How Will Persistent Low Expected Returns Shape Household Behavior?

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Abstract

Many economists posit that global capital markets will pay much lower expected returns on investments in the future compared to the past. This paper examines how lower real returns will influence work, retirement, saving, and investment behavior of older Americans. Using a calibrated realistic dynamic life cycle model that builds on our past work, we show that, in a low expected return regime, workers build up less wealth in their tax-qualified 401(k) accounts compared to the past. Moreover, men and women optimally claim social security benefits later and work more, when expected real returns are low. Naturally, there is heterogeneity in responses due to the tax and transfer system, which causes the better-educated to be relatively more sensitive to real interest rate changes. By contrast, the least-educated alter their behavior less. Interestingly, this result implies that wealth inequality is lower in periods of persistent low expected returns.

Key words: 401(k) plan; saving; investment, Social Security claiming; retirement; tax consequences

JEL: G11, G22, D14, D91

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Despite the recent rise of inflation in the United States and other Western developed countries, it appears that low *real* interest rates are likely to characterize the global economy for some time to come. For instance, governments in many European nations can now borrow at negative real rates for as far out as 50 years (Lewin, 2016; Zeng, 2017). The present paper asks how a long-term low return environment will alter household work and saving patterns, social security benefit claiming ages, and retirement decumulation.

Our analysis is informed by previous research examining how rational decision makers are influenced by shocks or unanticipated surprises in the environments they confront. For instance, the influential work of Gomes and Michaelides (2005) and Cocco, Gomes, and Maenhout (2015) was extended by Love (2010) and Hubener, Maurer, and Mitchell (2016), who showed how marriage, divorce, and widowhood as well as the arrival of children can influence optimal consumption, insurance, asset allocation, and retirement patterns. Love (2007) and Gomes, Michaelides, and Polkovnichenko (2009) develop a lifecycle model which includes tax-deferred 401(k) retirement accounts. Horneff, Maurer, Mitchell, and Rogalla (2015) reported how capital market surprises alter saving and investment choices. Chai, Horneff, Maurer, and Mitchell (2011) and Gomes, Kotlikoff, and Viceira. (2008) explained how labor market adjustments and endogenous claiming of social security benefits can help workers manage earnings and capital market risk in a life cycle setting. Horneff, Maurer, and Mitchell (2018) illustrated how the overall population would change behavior in response to low expected returns.

In what follows, we build and calibrate a life cycle model incorporating population heterogeneity which embeds stock market and labor market uncertainty, stochastic mortality, U.S. tax rules and minimum distribution requirements for 401(k) plans, and real-world social security benefit formulas. This calibrated lifecycle dynamic model produces realistic results that agree with observed saving, work, and claiming age patterns of U.S. households. Next, we simulate anticipated changes in behavior given lower real expected returns and compare outcomes with the baseline results. Of particular interest in this paper is to show how persistently low returns shape behavior across a heterogeneous population. For instance, both men and women claim social security benefits about a year later and work longer, and the response is strongest for the college-educated. Additionally, better-educated persons are more sensitive than others to real returns and so they reduce their saving more in their tax-qualified retirement accounts. Thus wealth inequality is lower in a low expected return world.

The Lifecycle Model

To illustrate how persistent low returns are likely to change household behavior in a life cycle setting, we build and calibrate a rational dynamic consumption and portfolio choice model for utility-maximizing individuals over the life cycle. We then simulate optimal outcomes in a positive real return environment. Finally, we compare those outcomes with results in a zero return world.

Preferences. Working in discrete time, we posit that the individual's decision period starts at $t = 1$ (age of 25) and ends at $T = 76$ (age 100); accordingly, each period corresponds to one year. People have uncertain lifetimes, where the probability of surviving from year t to $t + 1$ is denoted by p_t. We represent preferences in each period by a Cobb Douglas utility function $u_t(C_t, l_t) = \frac{(C_t l_t^{\alpha})^{1-\rho}}{1-\rho}$ which is a function of current consumption C_t and leisure time l_t (the latter is normalized as a fraction of total available time). The parameter α measures leisure preferences, ρ denotes relative risk aversion, and β is the individual's time preference factor. The value function is derived recursively as:

$$J_t = \frac{(C_t l_t^{\alpha})^{1-\rho}}{1-\rho} + \beta E_t(p_t J_{t+1}), \quad (1)$$

with terminal utility $J_T = \frac{(c_T l_T^{\alpha})^{1-\rho}}{1-\rho}$ and $l_t = 1$ after retirement. The survival rates p_t in the value function are from the US Population Life Tables (Arias 2010). As discussed later, we calibrate the preference parameters in such a way that our results match empirical claiming rates reported by the U.S. Social Security Administration (2015) as well as average wealth profiles invested in retirement plans.

Labor Income, Time, and Social Security Retirement Benefits. Our model quite realistically allows individuals to select flexible work effort patterns and a retirement age: that is, a worker can allocate up to $(1 - l_t)$ = 0.6 of his available time budget to paid work (assuming 100 waking hours per week and 52 weeks per year). Depending on his work effort, his uncertain yearly pre-tax labor income is given by:

$$Y_{t+1} = (1 - l_t) \cdot w_t \cdot P_{t+1} \cdot U_{t+1} \qquad (2)$$

Here w_t is a deterministic wage rate component that depends on age, education, and sex, and whether the individual works overtime, full-time, or part-time. The variable $P_{t+1} = P_t \cdot N_{t+1}$ represents the permanent component of the wage rate with independent log-normally distributed shocks $N_t \sim LN(-0.5\sigma_P^2, \sigma_P^2)$, having a mean of one and volatility of σ_P^2. In addition, $U_t \sim LN(-0.5\sigma_U^2, \sigma_U^2)$ is a transitory shock assumed to be uncorrelated with N_t and with volatility σ_U^2. This wage rate calibration follows Horneff, Maurer, and Mitchell (2016) who estimated the deterministic component of the wage rate process w_t^i and the variances of the permanent and transitory wage shocks N_t^i and U_t^i using the 1975–2013 waves of the PSID.[1] These are estimated separately by sex and educational level, where the latter is identified as less than High School, High School graduate, or at least some college (<HS, HS, Coll+).[2]

In the U.S., a worker may decide to quit working and claim social security benefits between the ages of 62 and 70, which depend on his average lifetime 35 best years of earnings.

[1] Dollar values are given in 2013 terms.
[2] Details are given in Horneff, Maurer and Mitchell (2016); see Table A1, Appendix A.

If the individual claims benefits prior to (after) the system-defined Normal Retirement Age, his lifelong social security benefits are reduced (increased) according to a pre-specified set of factors. If he works beyond age 62, the model requires that he devote at least one hour per week; also, overtime work is excluded (i.e., $0.01 \leq (1 - l_t) \leq 0.4$).

Constraints During the Work Life. During his work life, an individual may use his cash on hand for consumption or for investments. Some portion A_t of the worker's pre-tax salary Y_t can be invested in a tax-qualified 401(k)-retirement plan (up to a limit of $18 000 per year under current regulations).[3] Specifically, the plan is of the of the EET type such that contributions to the account and investment earnings are tax-exempt (E), while withdrawals are taxed (T). In addition, the worker may invest outside his retirement plan in risky stocks S_t and riskless bonds B_t. As such, his cash on hand X_t in each year is given by:

$$X_t = C_t + S_t + B_t + A_t, \tag{3}$$

where the usual constraints apply (i.e., $C_t, A_t, S_t, B_t \geq 0$). One year later, his cash on hand is given by the value of stocks (bonds) having earned an uncertain (riskless) gross return of R_{t+1} (R_f), plus income from work (after housing expenses h_t), plus withdrawals (W_t) from the 401(k) plan, minus any federal/state/city taxes and social security contributions (Tax_{t+1}):

$$X_{t+1} = S_t R_{t+1} + B_t R_f + Y_{t+1}(1 - h_t) + W_t - Tax_{t+1} \tag{4}$$

During his work life, the individual pays taxes (Tax_{t+1}) which reduce his cash on hand available for consumption and investments:[4] these include the payroll tax rate of 11.65% (1.45% for Medicare, 4% city and state taxes, and 6.2% for social security taxes). Additionally, under the US tax system, an individual must also pay progressive taxes on labor income as well as on withdrawals from tax-qualified retirement plans (including a 10% penalty tax for withdrawals before age 60), and on returns on stocks and bonds held outside the tax-qualified

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[3] This approach to retirement benefit taxation is therefore similar to how conventional defined benefit and defined contribution plan payments are handled under U.S. tax law.

[4] For details, see Horneff, Maurer and Mitchell (2016).

retirement account. If his cash on hand falls below $X_{t+1} \leq \$5{,}950$ p.a. (an amount also exempt from income taxes), we posit that he will receive subsistence support from the government at a minimum level of $5,950 for the next year.

Prior to the endogenous retirement age $t = K$, assets in the worker's tax-qualified retirement plan are invested in bonds earning a risk-free gross (pre-tax) return of R_f, and risky stocks with an uncertain gross return of R_t. Each year, the individual decides on the relative exposure of his retirement assets in stocks ω_t^s and $(1 - \omega_t^s)$ in bonds. The total value ($F_{t+1}^{401(k)}$) of his 401(k) assets at time $t + 1$ is determined by the previous period's value minus withdrawals ($W_t \leq F_t^{401(k)}$), plus additional employee contributions (A_t), plus matching contributions (if any) from the employer (M_t) , and returns from stocks and bonds:

$$F_{t+1}^{401(k)} = \omega_t^s\left(F_t^{401(k)} - \mathrm{W_t} + A_t + M_t\right)\mathrm{R_{t+1}} \\ + (1 - \omega_t^s)\left(F_t^{401(k)} - \mathrm{W_t} + A_t + M_t\right)R_f, \;\; for \;\; t < K. \tag{5}$$

Employer matches are often feasible in the retirement account subject to complex matching limits imposed by the Internal Revenue Code. Below we posit that the employer matches 100% of the employee contributions up to 5% of the employee's yearly salary (not exceeding $265,000).[5] Accordingly, the employer matching contribution is given by:

$$M_t = \min\left(A_t, \min(0.05A_t, 13{,}250)\right). \tag{6}$$

Wealth Dynamics after Claiming. As per U.S. social security rules, the worker may claim social security benefits between ages 62 and 70. Social security benefits use the 35 best years of income and bend points as of 2015 (US SSA nd), so the annual Primary Insurance Amount (or the unreduced social security benefit) equals 90 percent of (12 times) the first $791 of average indexed monthly earnings, plus 32 percent of average indexed monthly earnings over

[5] For instance, Love (2007) reported that pension contribution matching rates range between 1% and 10% with a modal value of 6%.

\$791 and through \$4,768, plus 15 percent of average indexed monthly earnings over \$4,768.[6] The retiree's RMD amounts from his 401(k) plan are set in accordance with the IRS Uniform Lifetime Table measures (IRS 2012a, b). Also, in line with U.S. rules, federal income taxes are calculated based on the individual's taxable income, six (progressive) income tax brackets, and the corresponding marginal tax rates for each tax bracket (Horneff et al. 2015).

After retirement at the endogenous age K, the individual has the opportunity to save outside the tax-qualified retirement plan in stocks and bonds:

$$X_t = C_t + S_t + B_t. \tag{7}$$

We model housing costs h_t as in Love (2010). Accordingly, cash on hand for the next period evolves as follows:

$$X_{t+1} = S_t R_{t+1} + B_t R_f + Y_{t+1}(1 - h_t) + W_t - Tax_{t+1}. \tag{8}$$

Old age retirement benefits provided by social security are determined by the individual's Primary Insurance Amount (PIA), which is determined by his 35 best years of earnings.[7] Social security payments (Y_{t+1}) in retirement ($t \geq K$) are given by:

$$Y_{t+1} = PIA_K \cdot \lambda_K \cdot \varepsilon_{t+1}\,. \tag{9}$$

Here λ_K is the adjustment factor for claiming prior to or after the government-set Normal Retirement Age, which in this exercise is set at age 66.[8] The variable ε_t is a transitory shock $\varepsilon_t \sim \text{LN}(-0.5\sigma_\varepsilon^2, \sigma_\varepsilon^2)$ reflecting out-of-pocket medical and other expenditure shocks during retirement (as in Love 2010). Benefit payments from social security are partially subject to tax

[6] For more on the Social Security formula see https://www.ssa.gov/oact/cola/piaformula.html.

[7] The benefit formula is a piece-wise linear function of the Average Indexed Monthly Earnings providing (as of 2013) a replacement rate of 90% up to a first bend point (\$791), 32% between the first and the second bend point \$4768), and 15% above that. See US SSA (nd, a).

[8] The factors we use are 0.75 (claiming age 62), 0.8 (claiming age 63), 0.867 (claiming age 64), 0.933 (claiming age 65), 1.00 (claiming age 66), 1.08 (claiming age 67), 1.16 (claiming age 68), 1.24 (claiming age 69), and 1.32 (claiming age 70). See US SSA (nd, a, c). The Normal Retirement Age will move to age 67 in the near future.

at the individual's federal income tax rate, as well as a 1.45% Medicare and 4% city and state tax.[9]

We model the retiree's 401(k) plan payouts as follows:

$$F_{t+1}^{401(k)} = \omega_t^s \left(F_t^{401(k)} - \mathrm{W_t}\right)\mathrm{R_{t+1}} + (1-\omega_t^s)\left(F_t^{401(k)} - \mathrm{W_t}\right)R_f, \quad for\ t < K. \tag{10}$$

Under US law, plan participants must take retirement account payouts from age 70 onwards according to the Required Minimum Distribution (RMD) rules (*m*) specified by the Internal Revenue Service (IRS nd). Accordingly, to avoid substantial penalty taxes withdrawals from the retirement account, the retiree must take into account the following constraint: $F_t^{401(k)} m \leq W_t < F_t^{401(k)}$. All of these rich institutional factors are taken into account in generation model outcomes.

Optimal Behavior Under the "Normal" Baseline

We simulate our model under what had been thought to be "normal" interest rate conditions, so as to illustrate baseline optimal patterns of consumption, work, social security claiming age, portfolio allocations outside inside and outside the tax-qualified accounts, and saving as withdrawals from the tax-qualified 401(k) plans. This baseline calibration assumes a risk-free interest rate of 1%, and an expected risk premium on stocks (over the risk-free rate) of 5% with a volatility of 18%. When simulating other return environments, we vary these assumptions and then assess how behavioral outcomes compare.

We posit that households maximize the value function (1) under the budget restrictions given above. Since this optimization problem cannot be solved analytically, we apply a

[9] For tax rules for Social Security see US SSA (nd, b). Based on the combined income up to 85% of Social Security can be taxed for households with high income additional to Social Security benefits. Yet because of quite generous exemptions, many households receive their Social Security benefits tax-free (see Horneff, Maurer, and Mitchell 2016).

numerical procedure using dynamic stochastic programming. To generate optimal policy functions, in each period t we discretize the space in four dimensions 30(X)×20($F^{401(k)}$)×10(P)×9(K), with X being cash on hand, $F^{401(k)}$ assets held in the 401(k) retirement plan, P permanent income, and K the claiming age. Next, we simulate 100,000 independent life cycles based on optimal feedback controls for each of the six population subgroups of interest (male/female in three education groups of <HS/HS/Coll+). Using weights from the National Center on Education Statistics (2012) we aggregate the subgroups to obtain national mean values. The population is comprised of 50.7% females (of whom 62% have Coll+, 30% have HS, and 8% have <HS education), and 49.3% males (of whom 60% have Coll+, 30% have HS, and 10% <HS education).

Baseline Results. For each of the six subgroups of interest, we select a unique set of values of the preference parameters so the model produces national mean 401(k) wealth profiles and national social security claiming patterns compatible with historical evidence. After solving the model several times, we find that a coefficient of relative risk aversion ρ of 5, a time discount rate β of 0.96 and a leisure preference parameter of $\alpha = 0.9$ are the parameters that closely match simulated model outcomes to empirical evidence.[10]

Specifically. Panel A of Figure 1 indicates that the social security claiming patterns generated by our model align well with empirical claiming rates reported by the US Social Security Administration (2015).[11] In particular, the model produces a substantial peak at the earliest claiming age of 62, similar to the data where around 45% of workers claim benefits at that early age. Also in line with the evidence, a smaller second peak can be seen at the (system-defined) Full Retirement Age of 66 where about 15% of workers claim benefits for the first time.

[10] Interestingly, these parameters are also in line with those used in prior work on life-cycle portfolio choice. See for instance Brown (2001).
[11] This model therefore provides a theoretical backing for the empirical claiming patterns shown by Shoven and Slavov (2012, 2014).

Figure 1 here

In addition, our model closely tracks EBRI (2014) data on average 401(k) account balances for 7.5 million plan participants in five age groups (20-29, 30-39, 40-49, 50-59, and 60-69) in 2012. Panel B of Figure 1 displays our simulated and the empirical data for the five age groups, and it reveals that our simulated outcomes are remarkably close to the empirically-observed 401(k) account values.

Overall, then, our model generates results that agree closely with observed saving and social security claiming behavior of U.S. households during what we call the "baseline" economic environment, before the advent of a persistently low expected real return "new normal."

How Persistent Low Returns Will Drive Behavioral Change

To determine how optimal behavior would differ in alternative interest rate environments, we compare outcomes for real risk-free interest rates of 0%, 1%, and of 2%, with a particular focus on the lowest and the highest expected return (the equity risk premium remains at 5%). Table 1 shows how social security claiming patterns would vary by gender and age, average claiming ages, and average hours of work.

Table 1 here

A first finding is that optimal social security claiming ages and hours of work are higher when the risk-free rate is lower. This is not surprising, inasmuch as individuals earn less on their savings in a 0% environment and hence would need to withdraw more of their assets if they were to claim early. Specifically, when the long term interest rate is 0% instead of 2%, the average claiming age is about one year later and average work hours are five percent higher, for both men and women. Moreover, substantially fewer women and men claim at age 62 in the low-return world: only 35% (23.6) of the females (males) do so when the real return is 0%, versus 46.5% (37%) at a 2% real return. This supports Shoven and Slavov's (2012) and Cahill, Giandrea, and Quinn's (2015) surmise that delayed claiming is more appealing in a low versus a high return environment.

Figure 2 provides additional insight into the heterogeneous impact of low versus high returns. Specifically, the most-educated defer claiming more when returns are 0% versus 2%; a similar conclusion applies to both men and women, while the least educated (particularly women) change claiming behavior least.

Figure 2 here

Next we report how optimal wealth accumulation patterns change with the interest rate regime, both inside and outside of 401(k) plans. Table 2 shows that workers build up far less wealth in their retirement plans in a low versus a higher expected return environment. For instance, when the safe yield is 0%, middle aged women (age 45-54) optimally accumulate an average of about $144,800 in their 401(k) plans, while in the 2% yield scenario, they average 20% more, or $168,200 at the same point in their life cycle. Middle-aged men accumulate $172,500 in the zero-rate environment, and 20% more ($210,000) in the 2% interest rate scenario. In other words, the gain from saving in pretax plans is lower in a low environment, depressing the tax advantage of saving in 401(k) plans in a low expected return world. The Table also shows that the impact of a lower interest rate on assets in non-qualified accounts is relatively small. The reason is that such accounts tend to be held for precautionary reasons, that is, to smooth consumption in case of income shocks or capital market shocks.

Table 2 here

Figure 3 shows how 401(k) asset values differ under the low versus the high expected return scenarios by gender and education. When returns are lower, the optimal value of tax-qualified retirement savings proves to be substantially lower for both men and women and for all three age and education groups. Additionally, the saving reductions are most notable for the best-educated individuals. Conversely, in a higher return world, the college-educated save 30-

40% more, and much less (under 15%) for high-school dropouts. Accordingly, wealth inequality is lower in times of low real expected returns.

Figure 3 here

Conclusions

Currently $8 trillion of bonds trade at negative rates around the world, compared to none in 2014 (Slok, 2018). Despite this new global reality, relatively little research has focused on the profound impacts of persistent low returns on life cycle work, saving, investment, and social security claiming behavior.

Our contribution in this paper has been to develop and calibrate a richly-detailed life cycle model that helps us explore the potential impacts of the new economic environment across heterogeneous population subgroups. To this end, we model realistic tax, social security, and minimum distribution rules, as well as uncertain income, stock returns, medical spending, and mortality. We then use this model to assess how key outcomes compare. Our baseline simulation which assumes a 1% expected real return generates wealth and claiming patterns quite consistent with the evidence, including a peak claiming rate at the earliest feasible age of 62, and asset accumulation patterns comparable to actual data.

By contrast, a zero expected return induces workers to claim social security benefits later and work more. Moreover, people save less, particularly in their tax-qualified accounts, and they draw down these 401(k) assets sooner. Overall, this reduces wealth inequality. Focusing on subgroups of the population, results prove to be similar for men and women. Nevertheless, the best-educated subgroup optimally changes behavior more, compared to the least-educated.

We leave for future work a discussion of the potential macroeconomic consequences of reduced saving and earlier claiming patterns. Nevertheless, our life cycle model which embodies richly detailed tax and social security claiming rules is clearly an invaluable tool to help assess how households will react to the “new normal” financial market conditions.

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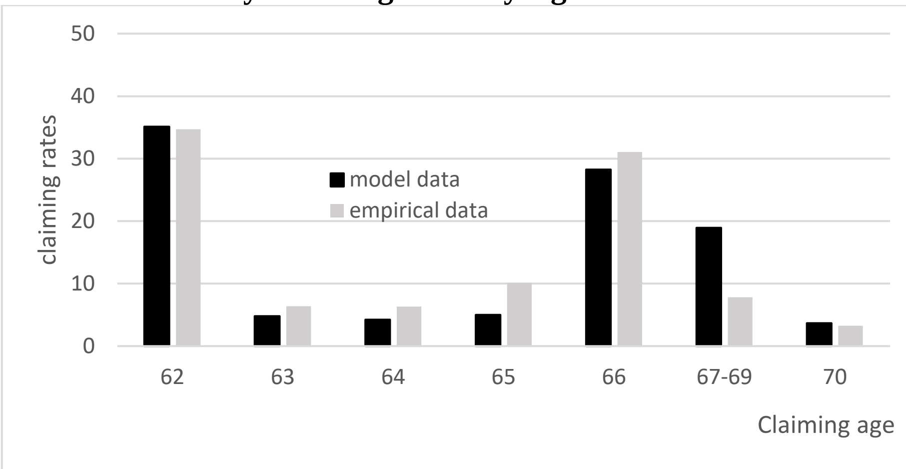
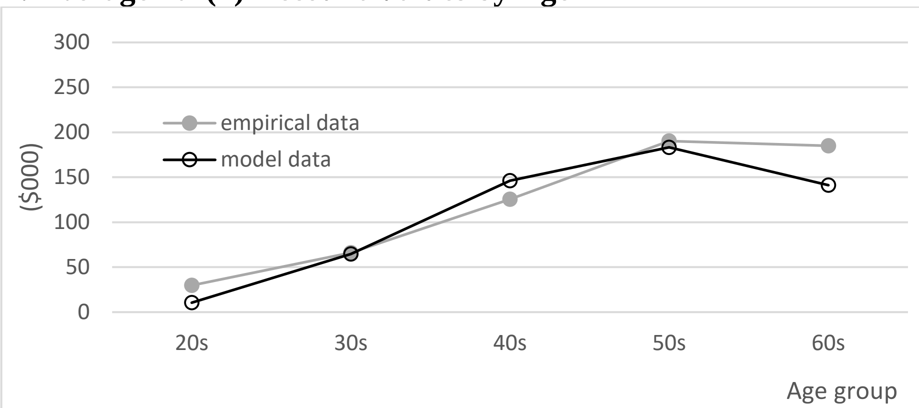
Figure 1: Social Security Claiming Patterns and 401(k) Account Values in a Normal Return Environment: Model versus Data

A . Social Security Claiming Rates by Age

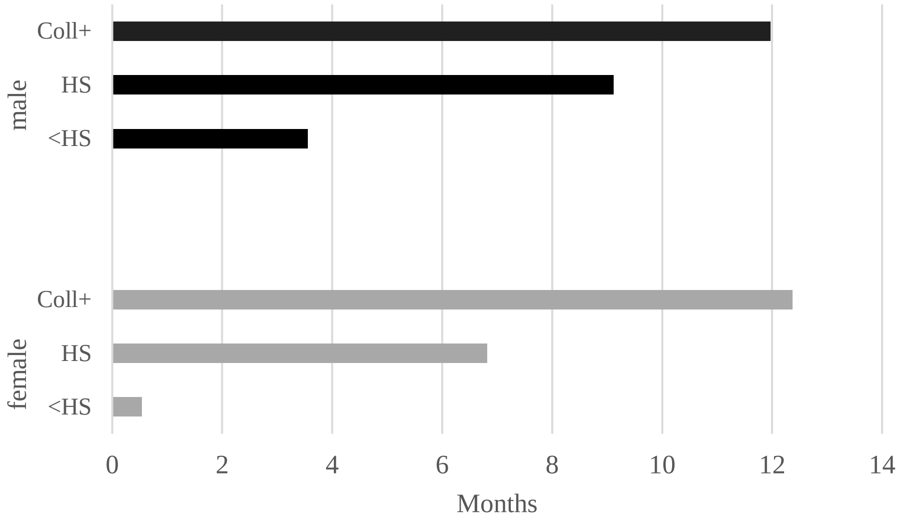


B. Average 401(k) Account Values by Age



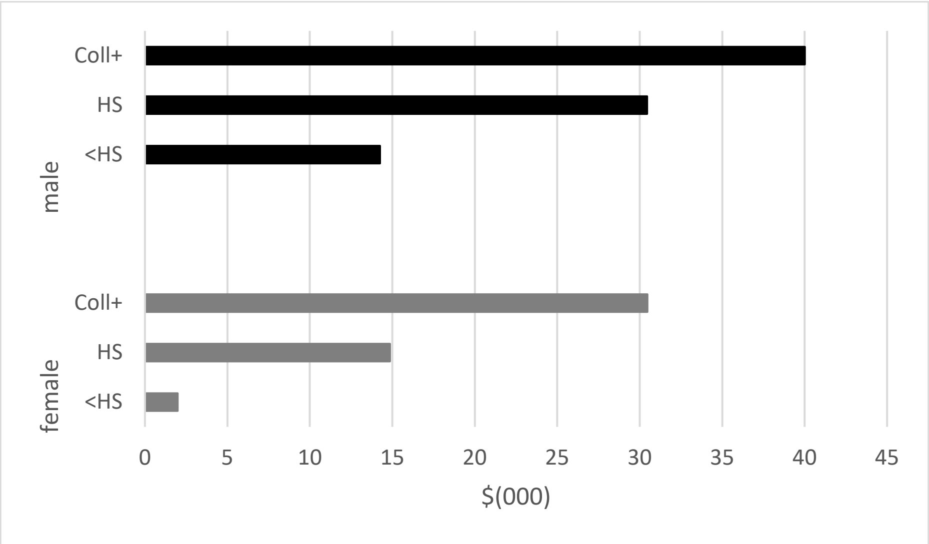
Notes: Panel A compares endogenous social security claiming rates at ages 62-70 generated by our life cycle model versus retirement (and disability) empirical claiming rates by age from Social Security Administration (2015). Expected values are calculated from 100,000 simulated lifecycles based on optimal feedback controls for each of the six subgroups of interest. Results for the female (male) population use income by education levels for men (62% +Coll; 30% HS; 8% <HS) and women (60% +Coll; 30% HS; 10%<HS). Baseline calibration parameters are: risk aversion $\rho = 5$; time preference $\beta = 0.96$; and leisure preference α=0.9. Social security benefits are based on average permanent incomes and the 2013 value of bendpoints; minimum required withdrawals from 401(k) plans are based on life expectancy using the IRS-Uniform Lifetime Table in 2013; tax rules for 401(k) plans are as in Horneff (2015). The risk premium for stock returns is 5% and return volatility 18%; the risk-free rate in the Baseline is 1%. Panel B compares simulated 401(k) account balances by age (averages for ages 20-29, 30-39, 40-49, 50-59, and 60-69) with empirical data from EBRI (2014). Source: Authors' calculations.

Figure 2: Difference in Social Security Claiming Ages (in Months) by Gender and Education: Expected Return Scenarios of 2% versus 0%



Notes: This Figure reports the average claiming age *difference* for an interest rate level of 2% minus the corresponding claiming rates for 0%, by sex and three education groups (<HS, HS, +Coll), derived from 100,000 simulated lifecycles using optimal feedback controls in our life cycle model. The assumed risk premium for stock returns is 5% and return volatility 18%. Other parameters are in Figure 1. Source: Authors' calculations.

Figure 3: Differences in 401(k) Asset Values by Gender and Education: Expected Return Scenarios of 2% versus 0%



Notes: This Figure reports the *difference* in 401(k) assets (over the lifecycle) for interest rate level of 2% minus the corresponding values for 0%, by sex and three education groups (<HS, HS, +Coll), derived from 100,000 simulated lifecycles using optimal feedback controls in our life cycle model. The assumed risk premium for stock returns is 5% and return volatility 18%. Other parameters are as in Figure 1. Source: Authors' calculations.

Table 1: Optimal Social Security Claiming Ages and Work Hours by Gender: Expected Return Scenarios of 0%, 1%, and 2%

	Female			*Male*		
	0% Interest Rate	1% Interest Rate	2% Interest Rate	0% Interest Rate	1% Interest Rate	2% Interest Rate
Panel A: Percent Claiming by Age						
Age 62	35.0	39.2	46.5	23.6	30.9	37.0
Age 63	4.1	4.8	5.2	4.9	4.8	5.1
Age 64	3.4	4.0	3.1	5.1	4.4	4.6
Age 65	4.5	4.5	4.2	6.5	5.5	4.7
Age 66	22.8	23.6	25.0	29.0	33.1	35.1
Age 67	8.7	7.2	5.0	10.0	7.3	4.4
Age 68	9.9	8.6	5.8	10.2	6.4	3.2
Age 69	6.9	4.5	2.5	6.0	4.0	2.4
Age 70	4.7	3.6	2.7	4.5	3.7	3.5
Panel B: Claiming Ages						
Average	65.0	64.7	64.2	65.4	64.9	64.5
Panel C: Weekly Hours of Work						
Average	33.6	32.8	31.9	39.8	39.1	38.0

Notes: This Table reports claiming ages and weekly hours of work by age and gender, under three interest rate scenarios. Expected values are derived from 100,000 simulated lifecycles using optimal feedback controls in our life cycle model. The risk premium for stock returns is 5% and return volatility 18%. Other parameters are as in Figure 1. Source: Authors' calculations.

Table 2: Optimal Lifecycle Asset Accumulation Patterns by Gender: Expected Return Scenarios of 0%, 1%, and 2%

	Female			*Male*		
	0% Interest Rate	1% Interest Rate	2% Interest Rate	0% Interest Rate	1% Interest Rate	2% Interest Rate
Panel A: 401(k) Assets ($000)						
Age 25-34	25.2	27.1	28.3	25.1	26.4	28.2
Age 35-44	93.7	101.5	106.9	106.4	113.5	123.3
Age 45-54	144.8	156.5	168.2	172.5	191.6	210.0
Age 55-64	132.2	144.3	165.4	154.8	185.8	211.7
Age 65-74	97.2	115.6	140.8	102.4	138.7	168.1
Age 75-84	57.4	74.2	96.4	52.6	82.5	107.5
Age 85-94	18.3	27.1	39.6	14.1	27.1	39.8
Panel B: Non-Qualified Assets ($000)						
Age 25-34	3.5	3.7	4.0	4.2	4.8	4.9
Age 35-44	8.1	8.3	8.4	12.3	12.6	11.1
Age 45-54	10.6	13.7	11.7	20.8	19.0	15.2
Age 55-64	17.5	19.5	17.0	24.5	24.0	22.1
Age 65-74	14.1	13.4	12.7	20.4	19.5	19.2
Age 75-84	7.4	7.3	7.8	12.0	12.2	12.8
Age 85-94	6.1	6.1	6.2	8.8	8.5	8.7

Notes: This Table reports expected assets in tax-qualified 401(k) plans and non-qualified assets by age and gender, under three interest rate scenarios. Expected values are derived from 100,000 simulated lifecycles using optimal feedback controls in our life cycle model. The risk premium for stock returns is 5% and return volatility 18%. Other parameters are as in Figure 1. Source: Authors' calculations.