To Plan, or Not to Plan? Optimal Planning and Saving for Retirement*

Erin Cottle Hunt† Lafayette College

Seth Neumuller‡ Wellesley College

Yashna Shivdasani§ Wellesley College

September 30, 2022

Abstract

It is well known that a large percentage of U.S. households arrive at retirement with little or no financial wealth. Empirical evidence suggests that many of these households undertook little or no planning for retirement while young. We demonstrate how the decision to avoid planning and saving for retirement while young can arise as an optimal choice made by forward-looking, utility maximizing households. The novel feature of the general equilibrium, overlapping generations, life-cycle model we develop here is that households select the length of their planning horizon optimally each period, in addition to making optimal consumption and saving decisions. Households pay a utility cost to formulate optimal consumption-saving plans, which is increasing in the length of their chosen planning horizon, to proxy for the effort, cognitive or otherwise, that households must expend to plan for the future. Simulations of a calibrated version of our model suggest that when households choose their planning horizons optimally, they avoid planning and saving for retirement when young and, as a result, arrive at retirement with just over half of the wealth that they otherwise would have accumulated had they instead planned for their entire remaining lifetime each period, as in a standard life-cycle model.

Keywords: Planning; Retirement; Life-cycle Model; Short-Planning Horizon

JEL Codes: D15, D91, E21, E71, G51

---

*We thank Casey Rothschild and seminar participants at the 2022 Midwest Macro conference at Utah State, the 2022 Liberal Arts Macro Conference at Middlebury College, the 2021 Workshop on Economic Dynamics held virtually, and the University of New Hampshire for helpful comments and suggestions. All remaining errors and omissions are our own.

†cottlee@lafayette.edu

‡seth.neumuller@wellesley.edu

§yshivdas@wellesley.edu

1 Introduction

It is well known that a large percentage of U.S. households arrive at retirement with little or no financial wealth.[1] Empirical evidence suggests that many of these households undertook little or no planning for retirement while young.[2] These empirical findings, however, stand in stark contrast to a standard life-cycle model in which households anticipate the decline in income at retirement and plan accordingly by saving during their working years.

In this paper, we demonstrate how the decision to avoid planning and saving for retirement while young can arise as an optimal choice made by forward-looking, utility maximizing households. Specifically, we construct a general equilibrium, overlapping generations, life-cycle model in which households select the length of their planning horizon optimally each period, in addition to making optimal consumption and saving decisions. Households pay a utility cost to formulate optimal consumption-saving plans, which is increasing in the length of their chosen planning horizon, to proxy for the effort, cognitive or otherwise, that households must expend to plan for the future.[3] To fix ideas, let $\beta \in (0,1)$ be the subjective discount factor and suppose households live until age T_D. Our innovation is to allow households at each age $t = 1, ..., T_D$ to decide how many periods $h_t \in \{1, ..., T_D - t + 1\}$ into the future to plan. More concretely, if an age t household chooses planning horizon h_t, then when computing their planned discounted lifetime utility, the household applies a weight of β^{s-t} to utility from planned consumption at ages $s = t, ..., t + h_t - 1$ and a weight of 0 to utility from planned consumption at ages $s = t + h_t, ..., T_D$. Households also fully discount income received outside of their planning horizon when formulating their optimal consumption-saving plans.

In our model, planning for retirement while young is costly not only because of the utility cost to plan, but also because planning for periods in which income is expected to be relatively low (e.g. retirement), given the inherent desire to smooth consumption over the life-cycle, implies the need to reduce consumption today.[4] Households will therefore only choose to plan for retirement while young if these costs are relatively low. Otherwise, young households will find it optimal to simply ignore retirement altogether and enjoy the present.

[1] See, for example, Gustman and Juster (1996), Smith et al. (1997), and Venti and Wise (1998).

[2] The lack of planning for retirement has been documented empirically by Ameriks et al. (2003), Lusardi (2003), Lusardi and Mitchell (2007), and Lusardi and Mitchell (2011), among others. The failure to plan for retirement was identified empirically by Hurst (2004) as an important reason why some households under-save for retirement.

[3] Using data from the HRS, Lusardi (2003) finds suggestive evidence in support of the hypothesis that many household avoid planning for retirement because it is painful to think about. See also Capra et al. (2022) and Ganguly and Tasoff (2017) for behavioral evidence about people's desire to avoid painful information.

[4] We assume the marginal cost of planning is constant, although our results are robust to this assumption as long as the cost of planning is increasing in the length of the planning horizon.

We solve our model numerically in order to assess its quantitative implications for planning, consumption, and wealth over the life-cycle. For plausible calibrations, we show that households in our model do indeed opt to postpone the arduous process of planning and saving for retirement until late into their working lives. Specifically, the optimal planning horizons chosen by households in our model are weakly decreasing over the life-cycle. Young households choose to plan for around 25 years on average. As they age, households choose shorter and shorter planning horizons in an effort to avoid including retirement within their planning horizon. It is only when they reach middle age that households start including retirement within their planning horizon, and it is not until late in life that households choose to plan for their entire remaining lifetime. As they age, households in our model go through periods of time-consistent behavior in which they choose a planning horizon that is one period shorter than the planning horizon that they chose in the previous period, as well as periods in which they maintain the same planning horizon from one period to the next.

As a result of choosing to employ short planning horizons while young, the average household in our model arrives at retirement with just over half of the wealth they otherwise would have accumulated had they instead planned for their entire remaining lifetime each period, as in a standard life-cycle model. Consistent with recent empirical evidence, our model also produces a positive relationship between planning and income with high income households tending to plan further into the future, on average, than their low income peers.[5] As a result, wealth inequality at retirement in our model is higher than that predicted based solely on differences in income. In particular, the ratios of wealth at retirement held by college graduates relative to high school graduates and high school dropouts are 4.1 and 2.5, respectively, in our baseline model compared to just 2.3 and 1.8 if we force households to plan for their entire remaining lifetime each period, as in a standard life-cycle model.

Ex ante, households in our model understand that they will be better off in the long run if they plan and save for retirement. But like so many Americans today, when given the choice of how far into the future to plan, they choose to ignore retirement. Our model thus suggests that policies aimed at helping households plan and save for retirement may be welfare enhancing. Motivated by this observation, we introduce an unfunded, pay-as-you-go Social Security system into our model and examine its implications for planning, consumption, and wealth over the life-cycle. We find that while the presence of retirement benefits does indeed lead to higher average consumption during retirement, it fails to increase welfare for two reasons. First, the implicit rate of return on Social Security tax withholdings is strictly less than the rate of return on private savings.[6] Second, introducing a Social Security

[5] See Ameriks et al. (2003) and Lusardi (2003), among others.

[6] See, for example, İmrohoroğlu et al. (2003), Caliendo (2011), Cremer et al. (2008), Krueger and Kubler

system leads households to optimally adjust their choice of planning horizons. By flattening a household's (net) income profile, Social Security reduces their incentive to plan while young, since the benefit of choosing a longer planning horizon is smaller (i.e., the household doesn't have as high an income to include in their planning horizon). The introduction of Social Security also reduces the cost of planning for retirement late in a household's working life, since planning for retirement does not require as much of a reduction in consumption today given the presence of retirement benefits. Thus, households choose shorter planning horizons early in their working lives and longer planning horizons when middle aged and nearing retirement. On net, we find that these costs outweigh the benefits of a smoother consumption profile, implying that a pay-as-you-go Social Security system reduces welfare.

The main contribution of our paper is to demonstrate how the failure to plan and save for retirement can arise as an optimal choice made by forward-looking, utility maximizing households. Friedman's (1957) seminal contribution, *Theory of the Consumption Function*, was the first to allow for the possibility that households do not plan for their entire remaining lifetime. In the decades since, life-cycle models in which households make optimal consumption and saving decisions conditional on an exogenously determined (short) planning horizon have been employed extensively in the economics literature, for example, to determine the optimal level of Social Security benefits (Feldstein (1985)) and to explain the hump-shaped pattern of consumption over the life-cycle (Caliendo and Aadland (2007)). However, the policy implications derived from this class of models tend to be highly sensitive to the length of the chosen planning horizon. Since planning horizons are determined and respond endogenously in our model, we avoid this critique.

The model we develop here is most closely related to Park and Feigenbaum (2018) who rationalize the empirically observed consumption hump within a general equilibrium, overlapping generations, life-cycle model in which households employ an exogenously determined short planning horizon. Our model also generates a hump-shaped profile for average consumption that compares favorably to that documented empirically by Gourinchas and Parker (2002). But unlike their model, households in our model *choose* to employ a short planning horizon as an intentional strategy aimed at maximizing their discounted lifetime utility. In this sense, the model we develop here is also similar in many ways to Becker and Mulligan (1997) who construct a model of endogenous patience formation in which households can exert effort in order to increase their subjective discount factor. In both our model and theirs, the way in which households discount future utility is determined endogenously.

(2006), Kumru and Thanopoulos (2008), Bagchi (2015), among many others. Social Security can be welfare improving even in a dynamically efficient economy in some setting, including when agents have self-control problems (Bucciol (2011)) or if households have exogenous short planning horizons (Findley and Caliendo (2009), and Park and Feigenbaum (2018)).

Finally, several papers in the literature have examined the role of Social Security in models with myopia or exogenous short planning horizons, and find mixed results.[7] Our paper complements this literature by showing that households may adjust their planning horizons in response to the introduction of a government-sponsored, unfunded pension system. Our findings suggest that this behavioral response by households can exacerbate the negative welfare effects of a Social Security system with a low internal rate of return.

The remainder of this paper is structured as follows. In Section 2, we describe our overlapping generations life-cycle model and explore how households select optimal planning horizons. In Section 3, we calibrate our model and present our main quantitative results. In Section 4, we introduce a Social Security system into our model and then quantify its implications for consumption, planning, wealth, and welfare. Finally, Section 5 concludes.

2 The Model

The model economy consists of overlapping generations of measure one finitely lived households and a representative firm. Households are heterogeneous in their exogenously given level of educational attainment which determines their life-cycle labor productivity profile. At each age, households select a planning horizon and then make an optimal consumption-savings decision conditional on their wealth level and chosen planning horizon. Planning further into the future is costly insofar as the household must expend effort, cognitive or otherwise, to make a corresponding optimal consumption plan. The only assets available to households are one period, risk-free bonds.

2.1 Households

Households live for T_D periods. At entry into the model ($t = 1$), households inherit the educational attainment of their parents which we denote using the subscript $j \in \{N, G, C\}$, corresponding to high school drop-out (N), high school graduate (G), and college graduate (C), respectively. Within each cohort, an exogenously given fraction χ_N of households are high school dropouts, χ_G are high school graduates, and the remainder are college graduates. The demographic patterns are assumed to be stable, meaning that age t households with educational attainment j make up a constant fraction of the population at every point in time. Since we consider only stationary environments, all variables are indexed by the age t and education level j of households with the index for time left implicit.

[7] Feldstein (1985), Docquier (2002), Findley and Caliendo (2009), and Park and Feigenbaum (2018) find Social Security can be welfare enhancing, while Chu and Cheng (2019) finds the program reduces well-being.

Households derive utility from consumption $c_{t,j}$ and disutility from planning, the latter of which is increasing in the length of a household's planning horizon length $h_{t,j}$. The period utility function is $u(c_{t,j}, h_{t,j})$, where $u_{c_{t,j}} > 0$, $u_{h_{t,j}} < 0$, $u_{c_{t,j},c_{t,j}} < 0$. We take the period utility function to be

$$u(c_{t,j}, h_{t,j}) = \ln(c_{t,j}) - Ah_{t,j},$$

where the marginal disutility of planning is governed by the parameter $A > 0$.

Households are endowed with age and education-specific efficiency units of labor $\eta_{t,j}$ which evolve deterministically over their lifetime. Prior to retirement at age T_R, households supply their labor inelastically to firms in exchange for the efficiency wage w. During retirement, households are unable to work and, therefore, have no labor income. It follows that the income of an age t household with education level j is $y_{t,j} = \mathbb{I}_{t<T_R} w\eta_{t,j}$, where $\mathbb{I}_{t<T_R}$ is an indicator function that is equal to 1 for households age $t < T_R$ and 0 otherwise.

The decision problem of households within each model period takes place in two stages. First, households select an optimal planning horizon $h_{t,j} \in H_t \equiv \{1, ..., T_D - t + 1\}$. Then households make an optimal consumption and saving decision given their selected planning horizon $h_{t,j}$. The household optimizes each period and is able to update their choice of planning horizon (and thus of saving and consumption) at any (every) age, which can result in time-inconsistent behavior. The household is naive with regard to this potential time inconsistency. We first layout the consumption and saving problem given a planning horizon $h_{t,j}$. We then describe how households select their optimal planning horizon.

2.1.1 Optimal Consumption and Saving Decision

At every age t, given their education level j and current assets $b_{t,j}$, households choose the plan for consumption and saving, $\{\hat{c}_{s,j}(h_{t,j}), \hat{b}_{s+1,j}(h_{t,j})\}_{s=t}^{t+h_{t,j}}$, that maximizes their discounted utility realized within their selected planning horizon $h_{t,j} \in H_t$:

$$U_{t,j}(b_{t,j}; h_{t,j}) \equiv \max_{\{\hat{c}_{s,j}(h_{t,j}), \hat{b}_{s+1,j}(h_{t,j})\}_{s=t}^{t+h_{t,j}}} \sum_{s=t}^{t+h_{t,j}-1} \beta^{s-t} u\left(\hat{c}_{s,j}(h_{t,j}), h_{t,j}\right) \tag{1}$$

subject to the period budget constraints

$$\hat{c}_{s,j}(h_{t,j}) + \hat{b}_{s+1,j}(h_{t,j}) \leq y_{s,j} + R\hat{b}_{s,j}(h_{t,j}), \tag{2}$$

and the borrowing constraints

$$\hat{b}_{s+1,j}(h_{t,j}) \geq -\sum_{s=t}^{t+h_{t,j}-1} \frac{y_{s,j}}{R^{s-t}}, \tag{3}$$

for $s = t, ..., t + h_{t,j}$ where $\beta \in (0, 1)$ is the time-consistent subjective discount factor and R is the risk-free gross real interest rate on bonds. If the planning horizon is equal to a household's entire remaining lifetime, the constraints in Equation (3) are equivalent to imposing a natural borrowing constraint (i.e., the household cannot borrow more than they can commit to repay within their remaining lifetime). If the planning horizon is less than a household's entire remaining lifetime, the constraints in Equation (3) prevent the household from borrowing more than they can commit to repay within their planning horizon.[8] In other words, we assume that households fully discount income received outside of their planning horizon when formulating their optimal consumption-saving plan.

The household plans consumption and savings for all periods within their planning horizon, naively assuming they will follow their plan beyond the current period. However, if the household chooses to update their planning horizon in the following period (i.e, if $h_{t+1,j} \neq h_{t,j} - 1$), then they re-optimize and implement a new consumption and savings plan.

2.1.2 Selecting an Optimal Planning Horizon

Each period, households select the planning horizon that maximizes their discounted lifetime utility given the corresponding optimal consumption and saving plan $\{\hat{c}_{s,j}(h_{t,j}), \hat{b}_{s+1,j}(h_{t,j})\}_{s=t}^{t+h_{t,j}}$:

$$h^*_{t,j}(b_{t,j}) = \arg \max_{h_{t,j} \in H_t} U_{t,j}\big(b_{t,j}; h_{t,j}\big) \tag{4}$$

The optimal consumption and savings for a household with current assets $b_{t,j}$ is then given by $\big(c^*_{t,j}, b^*_{t+1,j}\big) = \big(\hat{c}_{t,j}(h^*_{t,j}), \hat{b}_{t+1,j}(h^*_{t,j})\big)$.

Households search for the optimal planning horizon $h^*_{t,j}(b_{t,j})$ sequentially, starting with $h_t = 1$ and experiencing marginal disutility $A > 0$ at each step in this process in order to formulate a corresponding optimal consumption and savings plan. Assuming that $U_{t,j}\big(b_{t,j}; h_{t,j}\big)$ is strictly concave in $h_{t,j}$ for all $b_{t,j}$, the optimal planning horizon $h^*_{t,j}(b_{t,j})$ is that for which

[8] The constraints in Equation (3) ensure that the household does not implicitly plan to have negative consumption outside of their planning horizon which would occur if the present value of planned consumption exceeds the present value of available resources within their planning horizon. In practice, the constraints in Equation (3) are thus equivalent to assuming that households plan to hold zero assets at the end of their chosen planning horizon (i.e., $b_{t+h_{t,j}} = 0$), as in Park and Feigenbaum (2018), or Caliendo and Aadland (2007).

$U_{t,j}\left(b_{t,j}; h^*_{t,j}-1\right) < U_{t,j}\left(b_{t,j}; h^*_{t,j}\right)$ and $U_{t,j}\left(b_{t,j}; h^*_{t,j}\right) > U_{t,j}\left(b_{t,j}; h^*_{t,j}+1\right)$.[9]

2.2 Representative Firm

The representative firm produces a homogeneous consumption good using capital K and efficiency units of labor N according to the Cobb-Douglass production technology,

$$Y = zK^{\alpha}N^{1-\alpha},$$

where $z > 0$ is total factor productivity. The firm chooses the quantity of each input in order to maximize its profits taking the risk-free gross real interest rate R, the efficiency wage rate w, and the capital depreciation rate $\delta \in (0,1)$ as given:

$$\max_{K,N} zK^{\alpha}N^{1-\alpha} - (R-1+\delta)K - wN.$$

2.3 Market Clearing

There are markets for capital, labor, and the homogeneous consumption good, all of which must clear in equilibrium. The capital rental market clears when the aggregate supply of bonds is equal to the demand for capital by the representative firm:

$$\sum_{t=0}^{T_D} \sum_{j\in\{N,G,C\}} \chi_j b_{t,j} = K.$$

The risk-free real gross interest rate R adjusts to clear this market. The labor market clears when the aggregate supply of efficiency units of labor is equal to the demanded for efficiency units of labor by the representative firm:

$$\sum_{t=0}^{T_D} \sum_{j\in\{N,G,C\}} \chi_j \eta_{t,j} = N.$$

The real wage w adjusts to clear this market. Finally, the goods market clears when the aggregate demand for consumption goods plus replacement of depreciated capital is equal

[9]The realized path of consumption and saving for a household is given by the optimal consumption and saving choice at each age $\{c^*_{s,j}, b^*_{s+1,j}\}_{s=0}^{T_D}$. The household does not necessarily follow a particular plan $\{\hat{c}_{s,j}(h_{t,j}), \hat{b}_{s+1,j}(h_{t,j})\}_{s=t}^{t+h_{t,j}}$ for more than one period, since they are able to choose a new planning horizon (and thus new saving-consumption plan) each period. This type of dynamic inconsistency is also present in models with exogenous short planning horizons such as Park and Feigenbaum (2018).

to the output of the representative firm:

$$\sum_{t=0}^{T_D} \sum_{j \in \{N,G,C\}} \chi_j c_{t,j} + \delta K = Y.$$

The market for consumption goods clears by Walras' Law provided all current period budget constraints hold with equality and the markets for capital and labor clear.

2.4 Definition of a Competitive Equilibrium

A competitive equilibrium for our model economy consists of policy rules for households $\{c^*_{t,j}(b_{t,j}), h^*_{t,j}(b_{t,j}), b^*_{t+1,j}(b_{t,j})\}$, policy rules for the representative firm $\{K^*, N^*\}$, and prices $\{w, R\}$ such that, given prices, households are optimized, the representative firm is maximizing its profits, and the markets for capital, labor, and the consumption good clear.

2.5 Discussion

Before moving on, it is useful to explore some intuition behind how the household selects their optimal planning horizon. Increasing the planning horizon changes discounted utility over the planning horizon in three ways. First, increasing the planning horizon increases the number of terms in the sum of discounted utility, i,e, in Equation (1). Second, increasing the planning horizon increases effort the household must spend, cognitive or otherwise, to implement the corresponding optimal consumption plan, i.e., $u_h < 0$. This decreases discounted utility. Finally, increasing the planning horizon changes the household's planned consumption—which can either increase or decrease discounted utility.

For a given planning horizon $h_{t,j}$, the household plans to smooth the resources available within the planning horizon across all of the periods in the planning horizon, by maximizing (1) subject to (2) and (3). The period budget constraints can be combined into a single present-value budget constraint

$$\sum_{s=t}^{t+h_{t,j}-1} \frac{\hat{c}_{s,j}(h_{t,j})}{R^{s-t}} = Rb_{t,j-1} + \sum_{s=t}^{t+h_{t,j}-1} \frac{y_{s,j}}{R^{s-t}} \equiv \psi_{t,j}(h_{t,j})$$

where $\psi_{s,j}(h_{t,j})$ indicates present value of resources available to the household within the planning horizon $h_{t,j}$. Using this present-value budget constraint in a Lagrangian function, the solution to the maximization problem is a path of planned consumption from age $s = t$

to age $s = t + h_t$ with each value of planned consumption given by:

$$\hat{c}_{s,j}(h_{t,j}) = \frac{(R\beta)^{s-t}\psi_{s,j}(t; h_{t,j})}{\sum_{i=t}^{t+h_{t,j}-1} \beta^{i-t}} \quad \text{for} \quad s \in [t, t + h_{t,j}]. \tag{5}$$

Increasing the planning horizon has competing effects that depend on income earned just outside the planning horizon, $y_{t+h_{t,j},j}$. Consider how planned consumption changes when the planning horizon is increased from $h_{j,t}$ to $h_{j,t} + 1$. This changes planned consumption for age $s = t$ to age $s = t + h_t + 1$ to

$$\hat{c}_{s,j}(h_{t,j} + 1) = \frac{(R\beta)^{s-t}\psi_{s,j}(h_{t,j}) + y_{t+h_{t,j},j}R^{-h_{t,j}}}{\sum_{i=t}^{t+h_{t,j}-1} \beta^{i-t} + \beta^{h_{t,j}}} \quad \text{for} \quad s \in [t, t + h_{t,j} + 1]. \tag{6}$$

If the present value of income outside the planning horizon is positive, then increasing the planning horizon allows the household to include more resources in their planned consumption path, which could increase planned consumption. This is visible by comparing the numerators of Equations (5) and (6); the present value of period $t + h_{t,j}$ income ($+y_{t+h_{t,j},j}R^{-h_{t,j}}$) is added to the numerator for the longer planning horizon. On the other hand, if income outside the planning horizon is small or zero, increasing the planning horizon may not increase planned consumption since the resources available to the household must be spread across a greater number of periods. This effect is also evident by comparing the denominators of (5) and (6) and noting the denominator of (6) is larger.

This is the central trade-off the household faces when deciding whether or not to plan for an additional period. On the one hand, planning for an additional period allows the household to access more of their lifetime resources; however, the household has to smooth those resources over additional periods and pay a higher utility cost to implement their chosen plan. We formalize this trade-off in the following proof:

Proposition 2.1 *Suppose the period utility function is $u(\hat{c}_{s,j}(h_{t,j}), h_{t,j}) = \ln(\hat{c}_{s,j}(h_{t,j})) - Ah_{t,j}$. A household will prefer a planning horizon of $h_{t,j} + 1$ periods to a horizon of $h_{t,j}$ if the plan implementation cost A is below a threshold A^*. That threshold is given by:*

$$A^* = \frac{\sum_{s=t}^{t+h_t} \beta^{s-t} \ln(\hat{c}_{s,j}(h_{t+1,j})) - \sum_{s=t}^{t+h_t-1} \beta^{s-t} \ln(\hat{c}_{s,j}(h_{t,j}))}{(h_{t,j} + 1)\left(\sum_{s=t}^{t+h_{t,j}} \beta^{s-t}\right) - h_{t,j}\left(\sum_{s=t}^{t+h_{t,j}-1} \beta^{s-t}\right)} \tag{7}$$

.

Proof See Appendix A.

The threshold A^* is increasing in resources just outside of the planning horizon $y_{t+h_{t,j},j}$. The household is willing to pay a larger utility cost to implement a plan associated with a longer planning horizon if the additional resources available to the household outside of the planning horizon are large.

In summary, the timing of income matters for the optimal path of consumption over the life-cycle when the household chooses their planning horizon optimally each period. Given that our model does not admit an analytical solution, we must proceed numerically. In the following section, we first calibrate our model and then simulate it in order to explore its implications for planning, consumption, wealth, and welfare.

3 Quantitative Analysis

We first describe how we calibrate the model parameters. We then explore our calibrated model's quantitative implications for planning, consumption, and wealth over the life-cycle.

3.1 Calibration

Table 1 summarizes our calibration. To start, each model period represents one calendar year and we assume that households enter the model at age 25 ($t = 1$), retire at age 65 ($T_R = 41$), and die at age 80 ($T_D = 55$). We set the fraction of each cohort that are high school dropouts χ_N and high school graduates χ_G equal to 0.20 and 0.54, respectively, which are consistent with the corresponding estimates reported by Love and Schmidt (2015).

Because households supply labor inelastically prior to retirement, labor productivity is proportional to labor income. Prior to retirement, we assume that the deterministic age and education specific labor productivity process $\eta_{t,j}$ is equal to the 5th order polynomial labor income processes estimated by Cocco et al. (2005). Assuming that retired households are unable to work, the resulting education–specific income profiles are depicted in Figure 1.

We set the risk-free gross real interest rate R equal to 1.04 and the capital share parameter α equal to 0.355 as in Park and Feigenbaum (2018). Given a target capital-output ratio (K/Y) of 2.94, as in Park and Feigenbaum (2018), it follows that the depreciation rate δ consistent with profit maximization by the representative firm is given by

$$\delta = \alpha \left(\frac{K}{Y} \right)^{-1} - (R - 1) = 0.08.$$

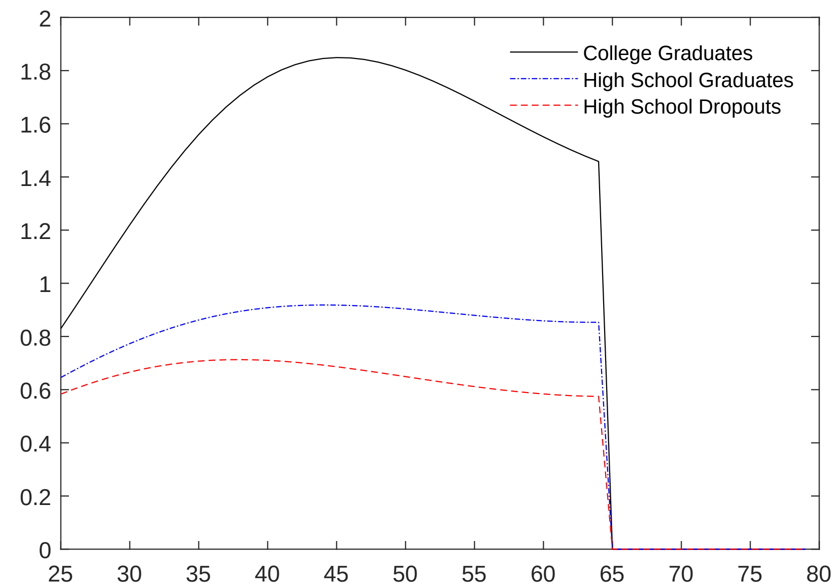


Figure 1: Education–specific income profiles relative to median income.

Table 1: Calibration Summary

Parameter	Value	Source/Target
Model retirement age, T_R (retire at age 65)	41	Park and Feigenbaum (2018)
Length of lifetime, T_D (die at age 80)	55	Park and Feigenbaum (2018)
Fraction of high school dropouts, χ_N	0.20	Love and Schmidt (2015)
Fraction of high school graduates, χ_H	0.54	Love and Schmidt (2015)
Risk-free gross real interest rate, R	1.04	Hansen and Wright (1992)
Capital share, α	0.355	Park and Feigenbaum (2018)
Depreciation rate, δ	0.08	See Text
Subjective discount factor, β	0.980	Target capital-output ratio of 2.94
Marginal disutility of planning, A	0.0754	Target peak consumption at age 45

The two parameters that remain to be calibrated are the subjective discount factor β and the marginal disutility of planning A. We choose these parameters jointly so that the model both generates a capital-output ratio (K/Y) of 2.94 and peak average household consumption at age 45, the latter of which is consistent with the empirical life-cycle profile of consumption estimated by Gourinchas and Parker (2002). We find that setting β equal to 0.980 and A equal to 0.0754 allows our model to match these moments in the data.

Figure 2 compares average consumption over the life-cycle generated by our model to that estimated by Gourinchas and Parker (2002). The model is calibrated to match the age of peak consumption, but appears to offer a plausible representation of average consumption throughout the life-cycle.

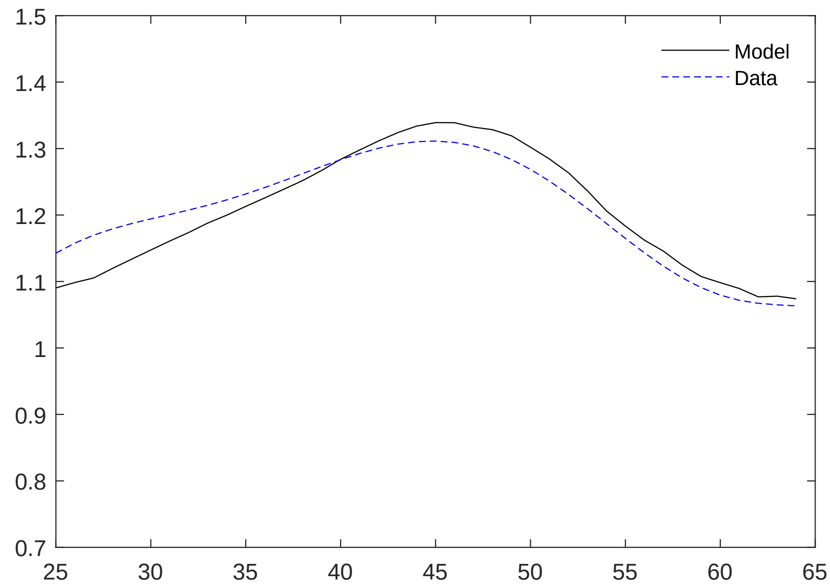


Figure 2: Average consumption over the life-cycle relative to median income in our baseline model compared to that estimated by Gourinchas and Parker (2002).

3.2 Planning, Consumption, and Wealth over the Life-Cycle

The optimal planning horizons chosen by the average household in our baseline model are shown in Figure 3 and are (weakly) decreasing over the life-cycle. To understand why, recall that, according to Proposition 2.1, the key trade-off the household faces in determining whether to plan for an additional period are the "costs" of planning and financing consumption in the additional period versus "benefit" of having the income received in this additional period included within their planning horizon. Consistent with Proposition 2.1, the household's choice of planning horizon is intimately related to the shape of their life-cycle income profile. During the early working years, the households face an increasing income profile, and choose a planning horizon that includes the peak of their income profile while excluding the years later in life when the income profile is declining. Through their mid-30s to mid-40s, households choose to plan up to the date of retirement, excluding the retirement years (when income is zero) from their optimal planning horizon. It is only when retirement is around 20 years away and the income profile is declining that households choose to plan for retirement. In other words, the average household in our model optimally ignores the drop in income at retirement until they reach their mid-40s.

Figure 3 also depicts the planning horizons chosen by the average household in our model when we set the disutility of planning A equal to zero. Note that this version of our model corresponds to a standard life-cycle model in which households plan, by default, for their entire remaining lifetime each period.[10] In addition, Figure 3 illustrates the case in which we impose a planning horizon of 20 years for all households at every age. This version of our model corresponds to the exogenous (short) planning horizon model of Park and Feigenbaum (2018), where 20 years is chosen such that this version of our model generates a peak in average consumption at age 45 as in Gourinchas and Parker (2002).

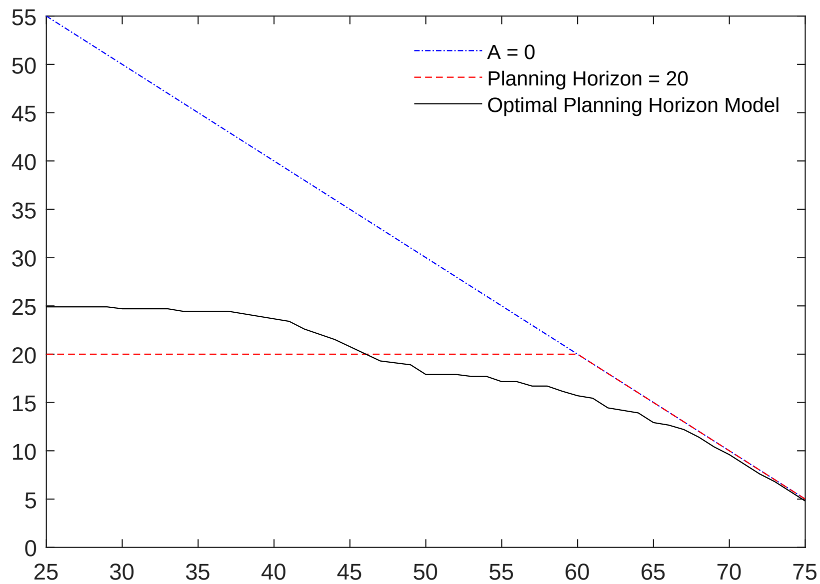


Figure 3: Average planning horizons over the life-cycle in our model, the case in which the marginal disutility of planning A is set equal to 0, and the case in which households are forced to plan for 20 years each period.

The average optimal consumption profile for households in our baseline model is depicted in Figure 4, along with that for the case in which $A = 0$ and the case in which all households

[10]It is not *necessarily* the case that a household will choose to plan for their entire life-cycle if the disutility of planning $A = 0$. A household only chooses a horizon $h_t + 1$ over a horizon h_t if choosing the longer horizon results in a larger sum of planned utility within the horizon, as in Proposition 2.1. In our numerical analysis households always choose to plan for their full life-cycles when $A = 0$ because at any age $s < T_D$ the present value of their remaining lifetime resources is always large enough that dividing those resources across all of the remaining periods of life generates higher planned lifetime utility than choosing a shorter horizon and having fewer terms in the sum of planned utility within the particular horizon.

are forced to use a planning horizon of 20 years. For the case in which $A = 0$, households plan for their entire remaining lifetime. Given that $\beta R > 1$, the optimal consumption profile is smooth and upward sloping as in a standard life-cycle model. Notice, however, that this consumption profile is sharply at odds with the hump-shaped nature of consumption in the data as depicted in Figure 2.

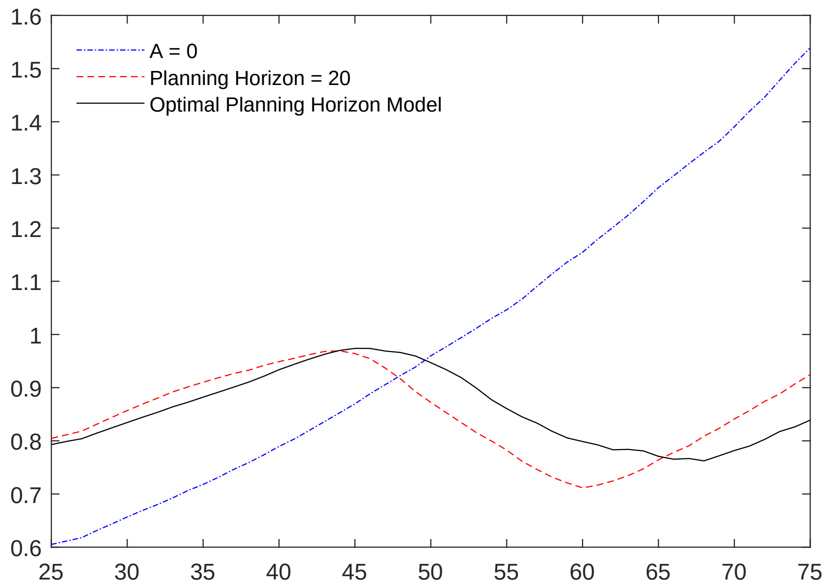


Figure 4: Consumption over the life-cycle relative to median income in our model, the case in which the marginal disutility of planning A is set equal to 0, and the case in which households are forced to plan for 20 years each period.

For the case in which households are forced to plan for 20 years, consistent with the results described in Park and Feigenbaum (2018), the model successfully generates a hump-shaped consumption profile similar to that observed in the data. To understand why, note that when households are young, the present value of income earned within their planning horizon increases with age. Households optimally respond by increasing their planned consumption at each age through their peak earning years. At age 45, when the drop in income at retirement enters the planning horizon, the present value of income earned within their planning horizon begins to decline with age. Households optimally respond by decreasing their planned consumption as retirement draws closer. At age 60, and households have their entire remaining lifetime within their planning horizon, they optimally choose a smooth and strictly increasing consumption profile through the end of life.

The consumption profile generated by our model is generally similar to that for the case in which households are forced to plan for 20 years. However, in our model the drop in consumption after age 45 is less steep and continues through the first few years of retirement. This happens because the average planning horizon chosen by households older than 45 in our model is strictly less than 20 years. As a result of continuing to employ a short planning horizon, the average household in our model optimally reduces their consumption with age until they reach their late-60s, at which point their planning horizon includes all but their final year or two of life. From this point on, the average household optimally choose a smooth and strictly increasing consumption profile through the end of life.

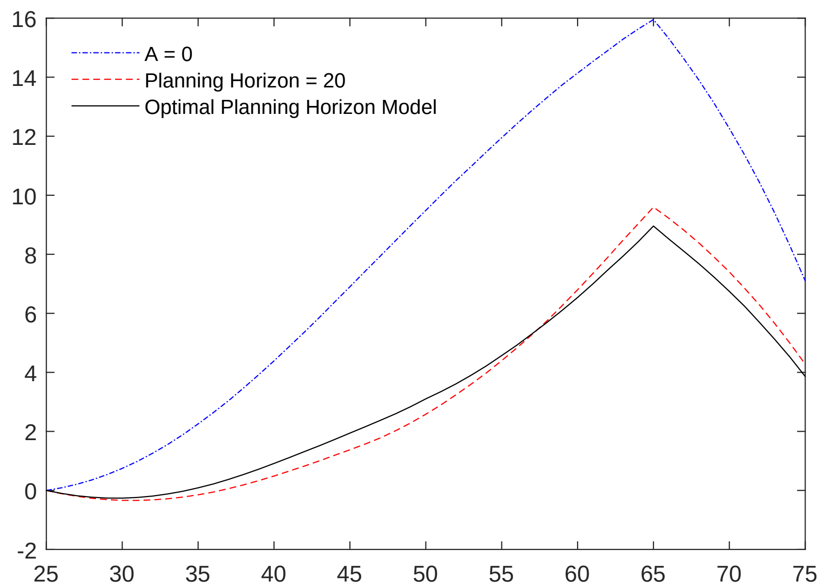


Figure 5: Wealth over the life-cycle relative to median income in our model, the case in which the marginal disutility of planning A is set equal to 0, and the case in which households are forced to plan for 20 years each period.

Figure 5 depicts the average wealth profile for households in our model. Early in life, consumption closely tracks income and, as a result, the household neither saves nor borrows and wealth remains close to zero. It is only once the household reaches their early 40's, with the declining portion of the household's income profile now within their optimal planning horizon and retirement around the corner, that the household begins to save for retirement. The household's wealth peaks at retirement and then declines monotonically with age thereafter.

The average wealth profile for the case in which households are forced to plan for 20 years is quantitatively similar to that in our baseline model. However, for the case in which

A is set equal to 0, the average household plans for their entire remaining lifetime and, as a result, they begin saving for retirement earlier and hold vastly more wealth at retirement than the average household in our baseline model. Indeed, when A is set equal to 0, the average household holds 45% more wealth at retirement than the average household in our baseline model. In this sense, our results suggest that the lack of planning for retirement is a quantitatively important factor in explaining why a large percentage of U.S. households arrive at retirement with little or no financial wealth.

Recall that our model economy is comprised of households with three different levels of education and corresponding labor income profiles (see Figure 1). The planning horizons selected by households with each education level are presented in Figure 6. College graduates have a steeper income profile when young and, as a result, they select longer planning horizons compared to high school graduates and high school dropouts. This positive relationship between education and planning is consistent with empirical findings reported by Ameriks et al. (2003) and Lusardi (2003), among many others.

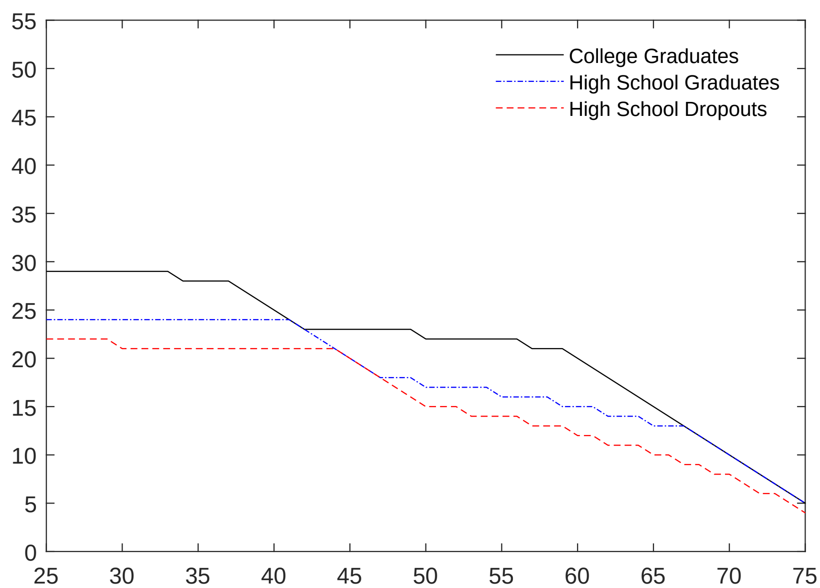


Figure 6: Planning horizons over the life-cycle by education level in our baseline model.

College graduates choose a planning horizon of 29 years when young (before age 35). Then, in their late 30s, they choose to plan up to the retirement age, excluding the retirement years from their plan. It is only when they reach their early-40s that the college graduates begin to include some of their retirement years in their planning horizon. By their late-50s, college graduates plan up to the end of their life-cycle.

High school graduates face a flatter (and lower) income profile compared to the college graduates. As a result, they choose a shorter planning horizon early in life. They plan for 24 years until they reach their early-40s. Subsequently, they choose shorter horizons to avoid including retirement in their plan up until their late-40s, at which point high school graduates begin to plan for some of their retirement years. It is only upon reaching retirement that these households choose to plan up to the end of their life-cycle.

High school dropouts choose the shortest planning horizons. They initially plan for 22 years, and avoid including retirement in their planning horizon until they reach their late-40s. These households then choose gradually shorter planning horizons until the reach their mid-70s, at which point they plan up to the end of their life-cycle.

Differences in planning horizons and income profiles lead to differences in patterns of consumption over the life-cycle across education groups as depicted in Figure 7. The level of consumption is higher for households with higher income. The shape of the consumption profile also differs. In particular, the consumption profile is both steeper and peaks earlier for college graduates. This is because the income profile is steeper for college graduates and because they choose longer planning horizons when young. Moreover, since college graduates include retirement in their planning window at a younger age than their lower income peers, they begin to consume less and save more for retirement at a younger age. This accounts for the relatively steeper drop in consumption after it peaks. It is these differences in planning horizon choices that lead the age of peak consumption to decrease with educational attainment. Specifically, consumption peaks at age 49 for high school dropouts, age 46 for high school graduates, and age 42 for college graduates.

Patterns of wealth accumulation over the life-cycle also differ markedly by education group, as depicted in Figure 8. College graduates are the only group to borrow early in life. By age 40 they have repaid their debts and have begun saving for retirement. Conversely, high school graduates and high school dropouts do not begin saving for retirement in a meaningful way until around age 50 when the first few years of retirement have entered their respective planning horizons. Lower income, combined with their decision to delay saving for retirement, leads high school graduates and high school dropouts to arrive at retirement with just 40% and 24%, respectively, of the wealth accumulated by college graduates.[11]

[11] The ratio of wealth to income is positively correlated with education in our model, consistent with data from the U.S. in our simulation college graduates have wealth to income of 4.94, high school graduates 4.23, and high school drop-outs 4.04. The inequality between groups is not as stark as what we observe in data, but the correlation is in the right direction. Using PSID data, Lusardi et al. (2017) find the wealth-to-income ratio to be 3.21 for high school drop outs, 4.99 for high school graduates, and 7.695 for college graduates. Hubbard et al. (1995) also observe a wealth to income ratio that increasing in education level using PSID data Boshara et al. (2015) document a similar pattern with SCF data, and Attanasio (1994) show the saving rate and savings are increasing in education using CEX data. In contrast, the correlation between the ratio

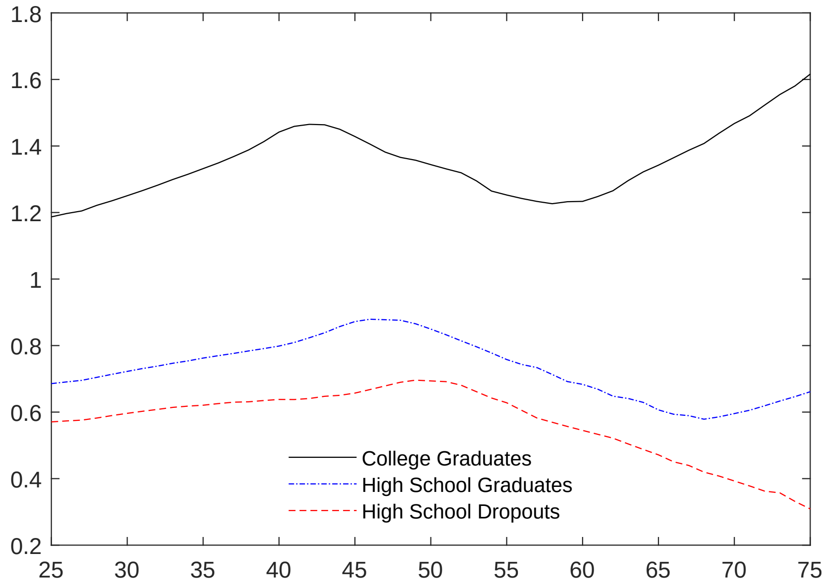


Figure 7: Consumption over the life-cycle relative to median income by education level in our baseline model.

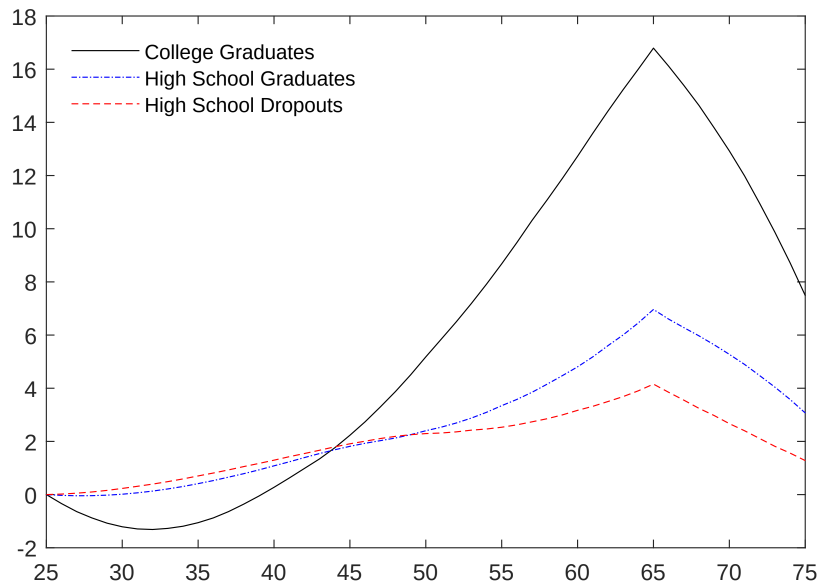


Figure 8: Wealth over the life-cycle relative to median income by education level in our baseline model.

of wealth to income and education is negative in the standard life-cycle model and the exogenous horizon model.

Comparing wealth at retirement by education group in the model with A set equal to 0 allows us to identify how much of these wealth differences are due to differences in income, and how much are due to differences in optimal planning horizons. Recall that in the model with A set equal to 0, all households plan for their entire remaining lifetime. As a result, differences in wealth at retirement are solely due to differences in income. In this version of our model, high school graduates and high school dropouts to arrive at retirement with 56% and 44%, respectively, of the wealth accumulated by college graduates. Together with the results from our baseline model, we can conclude that about three quarters of the difference in wealth at retirement can be attributed to differences in income with the remainder being caused by differences in planning horizons. In this sense, endogenous planning horizons work to amplify the impact of differences in income on differences in wealth at retirement.

4 Social Security

Each household's choice of planning horizon depends on the shape of their income profile. In our baseline model, households choose to avoid planning for retirement until well into their 40s. This is mainly because planning for retirement is painful—it requires effort to plan and necessitates reducing consumption today. Households would be better-off if they planned for retirement, but they lack the ability to do so themselves. This observation suggests that a paternalistic government policy designed to transfers income from a household's working years to retirement may improve their welfare. In this section, we add a government that operates a pay-as-you-go Social Security system to our model and explore its impact on planning, consumption, and wealth over the life-cycle.

Specifically, there is a government that levies Social Security payroll tax τ on all households age $t < T_R$. The government uses the revenue generated by this tax to fund Social Security benefit payments x to all households age $t \geq T_R$.[12] Budget balance implies that:

$$x = \left(\frac{1}{T_D - T_R + 1}\right) \sum_{t=0}^{T_R-1} \sum_{j \in \{N,G,C\}} \tau w \eta_{t,j}.$$

Following Feigenbaum (2008), we set the Social Security payroll tax rate τ equal to 0.106. Take-home pay at age t is equal to after-tax wages during the working years and the Social

[12] Here we assume that all households receive the same benefit x, regardless of income earned while working. Using the benefit earning rule with bend points calibrated relative to the mean wage as in Alonso-Ortiz (2014), and then scaling benefits down proportionally to balance the budget with a tax rate of 10.6%, the replacement rates would be 0.32, 0.30, and 0.27, compared to our replacement rates of 0.40, 0.30, and 0.22. Our calibration is more redistributive because everyone receives the same benefit.

Security benefit during retirement:

$$y_{t,j} = \mathbb{I}_{t<T_R}(1-\tau)w\eta_{t,j} + (1-\mathbb{I}_{s<T_R})x. \tag{8}$$

We solve for the equilibrium factor prices needed to clear the capital, labor, and goods markets, assuming that take-home pay $y_{t,j}$ is given by Equation (8) and holding all other model parameters constant at their calibrated values listed in Table 1.

The introduction of a Social Security program induces the households to choose different planning horizons over the life-cycle as shown in Figure 9. Social Security flattens households' (after-tax) income profile. On one hand, this leads households to choose shorter planning horizons when young since they do not gain as much by including their peak earning years in their planning window. On the other hand, households include retirement within their planning horizons at a younger age because planning for retirement is less costly – households do not have to cut consumption as much today given that they will be receiving Social Security benefits in the future.

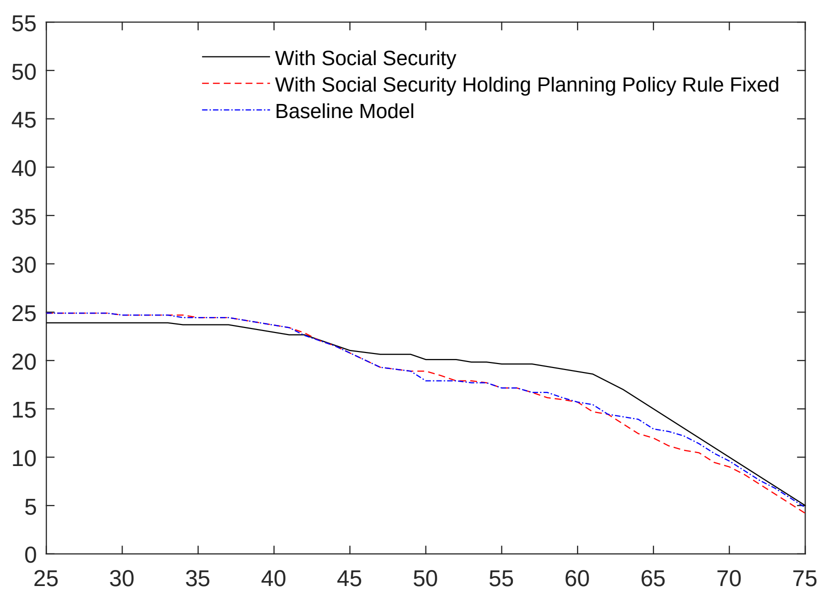


Figure 9: Planning horizons in our baseline model with and without Social Security.

Figure 10 compares average consumption over the life-cycle in our baseline model to that with a Social Security program. Average consumption is lower during the working years as a result of the Social Security tax and higher in retirement given the Social Security benefits.

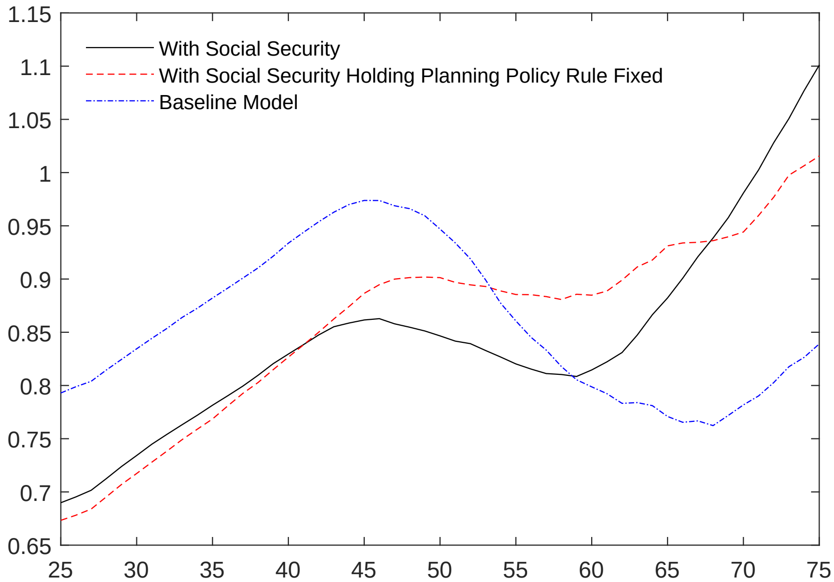


Figure 10: Average consumption relative to median income in our baseline model with and without Social Security.

The introduction of a Social Security program also affects the wealth profile over the life-cycle as shown in Figure 11. In the presence of a Social Security program, the average household borrows less when young and accumulate fewer assets by retirement than in our baseline model. This crowding out of private savings is consistent with the theoretical and empirical Social Security literature.[13]

In our model, the introduction of a Social Security program affects average consumption and wealth profiles because it both impacts optimal planning horizons and consumption-saving plans for a given planning horizon. To disentangle these effects, we conduct a counter-factual analysis where we take the optimal planning horizon policy rule from our baseline model and force households to use this same policy rule after the introduction of a Social Security program.[14]

The consumption and wealth profiles from this counter-factual exercise are plotted in Figures 10 and 11. Holding the planning horizon policy rule fixed, adding Social Security to the model reduces consumption before age 55 and increases consumption thereafter. The

[13]See Slavov et al. (2019) and Cottle Hunt and Caliendo (2022) for a discussion of the literature on Social Security and private savings.

[14]Recall from Equation 4 that optimal planning horizons are a function of current assets, age, and education level. We use the phrase "planning policy rule" to refer to the rule that maps assets, $b_{t,j}$, to optimal planning horizon choice $h^*_{t,j}(b_{t,j})$. Figure 9 includes the optimal planning horizons for a household with Social Security who is forced to use the optimal planning horizon policy rule from our baseline model without Social Security.

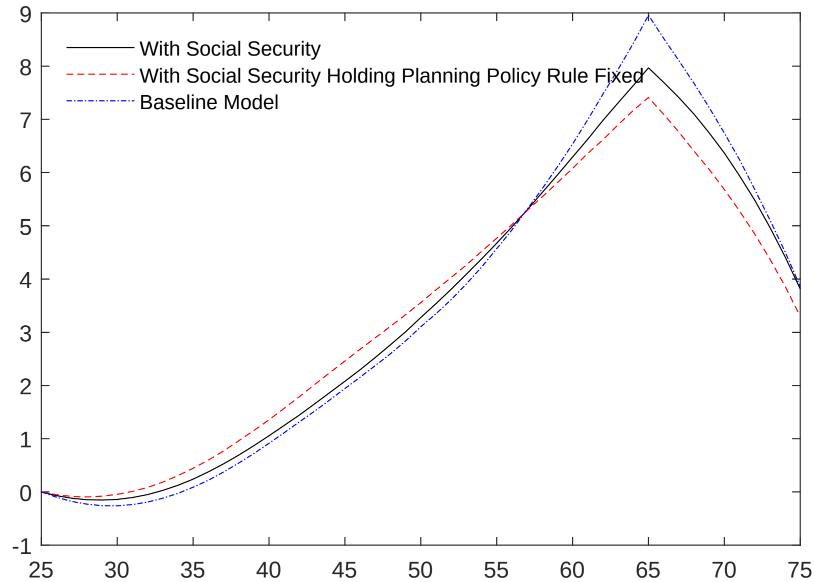


Figure 11: Wealth over the life-cycle relative to median income in our baseline model with and without Social Security.

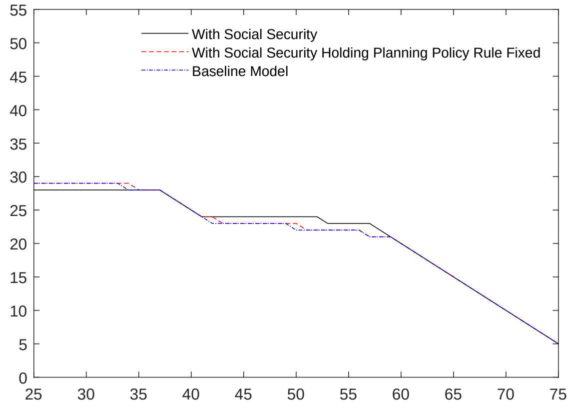
consumption profile is less “hump-shaped” and increases more dramatically over the life-cycle compared to our baseline model without Social Security. Allowing the household to update their planning horizon policy rule changes the consumption profile. Recall that young households choose shorter planning horizons with Social Security. This dampens the reduction in average consumption early in life since households aren't planning for (as much of) their post-peak earning years when income is declining prior to retirement. Through the peak-earning years up to retirement households choose longer planning horizons with Social Security. This reduces their consumption compared to holding the planning horizon policy fixed, since households are including more retirement years in their planning windows. After retirement households are able to consume more because they have saved more.

Holding the planning horizon policy rule fixed, adding Social Security to the model causes households to borrow less when young and accumulate more wealth until around age 55 compared to our baseline without Social Security. After age 55, households save less compared to our baseline and reach retirement with fewer assets. Allowing the household to update their optimal planning horizon policy rule dampens both of these effects. They still borrow less and save more before age 55 compared to our baseline model without Social Security, but the changes are not as big as they would be if the planning policy rule was held fixed. Similarly, they have accumulated less wealth at retirement, but the reduction is not as large as if the planning horizon policy rule was held fixed.

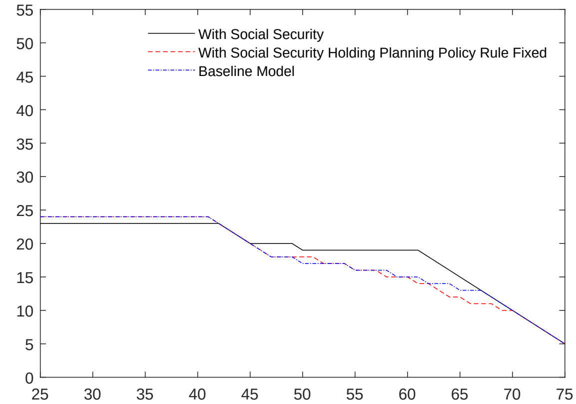
Figure 12 compares the optimal planning horizons chosen by households conditional on their education level in our baseline model to the model with a Social Security program. The introduction of a Social Security program has broadly similar effects on the optimal planning horizons chosen by household of all three education levels. Namely, households tend to choose shorter planning horizons when young and longer planning horizons when old in the presence of Social Security. The impact on high school drop-outs, however, is larger than more educated households, particularly after the age of 45. Without Social Security these households do not plan for very many periods into retirement. Adding Social Security induces these households to plan several years further into retirement.

Figure 13 plots the consumption paths for each education group with and without Social Security, as well as the counter-factual consumption path households would choose in a world with Social Security if they were forced to use the optimal planning horizon policy rule from the our baseline model without Social Security. As with the choice of planning horizons, the difference between consumption with and without Social Security is most striking for high school drop-outs. In our baseline model without Social Security, consumption peaks for these households in their late 40s and then declines monotonically thereafter. Consumption in the years around and during retirement is much lower than when young. Introducing a Social Security program reduces consumption of these households when young and increases their consumption when old to levels that exceed consumption prior to retirement. The consumption path of high school drop-outs is qualitatively different when the planning horizon policy rule is held fixed. This suggests that endogenous changes in these households' planning horizons have a quantitatively large impact on the consumption profile, in addition to changes in the timing of income generated by the introduction of a Social Security program. When the optimal planning horizon policy rule is held fixed in the presence of a Social Security program, high school drop-outs have a relatively flat consumption profile for the 20 years leading up to retirement. If given the option, these households would choose longer planing horizons over this period of life, and thus lower consumption because more retirement years (which are characterized by relatively low income) would have been included in their planning horizon.

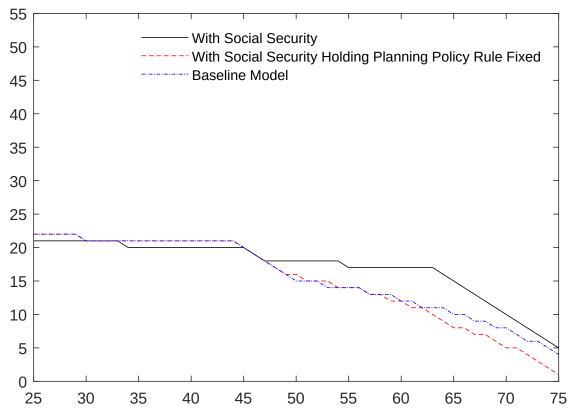
Wealth over the life-cycle with and without Social Security conditional on education is shown in Figure 14, along with the counter-factual path that would occur if the planning horizon policy rules were held fixed after the introduction of Social Security. The impact of Social Security on the wealth profiles of college graduates and high school graduates is qualitatively similar to its impact on the average wealth profile depicted in Figure 11, although different in magnitude. Social Security reduces borrowing when young, increases



(a) College Graduates



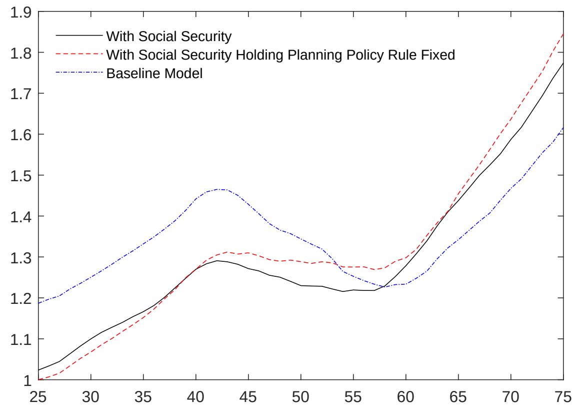
(b) High School Graduates



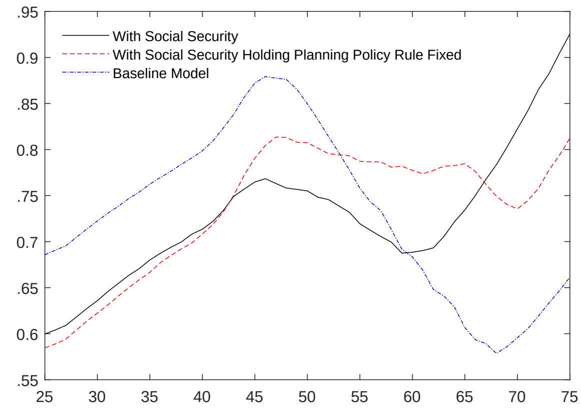
(c) High School Drop Outs

Figure 12: Planning horizons for each education group in our baseline model with and without Social Security.

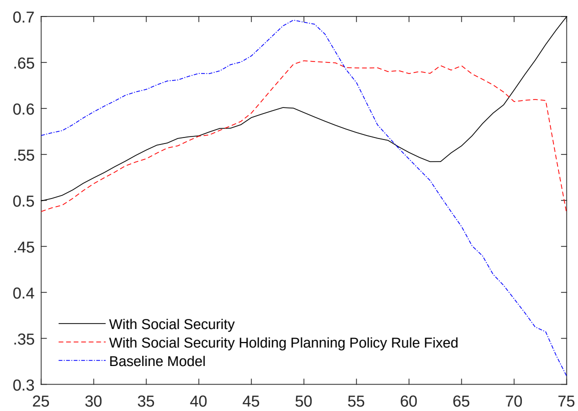
wealth accumulation until middle age, and then depresses saving relative to our baseline model without Social Security. All three effects are more pronounced when the planning horizon policy rules are held fixed. The wealth profile for the high school drop-outs is affected the most when Social Security is introduced and the planning horizon rule is held fixed. In this counter-factual exercise, the wealth profile increases until age 45 and then flattens out (increasing at a lower rate). Wealth at retirement would be about a third lower than without Social Security. Allowing households to adjust their planning horizons optimally results in a wealth profile that is much closer to our baseline model.



(a) College Graduates



(b) High School Graduates

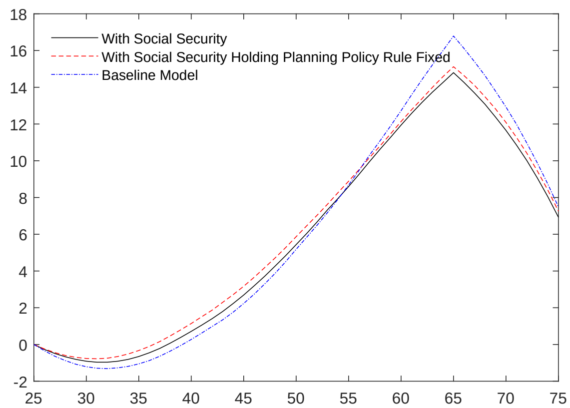


(c) High School Drop Outs

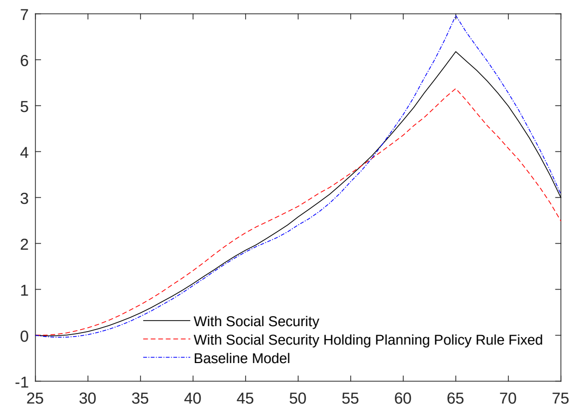
Figure 13: Consumption relative to median income for each education group in our baseline model with and without Social Security.

4.1 Welfare Effects of Social Security

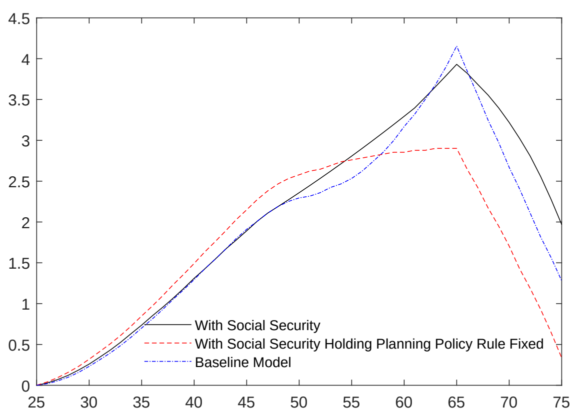
Social Security has the potential to make the households in our model better off by helping them smooth consumption over their life-cycle. Social Security could also make households better off if it enables them to choose shorter planning horizons and, as a result, expend less effort in formulating their optimal consumption-saving plans. Conversely, Social Security likely also makes households in our model worse off because the economy is dynamically efficient: the average internal rate of return of Social Security is zero (since there is no population growth), while the real return on private savings is positive (i.e., $R > 1$).



(a) College Graduates



(b) High School Graduates



(c) High School Drop Outs

Figure 14: Wealth over the life-cycle relative to median income for each education group in our baseline model with and without Social Security.

We estimate the welfare effects of implementing a Social Security program using a standard consumption equivalent variation (CEV) notion. Specifically, we compute the proportional increase in the optimal consumption profile that would be required to improve the lifetime well-being of households in our baseline model by as much as their well-being would increase if the government operated a pay-as-you-go Social Security system as described above. The CEVs are reported in Table 2.

Our results suggest that introducing a Social Security program reduces the welfare of all households, regardless of their education level. Although Social Security is a form of forced

Table 2: Welfare Gains from Introducing a Social Security Program, Estimated using a Consumption Equivalent Variation (CEV) Notion of Welfare

	Overall	Holding Optimal Planning Horizon Policy Rule Fixed
High School Drop-outs	-0.070	0.010
High School Graduates	-0.083	-0.033
College Graduates	-0.084	-0.072

saving which increases the resources available to households during retirement, the implied rate of return is so low that households would be better off saving for themselves. Social Security also induces households to plan further into the future, on average, which decreases their utility since the cost associated with formulating optimal consumption-saving plans is increasing in the planning horizon. Social Security reduces welfare the most for college graduates and the least for high school dropouts due to the progressivity of the program and because the impact on the consumption profile of high school drop outs is larger, particularly during retirement.[15]

To disentangle the effects of Social Security on the household's optimal horizon choice and consumption-saving decisions, we compute the welfare gains from introducing a Social Security program when we hold the optimal planning horizon policy rules fixed. This isolates the impact of changes in the timing of income from the effects of endogenous changes in optimal planning horizons. When the optimal planning horizon policy rules are held fixed, introducing a Social Security program still reduces the welfare of college graduates and high school graduates, but to a lesser degree, but it reverses the welfare effect for high school drop-outs – holding the planning horizon policy rule fixed, Social Security *increases* the well-being of high school drop-outs by helping them smooth consumption over the life-cycle in spite of the fact that it is dynamically inefficient. This suggests that the introduction of a Social Security program would be welfare enhancing for the lowest income, least education households in our model if not for its impact on their choice of planning horizons. It is because these households optimally choose to plan further into the future, on average, that Social Security fails to increase their overall well-being. For these households, the reduction in utility that results from choosing longer planning horizons completely offsets the welfare gains from a smoother consumption profile. Counter-intuitively, inducing the household to choose a longer planning horizon makes these households worse off, since planning further into the future is more costly (in terms of utility).

[15]Recall, in our model Social Security is progressive because workers pay taxes proportional to their income and all households receive the same benefit (i.e. benefit payments are independent of income).

5 Conclusion

We propose an overlapping generations, life-cycle model in which households choose their planning horizon optimally each period. We show theoretically that optimal planning horizons and, by implication, the paths of consumption and wealth over the life-cycle, depend critically on the shape of households' income profile. In a calibrated version of our model, households choose weakly decreasing planning horizons over the life-cycle and avoid planning for retirement until well into their 40s. Average planning horizons in our model are increasing in education and income. As a result, households with higher levels of education and income end up accumulating more wealth at retirement relative to their income, consistent with empirical evidence. Our model is thus able to rationalize the empirical observation that a large number of household fail to plan and save for retirement, and that higher education and higher income households engage in more financial planning which, in turn, allows them to arrive at retirement more well-prepared than their less educated, lower income peers.

The decision of households in our model to avoid planning for retirement suggests a potential role for welfare enhancing policies intended to smooth consumption over the life-cycle. We examine one such intervention, namely a pay-as-you-go Social Security. However, simulations of our model suggest that Social Security reduces household welfare, partially because the program offers a relatively low implicit rate of return, but also because households respond to the program by choosing longer planning horizons in middle age, which is costly in terms of utility.

If the optimal planning horizon choices of households are not taken into consideration—either because the planning horizon is exogenously imposed or if the planning horizon policy rule is held fixed as a counter-factual exercise—Social Security appears to increase the welfare of the lowest education group. It is only when the behavioral responses of the households are taken into consideration that the program appears to reduce welfare for all education levels. Failing to consider the cost of implementing a longer planning horizon can lead to qualitatively different policy implications.

In a recent study, Findley and Caliendo (2015) examine the interaction between saving for retirement and the decision of when to retire in a model with hyperbolic discounters. They demonstrate that allowing naive agents to select their retirement date induces them to start saving for retirement earlier than they otherwise would. In future work, it might prove fruitful to study how allowing households to both plan optimally and decide when to retire affects planning and saving for retirement.

6 References

Alonso-Ortiz, J. (2014). Social security and retirement across the OECD. *Journal of Economic Dynamics and Control*, 47:300 – 316.

Ameriks, J., Caplin, A., and Leahy, J. (2003). Wealth accumulation and the propensity to plan. *The Quarterly Journal of Economics*, 118(3):1007–1047.

Attanasio, O. P. (1994). Personal saving in the u.s. *International Comparison of Household Saving, James M. Poterba, ed. University of Chicago Press.*

Bagchi, S. (2015). Labor supply and the optimality of Social Security. *Journal of Economic Dynamics and Control*, 58:167 – 185.

Becker, G. S. and Mulligan, C. B. (1997). The endogenous determination of time preference. *The Quarterly Journal of Economics*, 112(3):729–758.

Boshara, R., Emmons, W. R., and Noeth, B. (2015). The demographics of wealth: How age, education and race separate thrivers from strugglers in today's economy. essay no. 2: Education and wealth. Technical report, Federal Reserve Bank of St. Louis.

Bucciol, A. (2011). A note on social security welfare with self-control problems. *Macroeconomic Dynamics*, 15(4):579 – 594.

Caliendo, F. and Aadland, D. (2007). Short-term planning and the life-cycle consumption puzzle. *Journal of Economic Dynamics & Control*, 31(4):1392–1415.

Caliendo, F. N. (2011). Time-inconsistent preferences and social security: Revisited in continuous time. *Journal of Economic Dynamics and Control*, 35(5):668 – 675.

Capra, C. M., Tasoff, J., and Xu, J. (2022). Dread of future pain and current consumption. *Claremont Graduate University working paper.*

Chu, H. and Cheng, C.-c. (2019). Optimal social security tax with myopic agents. *Economic Modelling*, 80:320–327.

Cocco, J. F., Gomes, F. J., and Maenhout, P. J. (2005). Consumption and portfolio choice over the life cycle. *Review of Financial Studies*, 18(2):491–533.

Cottle Hunt, E. and Caliendo, F. N. (2022). Social security and risk sharing: A survey of four decades of economic analysis. *JOURNAL OF ECONOMIC SURVEYS*.

Cremer, H., Donder, P., Maldonado, D., and Pestieau, P. (2008). Designing a linear pension scheme with forced savings and wage heterogeneity. *International Tax and Public Finance*, 15(5):547–562.

Docquier, F. (2002). On the Optimality of Public Pensions in an Economy with Life-cyclers and Myopes. *Journal of Economic Behavior & Organization*, 47(1):121 – 140.

Feigenbaum, J. (2008). Can mortality risk explain the consumption hump? *Journal of Macroeconomics*, 30(3):844 – 872.

Feldstein, M. (1985). The optimal level of social security benefits. *The Quarterly Journal of Economics*, 100(2):303–320.

Findley, T. S. and Caliendo, F. N. (2009). Short horizons, time inconsistency, and optimal social security. *International Tax and Public Finance*, 16(4):487 – 513.

Findley, T. S. and Caliendo, F. N. (2015). Time inconsistency and retirement choice. *Economics Letters*, 129:4–8.

Friedman, M. (1957). *A Theory of the Consumption Function*. National Bureau of Economic Research, Inc.

Ganguly, A. and Tasoff, J. (2017). Fantasy and dread: The demand for information and the consumption utility of the future. *Management Science*, 63(12):4037–4060.

Gourinchas, P.-O. and Parker, J. A. (2002). Consumption over the life cycle. *Econometrica*, 70(1):47–89.

Gustman, A. L. and Juster, F. T. (1996). Income and wealth of older american households: Modeling issues for public policy analysis. *Assessing Knowledge of Retirement Behavior*, page 11.

Hansen, G. D. and Wright, R. (1992). The labor market in real business cycle theory. *Federal Reserve Bank of Minneapolis. Quarterly Review-Federal Reserve Bank of Minneapolis*, 16(2):2.

Hubbard, R. G., Skinner, J., and Zeldes, S. P. (1995). Precautionary saving and social insurance. *Journal of Political Economy*, 103(2):360–399.

Hurst, E. (2004). Grasshoppers, ants and pre-retirement wealth: A test of permanent income consumers.

İmrohoroğlu, A., İmrohoroğlu, S., and Joines, D. H. (2003). Time-Inconsistent Preferences and Social Security. *The Quarterly Journal of Economics*, 118(2):745–784.

Krueger, D. and Kubler, F. (2006). Pareto-Improving Social Security Reform when Financial Markets Are Incomplete!? *The American Economic Review*, 96(3):737–755.

Kumru, C. S. and Thanopoulos, A. C. (2008). Social security and self control preferences. *Journal of Economic Dynamics and Control*, 32(3):757–778.

Love, D. and Schmidt, L. (2015). Comprehensive Wealth of Immigrants and Natives. (University of Michigan Retirement Research Center Working Paper 328).

Lusardi, A. (2003). Planning and saving for retirement. *Dartmouth College working paper*.

Lusardi, A., Michaud, P.-C., and Mitchell, O. S. (2017). Optimal financial knowledge and wealth inequality. *Journal of Political Economy*, 125(2):431–477.

Lusardi, A. and Mitchell, O. S. (2007). Baby boomer retirement security: The roles of planning, financial literacy, and housing wealth. *Journal of Monetary Economics*, 54(1):205–224.

Lusardi, A. and Mitchell, O. S. (2011). Financial literacy and planning: Implications for retirement wellbeing. *National Bureau of Economic Research*.

Park, H. and Feigenbaum, J. (2018). Bounded rationality, lifecycle consumption, and Social Security. *Journal of Economic Behavior and Organization*, 146:65 – 105.

Slavov, S., Gorry, D., Gorry, A., and Caliendo, F. N. (2019). Social security and saving: An update. *Public Finance Review*, 47(2):312–348.

Smith, J. P. et al. (1997). Wealth inequality among older americans. *Journals of Gerontology Series B*, 52:74–81.

Venti, S. F. and Wise, D. A. (1998). The cause of wealth dispersion at retirement: Choice or chance? *The American Economic Review*, 88(2):185–191.

Appendix

A Proof of proposition 2.1

The household's planned discounted utility from consumption given planning horizon h_t is

$$U_t(b_{t,j}; h_{t,j}) = \sum_{s=t}^{t+h_{t,j}-1} \beta^{s-t} \ln\left(\hat{c}_{s,j}(h_{t,j})\right) - \sum_{s=t}^{t+h_{t,j}-1} \beta^{s-t} A h_{t,j}. \tag{9}$$

The household would prefer to plan for an additional period if utility is higher with planning horizon $h_t + 1$:

$$U_t(b_{t,j}; h_{t,j} + 1) > U_t(b_{t,j}; h_{t,j}), \tag{10}$$

which is true if and only if

$$\begin{aligned} &\sum_{s=t}^{t+h_{t,j}} \beta^{s-t} \ln\left(\hat{c}_{s,j}(h_{t,j}+1)\right) - \sum_{s=t}^{t+h_{t,j}} \beta^{s-t} A(h_{t,j}+1) \\ &> \sum_{s=t}^{t+h_{t,j}-1} \beta^{s-t} \ln\left(\hat{c}_{s,j}(h_{t,j})\right) - \sum_{s=t}^{t+h_{t,j}-1} \beta^{s-t} A h_{t,j}. \end{aligned} \tag{11}$$

Gathering the like terms,

$$A < \frac{\sum_{s=t}^{t+h_t} \beta^{s-t} \ln(\hat{c}_{s,j}(h_{t+1,j})) - \sum_{s=t}^{t+h_t-1} \beta^{s-t} \ln(\hat{c}_{s,j}(h_{t,j}))}{(h_{t,j}+1)\left(\sum_{s=t}^{t+h_{t,j}} \beta^{s-t}\right) - h_{t,j}\left(\sum_{s=t}^{t+h_{t,j}-1} \beta^{s-t}\right)}. \tag{12}$$