w/o HECM Loans
Race/Ethnicity		
White	74.9%	78.1%
Black	12.5%	8.3%
Other	12.6%	13.6%
Hispanic	12.9%	23.2%
Education		
Less Than High School	12.5%	17.1%
High School Graduates	18.3%	20.9%
Some College	17.9%	14.9%
College Graduates or More	16.2%	10.2%
Income/House Value		
Median Income	$45,362	$32,209
Median House Value	$143,843	$100,632

Note: Characteristics are based on 2000 Census data.

Table 3.4: MSAs with the Most HECM Loans Originated between 1989 and 2007

MSA Name	N
Los Angeles-Long Beach-Glendale, CA	20,249
Riverside-San Bernardino-Ontario, CA	15,753
Chicago-Naperville-Joliet, IL	9,560
New York-White Plains-Wayne, NY-NJ	8,911
Phoenix-Mesa-Scottsdale, AZ	8,171
San Diego-Carlsbad-San Marcos, CA	7,262
Denver-Aurora, CO	7,231
Sacramento–Arden-Arcade–Roseville, CA	7,082
Nassau-Suffolk, NY	6,951
Washington-Arlington-Alexandria, DC-VA-MD-WV	6,604
Philadelphia, PA	5,909
Baltimore-Towson, MD	5,822
Detroit-Livonia-Dearborn, MI	5,564
Miami-Miami Beach-Kendall, FL	5,421
Fort Lauderdale-Pompano Beach-Deerfield Beach, FL	5,368
Oakland-Fremont-Hayward, CA	5,144
Tampa-St. Petersburg-Clearwater, FL	5,111
Seattle-Bellevue-Everett, WA	4,906
Houston-Sugar Land-Baytown, TX	4,813
Las Vegas-Paradise, NV	4,692

Table 3.5: Proportional Hazard Model Estimation Results

	Single Females	Couples
Coefficient	-0.285	-0.561
	(0.014)	(0.015)
Hazard Ratio	0.752	0.571
N	778,252	778,252

Note: Other controls include age fixed effects and year fixed effects. Standard errors are in parentheses. Hazard ratios shown above are relative to the termination hazard of single males.

Table 3.6: Fraction of Loans Resulted in Claims due to Foreclosure, Assignment, and Lower-than-Expected Sale Price

Claim Reasons	Loans Originated between 1989 and 1997	Loans Originated between 1998 and 2002
Foreclosure	3.59%	1.50%
Assigned to HUD by Lenders	18.38%	3.36%
Sale Price Less Than Loan Balance	0.26%	0.14%
Total	22.22%	5.01%

Note: All HECM loans in our data are censored at the end of 2007.

Table 3.7: Simulation Results on HECM Loans Originated in 2007: Probability of HUD Insurance Claim and Average Claim Amount

A. Probability of HUD Insurance Claim				
High Termination	All	Males	Females	Couples
Benchmark	12.6%	9.7%	12.9%	13.7%
4% Nominal Housing Appreciation	2.7%	2.0%	3.0%	2.6%
Sample with House Values ≤ MCA	15.1%	11.5%	15.3%	16.9%
Decline in House Values	43.2%	40.6%	44.9%	42.3%
Tenure Payment	6.8%	4.6%	6.9%	8.0%
Low Termination				
Benchmark	32.4%	24.6%	31.0%	38.5%
4% Nominal Housing Appreciation	8.9%	6.3%	9.0%	10.2%
Sample with House Values ≤ MCA	37.5%	28.2%	35.7%	45.8%
Decline in House Values	65.4%	59.3%	64.2%	70.2%
Tenure Payment	25.8%	17.3%	24.2%	32.5%
B. Average Claim Amount				
High Termination	All	Males	Females	Couples
Benchmark	$20,728	$19,110	$19,829	$22,481
4% Nominal Housing Appreciation	$14,219	$13,429	$13,675	$15,375
Sample with House Values ≤ MCA	$19,312	$17,864	$18,532	$20,955
Decline in House Values	$29,352	$27,112	$28,714	$31,421
Tenure Payment	$29,586	$27,734	$29,818	$29,899
Low Termination				
Benchmark	$27,366	$24,699	$26,112	$29,633
4% Nominal Housing Appreciation	$17,110	$16,000	$16,368	$18,349
Sample with House Values ≤ MCA	$25,361	$22,935	$24,235	$27,562
Decline in House Values	$40,420	$36,059	$38,698	$44,521
Tenure Payment	$37,578	$34,118	$36,861	$39,290

Note: In our model, we stipulate that a HUD insurance claim occurs when the loan balance exceeds the house value at the time of termination. "High Termination" refers to termination rates observed in the 1989-2006 HECM loan data. "Low Termination" refers to mortality rates in the 2004 NCHS mortality tables. "Benchmark" results assume a lump sum payment with house values constant in real terms. "4% Nominal Housing Appreciation" assumes house values increase by 4% per year in nominal terms. "Sample with House Values ≤ MCA" uses the benchmark assumptions on the sub-sample of HECM loans originated in 2007 with appraised house values less than or equal to the local Maximum Claim Amount. "Decline in House Values" assumes house values drop to the average of 1998 and 2007 prices in the first year and remain constant in real terms after that. (MSA-level OFHEO housing price indices are used to calculate the average of 1998 and 2007 prices.) "Tenure Payment" assumes a constant nominal payment each year of the largest size possible under HECM rules. Claim amounts are reported in 2007 dollars. N=84,662 for the full samples and 60,020 for the sub-sample. 1000 simulations are performed on each HECM borrower.

Table 3.8: Simulation Results on HECM Loans Originated in 2007:
Average Profits-per-Loan for HUD

High Termination	All	Males	Females	Couples
Benchmark	\$8,682	\$8,297	\$8,091	\$9,675
4% Nominal Housing Appreciation	\$10,909	\$9,880	\$10,247	\$12,346
Sample with House Values ≤ MCA	\$6,497	\$6,500	\$6,038	\$7170
Decline in House Values	(\$1,377)	(\$841)	(\$2,232)	(\$540)
Tenure Payment	\$5,856	\$5,833	\$5,410	\$6,459
Low Termination				
Benchmark	\$7,445	\$7,929	\$6,785	\$8,051
4% Nominal Housing Appreciation	\$14,784	\$13,004	\$13,400	\$17,586
Sample with House Values ≤ MCA	\$4,091	\$5,364	\$3,811	\$3,730
Decline in House Values	(\$10,116)	(\$7,385)	(\$9,988)	(\$11,779)
Tenure Payment	\$2,064	\$4,006	\$1,807	\$1,340

Note: Numbers in parenthesis are losses to HUD. "High Termination" refers to termination rates observed in the 1989-2006 HECM loan data. "Low Termination" refers to mortality rates in the 2004 NCHS mortality tables. "Benchmark" results assume a lump sum payment with house values constant in real terms. "4% Nominal Housing Appreciation" assumes house values increase by 4% per year in nominal terms. "Sample with House Values ≤ MCA" uses the benchmark assumptions on the sub-sample of HECM loans originated in 2007 with appraised house values less than or equal to the local Maximum Claim Amount. "Decline in House Values" assumes house values drop to the average of 1998 and 2007 prices in the first year and remain constant in real terms after that. (MSA-level OFHEO housing price indices are used to calculate the average of 1998 and 2007 prices.) "Tenure Payment" assumes a constant nominal payment each year of the largest size possible under HECM rules. Profits are reported in 2007 dollars. N=84,662 for the full samples and 60,020 for the sub-sample. 1000 simulations are performed on each HECM borrower.

Table 3.9: Simulation Results on HECM Loans Originated in 2007:Costs to Borrowers

A. Costs to Borrowers

	All	Males	Females	Couples
High Termination, Lump Sum Payment	$18,340	$16,847	$17,460	$20,320
High Termination, Tenure Payment	$14,933	$13,795	$14,272	$16,428
Low Termination, Lump Sum Payment	$24,670	$21,787	$22,833	$28,673
Low Termination, Tenure Payment	$20,114	$17,700	$18,673	$23,338

B. Ratio of Costs to Net Principal Limit at Origination

	All	Males	Females	Couples
High Termination, Lump Sum Payment	0.135	0.126	0.131	0.145
High Termination, Tenure Payment	0.111	0.104	0.108	0.118
Low Termination, Lump Sum Payment	0.184	0.165	0.174	0.206
Low Termination, Tenure Payment	0.151	0.136	0.144	0.169

Note: Cost to borrowers includes the present discounted value of FHA premiums, origination fees, closing costs, and loan servicing fees. The net principal limit at origination is the maximum lump sum that could be immediately withdrawn. "High Termination" refers to termination rates observed in the 1989-2006 HECM loan data. "Low Termination" refers to mortality rates in the 2004 NCHS mortality tables. These calculations are independent of assumptions about future house price behavior. N=84,662 and 1000 simulations are performed on each HECM borrower.

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