Bequest Motives and the Annuity Puzzle*

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Abstract

Few retirees annuitize any of their wealth, a fact that has so far defied explanation within the standard framework of forward-looking, expected utility-maximizing agents. The prevailing view is that people with plausible bequest motives should annuitize *part* of their wealth, and thus that bequest motives cannot explain why most people do not annuitize *any* wealth. I show, however, that people who wish to leave bequests are likely to be better off not annuitizing any wealth at available rates. Uninsured lifespan risk is much less costly for people who value the large bequests that arise incidentally from saving for future consumption with non-annuity wealth. The evidence suggests that bequest motives are the main reason annuity markets are so small.

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1 Introduction

Decisions about how quickly to spend wealth during retirement are complicated by the substantial lifespan risk in old age. While roughly one-fifth of 65-year-olds in the US will die before they turn 75, another fifth will live to age 90 and beyond. People who spend too quickly risk outliving their assets and having a low living standard in old age, but people who spend too slowly forgo consumption unnecessarily. Life annuities, which convert a stock of wealth into a lifelong flow of income, insure people against the risk of outliving their assets and provide long-lived annuitants with a larger income stream than they could achieve with equally risky non-annuity assets.

Although the considerable lifespan risk in old age suggests a valuable role for annuities in retirement planning, voluntary annuitization is almost non-existent in most countries.[1] Among people at least 65 years old in the US, private annuities comprise just one percent of total wealth (Johnson et al., 2004). The lack of annuitization is especially surprising given the large welfare gains from annuities in life cycle models. Calibrated models suggest that typical 65-year-olds would be willing to pay one-fourth of their wealth for access to actuarially fair annuities, which far exceeds the actuarial unfairness of available annuities (Mitchell et al., 1999). While the "annuity puzzle" literature has identified several extensions of the simple life cycle model that reduce annuity gains (see Brown (2007) for a review), trying to understand the near absence of voluntary annuitization within the framework of forward-looking, expected utility-maximizing agents has proven so difficult as to prompt a search for explanations outside of the rational model (e.g. Brown et al. (2008)).[2]

[1] See James and Song (2001) for information about Australia, Canada, Chile, Israel, Singapore, Switzerland, the UK, and the US. Variable annuities, which are the most popular type of annuity in most countries, are primarily a tax-deferred saving vehicle rather than longevity insurance. Less than one percent of variable annuity contracts in the US were converted to life annuities in 2003 (Beatrice and Drinkwater, 2004).

[2] Perhaps the most successful way yet found to reduce the demand for annuities in life cycle models is to include equity markets but rule out equity-linked annuities (e.g. Michaelides et al. (2007) and Yogo (2009)). Forcing people to choose between the equity premium and annuities' "mortality premium" reduces the value of annuities, but it does not explain why equity-linked variable annuities are similarly unpopular. See Horneff et al. (2009).

The perception that private annuity markets fail or that people fail to annuitize as much as they should is a central justification for one of the largest public programs in rich countries: government provision of old-age income (public pensions) (e.g. Diamond (2004)). In addition to the forced annuitization implicit in public pensions schemes, some countries, such as Germany and the UK, require people to at least partially annuitize the wealth they hold in tax-advantaged savings accounts. An important step toward evaluating policies that mandate or encourage annuitization is understanding why private annuity markets are so small in the first place.

In this paper, I propose that the main reason annuity markets are small is that most people value the prospect of leaving unspent wealth to their heirs. I estimate the welfare gains from annuities in a calibrated model in which the only reason to prefer non-annuity wealth to annuity income is that non-annuity wealth is bequeathable. Even in this most favorable situation for annuities, people with modest bequest motives—that have little effect on saving or purchases of actuarially fair annuities—are usually better off not annuitizing *any* of their wealth at moderately actuarially unfair rates. Using estimates of bequest motives from the literature on saving behavior, I show that people with typical bequest motives would be better off not annuitizing any wealth at available rates even if there were no other reason to prefer non-annuity wealth to annuity income.

The idea that bequest motives reduce optimal annuitization dates back at least to Yaari's (1965) seminal article and has considerable intuitive appeal: the single unavoidable cost of purchasing annuities is the foregone opportunity to bequeath that wealth. Despite this, the prevailing view in the literature is that while bequest motives may explain why people do not annuitize *all* of their wealth, bequest motives cannot explain why most people do not annuitize *any* of their wealth. The supposed desirability of partial annuitization is based on a result derived in a perfect markets setting—in which annuities are costless to buy and pay an actuarially fair rate of return—that people should annuitize all but what they wish to bequeath (Davidoff et al., 2005). According to this result, only people who wish to bequeath all of their non-annuity wealth or more do not at least partially annuitize. As

Davidoff et al. (2005) note, this prediction strictly applies only to actuarially fair annuities so its accuracy depends on annuity prices being close enough to actuarially fair, which means roughly that annuity loads (the excess of premiums over expected benefits) are small relative to the gain from fair annuities. In this paper, I find that annuity loads are not small relative to what people who wish to leave bequests gain from fair annuities.

Annuities allow people to increase their consumption at the expense of bequests and insure their bequests. Without annuities, even people without bequest motives leave large bequests on average in an effort to smooth their consumption over time. Trading these incidental bequests for greater consumption is a large free lunch for people without bequest motives and is the reason that selfish consumers' estimated annuity gains are so large and robust. Bequest motives, even those that have little effect on saving, significantly reduce the gain from this trade. People with stronger bequest motives use annuities primarily to insure their bequests: without annuities, bequests depend on realized lifespan. But unless people are very risk averse over bequests—much more than most altruists should be and more than estimates of the wealth elasticity of bequests indicate—bequest insurance is not worth buying at even slightly actuarially unfair rates.

2 Theory

This section uses a simple model to explain the prevailing view that people who do not wish to bequeath all of their non-annuity wealth should at least partially annuitize and to explain why people with bequest motives may be better off not annuitizing any wealth at actuarially unfair rates. Consider the wealth allocation decision of an individual who lives two periods with probability p and lives one period otherwise. In the first period, the individual chooses how much of his wealth, w, to consume, save, and annuitize, $c_1 + s + \pi = w$. Non-contingent saving, $s \geq 0$, earns a gross rate of return R regardless of whether the individual lives. Annuities, $\pi \geq 0$, earn a larger gross return than non-contingent saving if the individual lives, $R_a > R$, but return nothing if the individual

dies. In old age, the individual receives income, y, in addition to his accumulated non-contingent saving and annuities. Bequests if the individual dies young and wealth in old age are

$$\begin{aligned} b_1 &= Rs &&= R(w - c_1) - R\pi, \\ x_2 &= Rs + R_a\pi + y &&= R(w - c_1) + (R_a - R)\pi + y. \end{aligned} \tag{1}$$

In old age, the individual splits his wealth between consumption and an immediate bequest, $c_2 + b_2 = x_2$. Bequests must be nonnegative, $b_1, b_2 \geq 0$.

Without annuities, the individual's choice of how much to bequeath should he die young and his choice of how much to consume and bequeath in old age are inseparable—each unit of non-contingent saving buys R units of short-lifespan bequests and R units of wealth in old age, $\frac{db_1}{ds} = \frac{dx_2}{ds} = R$. In saving for old age, short-lifespan bequests arise incidentally. And in saving to leave short-lifespan bequests, wealth in old age arises incidentally. Annuities relax the constraint linking short-lifespan bequests and wealth in old age by allowing the individual to trade one for the other. Annuitizing an additional unit of saving reduces short-lifespan bequests by R and increases wealth in old age by $(R_a - R)$. By paying benefits only if the annuitant lives, annuities convert "incidental" bequests into wealth in old age.

Suppose the individual maximizes expected utility,

$$EU = u(c_1) + \beta \left[pV(x_2) + (1 - p)v(b_1) \right],$$

where

$$V(x) = \max_{c \in [0,x]} \{u(c) + v(x - c)\}$$

is utility in old age as a function of wealth in old age, x. Utility from consumption and bequests, $u(\cdot)$ and $v(\cdot)$, are strictly increasing and strictly concave, and the marginal utility of consumption approaches infinity as consumption approaches zero. The optimal allocation in old age satisfies the first order condition $u'(c_2^*) \geq v'(b_2^*)$, which holds with equality if $b_2^* > 0$.

Net expected marginal utility of annuitizing an additional unit of saving is

$$\frac{\partial EU(c_1,\pi)}{\partial \pi} = \beta\left[p(R_a - R)V'(x_2) - (1-p)Rv'(b_1)\right],$$

which can be rewritten

$$\frac{\partial EU(c_1,\pi)}{\partial \pi} = \beta R\left[(1-p-\lambda)V'(x_2) - (1-p)v'(b_1)\right], \tag{2}$$

where $R_a = (1-\lambda)\frac{R}{p}$ and $\lambda \geq 0$ is the annuity *load*, the percentage by which premiums exceed expected discounted benefits. Actuarially fair annuities have $\lambda = 0$.[3]

If actuarially fair annuities are available ($\lambda = 0$), expected marginal utility of annuitizing savings is

$$\frac{\partial EU(c_1,\pi)}{\partial \pi} = (1-p)\beta R\left[V'(x_2) - v'(b_1)\right]. \tag{3}$$

The individual annuitizes his savings up until the marginal utilities of short-lifespan bequests and wealth in old age are equal or until he annuitizes all of his savings, whichever comes first.[4] At the optimum, wealth in old age is at least as valuable at the margin as short-lifespan bequests and they are equally valuable if the individual leaves a bequest, $V'(x_2^*) \geq v'(b_1^*)$, which holds with equality if $b_1^* > 0$. The individual annuitizes all of his savings and leaves no bequests if the marginal utility of consumption were he to fully annuitize and consume everything is at least as large as the marginal utility of bequests at zero bequests, $u'(R_a(w - c_1^*) + y) \geq v'(0)$, and otherwise annuitizes what he wishes to consume above endowed income and bequeaths the rest, $u'(R_a\pi^* + y) = v'(b^*)$ and $b_1^* = b_2^* = b^* = R(w - c_1^* - \pi^*)$. Thus, *with fair annuities, people set aside what they wish to*

[3]The actuarially fair rate of return on annuities equalizes premiums and expected discounted benefits, $\pi = \frac{pR_a\pi}{R}$, so $R_a = \frac{R}{p}$.

[4]I assume throughout that the individual wishes to consume more than his endowed income in old age. This means that, without annuities, the marginal utility of wealth in old age exceeds the the marginal utility of short-lifespan bequests: $V'(x_2) = u'(c_2) \geq v'(b_2) > v'(b_1)$, where the last inequality follows because long-lifespan bequests are smaller than short-lifespan bequests, $b_2 = R(w - c_1) - (c_2 - y) < R(w - c_1) = b_1$. People in this situation would benefit from annuitizing their wealth at actuarially fair rates and thus would not buy actuarially fair life insurance, which is equivalent to selling actuarially fair annuities, ($\pi^* < 0$). This is consistent with Brown (2001b), who finds that life insurance ownership in old age appears to be driven more by tax incentives and past decisions than by a desire to increase bequests at the expense of consumption.

bequeath and annuitize all future consumption (Davidoff et al., 2005).[5,6] At the optimum with fair annuities, bequests are insured against lifespan risk and consumption and bequests are equally valuable at the margin if the individual leaves a bequest.

The main theoretical result about the demand for annuities—that people with access to actuarially fair annuities should annuitize all but what they wish to bequeath—is the basis for the view that bequest motives do not explain why almost nobody annuitizes any wealth. With fair annuities, the only people who should not annuitize any wealth are those who intend to bequeath all of their non-annuity wealth. It appears, however, that many people who do not annuitize any wealth do not intend to bequeath all of their non-annuity wealth. Most retirees expect to and do leave bequests worth less than their current stock of wealth (Hurd and Smith, 2002), and most people say that they save primarily for retirement or emergencies rather than to leave bequests (Dynan et al., 2002).

As Davidoff et al. (2005) note, with actuarially unfair annuities ($\lambda > 0$), people no longer annuitize all but what they wish to bequeath, but one would expect purchases of annuities whose prices are close to actuarially fair to approximate purchases of fair annuities.[7] Empirically, annuity *prices* appear reasonably close to actuarially fair: annuity loads are a smaller percentage of premiums than loads in several insurance markets with widespread participation and are much smaller than the welfare gains from actuarially fair annuities in simulation models.[8] Yet annuity *purchases* appear to be much smaller than one would expect with actuarially fair annuities.

There are at least two explanations for the discrepancy between observed behavior and the

[5]As Davidoff et al. (2005) note, this result is implicit in Yaari (1965).

[6]This simple model ignores many factors that could reduce optimal annuitization, such as uninsured medical spending risk, but Davidoff et al. (2005) show that substantial annuitization remains optimal under fairly general conditions.

[7]Equation 2 shows that, with actuarially unfair annuities ($\lambda > 0$), people who wish to leave bequests annuitize future consumption incompletely, $V'(x_2) > v'(b_1)$. Large enough loads (large λ) can eliminate annuity purchases entirely even by people who wish to consume more than their endowed income in old age, $(1 - p - \lambda)V'(R(w - c_1)) < (1 - p)v'(R(w - c_1))$ even though $V'(R(w - c_1)) > v'(R(w - c_1))$.

[8]Loads estimated in the US private annuity market average ten to fifteen percent, and the willingness to pay for actuarially fair annuities in the baseline model is about one-fourth of non-annuity wealth (Mitchell et al., 1999).

prediction of the perfect-markets, actuarially fair annuities model. One explanation, which has prompted a literature investigating several possibilities, is that the lack of annuitization is due to something that is missing from the simple model. An alternative explanation, which I test in this paper, is that the loads on available annuities are not small enough for perfect markets models to provide reliable predictions of annuitization. Although annuity loads are small relative to estimates of what *selfish* people gain from actuarially fair annuities, they may be large relative to what people *with bequest motives* gain from annuities.

For people who wish to consume out of their non-annuity wealth, annuitizing future consumption increases consumption at the expense of bequests, smooths consumption, and insures bequests. Consider how bequest motives affect the gain from each component in turn.

The gain from increasing consumption at the expense of bequests.— Annuitizing savings (given c_1) reduces short-lifespan bequests and increases wealth in old age, some of which is spent on consumption. For people without bequest motives, increasing consumption at the expense of bequests is a free lunch that has huge welfare benefits in calibrated models. The benefits are so large because, without annuities, people who wish to smooth their consumption over time leave large bequests whether they value them or not. Kotlikoff and Spivak (1981) estimate that a 55-year-old man without a bequest motive consumes only about three-fourths of his wealth on average out of a desire to smooth consumption over time.[9] Fully annuitizing his wealth using an annuity with a ten percent load would allow this man to consume 90 percent of his wealth on average, 15 percent more than he consumes without annuities. Of course, this increase in consumption comes at the expense of leaving smaller bequests—by fully annuitizing the individual leaves no bequest instead of leaving bequests worth one-fourth of his wealth on average—so people with bequest

[9]Specifically, a 55-year-old man with no annuitized wealth and constant relative risk aversion preferences with coefficient of risk aversion $\sigma = .75$ consumes about three-fourths of his wealth on average. An otherwise identical individual with a stronger preference for smooth consumption, $\sigma = 1.75$, consumes only about two-thirds of his wealth on average.

motives clearly gain less from this trade. Whereas someone without bequest motives would be willing to pay roughly 15 percent of his wealth for the opportunity to make this trade, someone who valued bequests at 50 cents on the dollar would be willing to pay roughly 2.5 percent of his wealth ($15 - 0.50 \times 25$), just one-sixth as much.

The gain from smoothing consumption.— By eliminating the risk of leaving larger bequests than one wishes, annuities also have a consumption smoothing benefit. Without annuities, the first order condition for consumption in the first period is

$$u'(c_1) = \beta R \left[(1-p)v'(b_1) + pV'(x_2) \right].^{10}$$

Wealth in old age is more valuable at the margin than short-lifespan bequests, $V'(x_2) \geq v'(b_2) > v'(b_1)$, because the individual has less wealth to bequeath after consuming in old age than had he died young. In deciding how much to consume in the first period, the individual trades off the cost of consuming "too" aggressively ($\frac{\beta u'(c_2)}{u'(c_1)} > \frac{1}{R}$) against the cost of leaving "excess" bequests ($v'(b_1) < u'(c_1)$). With log utility and the discount rate equal to the interest rate, people without bequest motives who wish to consume more than their income choose $c_2 = pc_1$: people consume half as much at age 85 as at age 65 because 65-year-olds have a fifty percent chance of surviving to age 85.[11] Bequest motives increase the return to saving and thereby encourage people to choose consumption paths that are closer to the optimal consumption path with perfect annuity markets. People with bequest motives partially insure their consumption by consuming some of their "intended" bequests in long-lifespan states.

The gain from insuring bequests.— Whereas people with weak bequest motives use annuities mostly to increase consumption at the expense of bequests, people with stronger bequest motives use annuities mostly to insure their bequests. Although people who are

[10] The assumption that the individual wishes to consume more than his income in old age guarantees an interior solution for first period consumption, $c_1 < w$, and this first order condition holds with equality.

[11] The average 65-year-old male born in 1950 has about a fifty percent chance of living to at least age 83, and the average female has about a fifty percent chance of living to at least age 88 according to US Social Security Administration forecasts.

risk averse over bequests clearly would benefit from insuring their bequests at actuarially fair rates, bequest insurance may not be sufficiently valuable to justify paying available annuity loads for it. Most altruists and their beneficiaries, for example, should not be very risk averse over bequests because bequests are usually small relative to beneficiaries' total wealth.

In deciding whether and how much wealth to annuitize at actuarially unfair rates, people trade off the benefits of a better distribution of wealth between consumption and bequests, a better distribution of consumption over time, and less risky bequests against the cost of reducing total consumption and bequests by the annuity loads.[12] The next section tests whether the smaller gains from annuities that people with bequest motives would enjoy are large enough to warrant paying available loads.[13]

3 Simulations

3.1 Model and parameterization

This section presents the life cycle model I use to estimate the effect of bequest motives on the demand for and welfare gain from annuities. Other than bequest motives, the model is the baseline model considered in the annuity literature—it excludes all other factors that reduce the gains from annuities such as family risk sharing and uninsured medical spending

[12]Buying annuities with loads ($\lambda > 0$) increases expected wealth in old age by less than it decreases expected short-lifespan bequests: $E(b_1 + x_2) = (1-p)b_1 + px_2 = R(w - c_1) + py - R\lambda\pi$ is decreasing in π.

[13]Most estimates of the demand for and value of annuities are based on models without bequest motives. Most of the exceptions include several factors that reduce annuity demand in addition to bequest motives (e.g. Michaelides et al. (2007) and Ameriks et al. (2008)), which makes it difficult to determine how bequest motives affect the value of insuring lifespan risk. Two exceptions that focus especially on bequest motives are Friedman and Warshawsky (1990) and Vidal-Melia and Lejarraga-Garcia (2006), who show that strong enough bequest motives can eliminate purchases of annuities with high enough loads. But both papers use bequest motives whose strength is difficult to interpret and whose homothetic form is inappropriate for altruists and inconsistent with some patterns in the data.

risk. A 65-year-old chooses a consumption path to maximize expected utility,

$$EU = \sum_{t=65}^{T} \beta^{t-65} S_t u(c_t) + \sum_{t=66}^{T+1} \beta^{t-65} p_t v(b_t),$$

subject to the constraints that bequests must be nonnegative,

$$b_t = (1+r)^{t-65}(N - \Pi) - \sum_{s=1}^{t-65}(1+r)^s(c_{t-s} - y) \geq 0, \quad \forall t \in \{66, 67, ...T+1\}.$$

T is the maximum achievable age, S_t is the probability of living to at least age t, and $p_t = S_t - S_{t-1}$ is the probability of dying between age $t-1$ and age t. The individual discounts future utility from consumption and bequests, $u(c)$ and $v(b)$, with the same discount factor, β. Assets earn a real after-tax return, r. The individual may use some of his initial non-annuity wealth, N, to purchase a single-premium immediate annuity. Total income from public and private pensions and from private annuities is constant in real terms and equal to y. In exchange for a single premium paid at age 65, Π, annuities provide the individual with a constant real income stream beginning immediately and lasting until death. The premium for an annuity paying a constant real income steam of a for life is

$$\Pi(a, \lambda) = \sum_{t=65}^{T} \frac{S_t a}{(1+r)^{t-65}} \ / \ (1-\lambda),$$

where λ is the load. Actuarially fair annuities have zero load, $\lambda = 0$. Annuities with a five percent load ($\lambda = .05$) pay on average 95 cents of income per dollar of premiums.

Utility from consumption is constant elasticity, $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$, with coefficient of relative risk aversion $\sigma = 2$. The discount rate and the interest rate are 3 percent per year, $\beta = \frac{1}{1+r} = \frac{1}{1.03}$. Mortality probabilities come from the 2003 US Social Security Administration male life table, adjusted so that the maximum possible age is 110 years, $T = 110$. Setting a maximum age allows me to solve the model via backward induction. One-third of the individual's wealth is already annuitized into a constant real income

stream.[14]

I consider bequest motives of the form

$$v(b) = \theta_1 \frac{(\theta_2 + b)^{1-\theta_3}}{1-\theta_3},$$

which incorporates as special cases most of the bequest motives used in life cycle models. $\theta_1 \geq 0$ measures the strength of the bequest motive and $\theta_2 \geq 0$ and $\theta_3 \geq 0$ determine the wealth elasticity of bequests and risk aversion over bequests.[15] Bequests are a luxury good if $\theta_3 < \sigma$ or if $\theta_3 = \sigma$ and $\theta_2 > 0$. Empirically, bequests are a luxury good: rich people leave a larger fraction of their wealth to their heirs than the poor.[16] I present results for four combinations of θ_2 and θ_3, which vary the degree to which bequests are a luxury good.

Linear bequest motives: $v(b) = \theta_1 b, \ (\theta_3 = 0).$— Linear (constant marginal utility) bequest motives represent the extreme of bequests being a luxury good. At low wealth levels the individual leaves no bequest and at high enough wealth levels the marginal expenditure share on bequests is one. People are risk neutral over bequests; they care only about the expected bequest. Hurd and Smith's (2002) estimate of the increase in anticipated bequests during the 1990s increase in stock and housing markets is captured almost perfectly by a model with linear bequest motives.[17] Linear bequest motives are sometimes

[14]Dushi and Webb (2004) find that most 65-year-old US households have much more than one-third of their wealth already annuitized by Social Security and (defined benefit) employer pensions. Households in the bottom decile of the wealth distribution have 80 percent of their wealth already annuitized on average, households around the median have about 65 percent, and households in the top decile have about 32 percent. By using one-third, I am estimating annuity gains for an individual who is considerably less annuitized than most people and so the results will overstate the value of annuities for all but the richest retirees.

[15]As Carroll (2000) emphasizes, the wealth elasticity of bequests and risk aversion over bequests are closely related.

[16]Hurd and Smith (2002) estimate that among single Americans who were at least 70 years old in 1993 and died before 1995, the 30th percentile of the bequest distribution was just $2 thousand, the median $42 thousand, and the mean $82 thousand. Hurd and Smith (2002) estimate a wealth elasticity of anticipated bequests of 1.3, which is similar to what is typically estimated for realized bequests (e.g. Auten and Joulfaian (1996).

[17]Hurd and Smith (2002) estimate that average anticipated bequests (based on how likely people say they are to leave bequests of different sizes) by households age 70 and over increased from about $70 thousand to about $123 thousand and average wealth increased from about $188 thousand to about $290 thousand between 1993 and 1995. My model with a linear bequest motive in which the marginal utility of bequests is equal to the marginal utility of consuming $25,500 each year matches average bequests before and after the increase in wealth almost exactly.

used to approximate altruistic bequest motives (e.g. Hurd (1987)), which arise from concern about the welfare of one's heirs, and are sometimes used to describe "joy-of-giving" bequest motives (e.g. Kopczuk and Lupton (2007)), which arise from enjoying giving for its own sake. Most altruists should have approximately linear bequest motives because bequests are typically small relative to recipients' total (human and non-human) wealth, which means that recipients' marginal utility of wealth (and the altruist's marginal utility of bequests) is little affected by bequest-sized windfalls (Hurd, 1987). Linear bequest motives are a particularly good approximation for altruists who have multiple heirs, whose heirs have bequest motives, or who give to large organizations.

Threshold bequest motives: $v(b) = \theta_1 \frac{(\theta_2+b)^{1-\sigma}}{1-\sigma},\ (\theta_2 > 0,\ \theta_3 = \sigma)$.— Threshold bequest motives are similar to linear bequest motives in that bequests are a luxury good, but are unlike linear bequest motives in that the marginal utility of bequests decreases in the size of the bequest—people are risk averse over bequests.[18] An intuitive way to parameterize this type of bequest motive is to imagine an altruist who has a single, selfish heir with a T_h-year planning horizon, $v(b) = a\sum_{i=1}^{T_h} \beta^{i-1} u(c_i^h(b))$. If the heir consumes her income, y_h, plus the annuity value of any bequest received and has the same constant elasticity preferences for consumption as the altruist, then

$$v(b) = a\left(\sum_{i=1}^{T_h} \beta^{i-1}\right) \frac{\left(y_h + \frac{b}{\sum_{i=1}^{T_h}(1+r)^{-(i-1)}}\right)^{1-\sigma}}{1-\sigma}.$$

In this case, $\theta_2 = \sum_{i=1}^{T_h} \frac{y_h}{(1+r)^{i-1}}$, the discounted value of the heir's wealth. This leaves two parameters to be specified: y_h and T_h. I assume that the heir's income is equal to what the individual's would be if he fully annuitized his wealth at the actuarially fair rate, $y_h = y_{full}$, and I report results for $T_h = 40$ and $T_h = 10$ ("Threshold 40" and "Threshold 10"). Threshold bequest motives may represent joy-of-giving bequest motives or altruistic bequest motives for altruists who are unusually risk averse over their bequests. Most

[18] De Nardi (2004) uses a bequest motive of this form to study the distribution of wealth in the US and Sweden.

altruists' bequest motives should be between the Linear and Threshold 40 cases.

Homothetic bequest motives: $v(b) = \theta_1 \frac{b^{1-\sigma}}{1-\sigma},\ (\theta_2 = 0,\ \theta_3 = \sigma)$.— Homothetic preferences over consumption and bequests are inconsistent with the evidence that bequests are a luxury good, but they are occasionally used in simulation models and can test the robustness of the results to unusually high risk aversion over bequests.

The strength of bequest motives.— My primary measure of the strength of bequest motives is the fraction of the individual's non-annuity wealth that he would bequeath had he access to actuarially fair annuities, $\frac{b^*}{N} \in [0, 1]$.[19] In the following results, the bequest motives at the $\frac{b^*}{N} = 0$ position are the strongest bequest motives consistent with leaving zero bequests, which for linear and threshold bequest motives is not the same as having no bequest motive.[20] Alternative measures of the strength of bequest motives appear in the Appendix and the second panel of Figure 2.

3.2 Results

Figure 1 shows how bequest motives affect the welfare gain from annuities with different loads. The welfare gain from annuities is the fraction of the individual's non-annuity wealth that he would be willing to pay for access to the annuities, $\frac{WTP}{N}$.[21] The figure shows that even modest bequest motives significantly reduce annuity gains. Whereas people without bequest motives are willing to pay 28.3 percent of their non-annuity wealth for access to actuarially fair annuities, most altruists who would bequeath one-fourth of their wealth had they access to fair annuities are willing to pay about four percent of their wealth for access to fair annuities (between the Linear and Threshold 40 cases). Even people who are unusually risk averse over bequests gain much less from annuities than people without

[19] With fair annuities, the individual sets aside what he wishes to bequeath and annuitizes the rest, $b^* + \Pi^*_{fair} = N$.

[20] With fair annuities, the individual fully annuitizes if and only if $u'(c_{full}) \geq v'(0)$. The linear and threshold bequest motives at the $\frac{b^*}{N} = 0$ position are such that $u'(c_{full}) = v'(0)$.

[21] An individual with initial non-annuity wealth $(N - WTP)$ and with access to annuity markets is equally well off as an otherwise identical individual with initial non-annuity wealth N and without access to annuities.

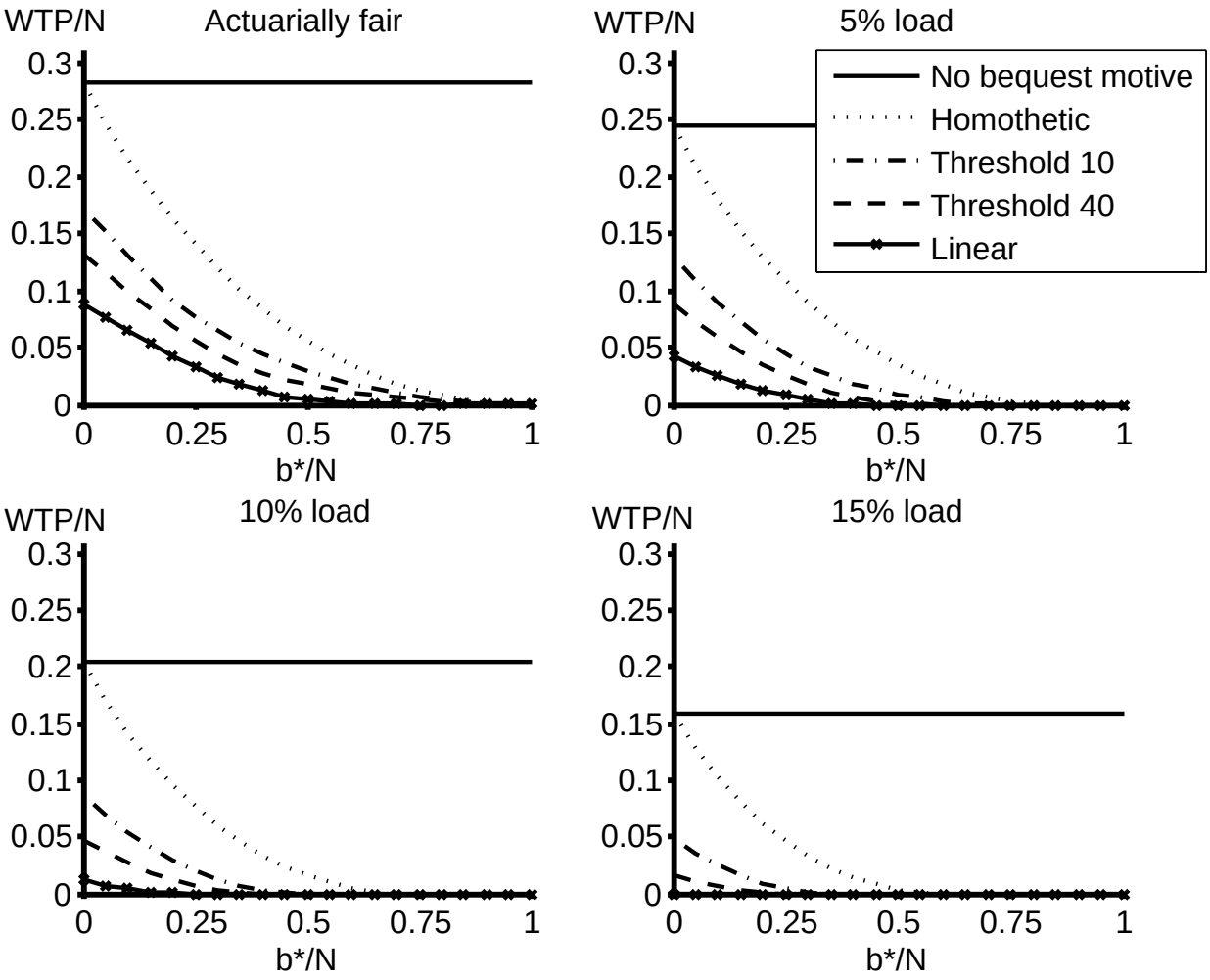

Figure 1: Welfare gains from annuities as a function of the type and strength of bequest motives. Each panel corresponds to annuities with different loads, the percentage by which premiums exceed expected discounted income. The y-axes measure the gain from annuities as the willingness to pay for access to the annuities as a percentage of non-annuity wealth. The x-axes measure the strength of bequest motives as the fraction of his non-annuity wealth the individual would bequeath had he access to actuarially fair annuities.

bequest motives. The assumption that people place zero value on the prospect of leaving wealth to their heirs is the key factor driving the large, robust gains from annuities typically estimated in the literature. For people with at least modest bequest motives, non-annuity wealth and actuarially equivalent income streams are fairly close substitutes.

The results in Figure 1 reject the prevailing view that people with bequest motives should partially annuitize their wealth. Even people who would annuitize most of their wealth had they access to actuarially fair annuities may be better off not annuitizing any wealth in the US private annuity market, where loads average ten to fifteen percent of premiums (Brown, 2007). While only people who wish to leave their entire stock of non-annuity wealth or more as a bequest ($\frac{b^*}{N} \geq 1$) would not annuitize any wealth at actuarially fair rates, altruists who would bequeath one-fourth of their non-annuity wealth (and annuitize three-fourths) had they access to fair annuities ($\frac{b^*}{N} = \frac{1}{4}$) are likely better off not annuitizing any wealth at ten percent loads. Bequest motives much weaker than those required to eliminate purchases of fair annuities can eliminate purchases of available annuities.

To understand why bequest motives have such a large effect on the value of annuities, consider how they affect the gain from trading bequests for consumption, the gain from smoothing consumption, and the gain from insuring bequests. Panel (a) of Figure 2 shows the size of each of these gains for people without bequest motives (the first bar) and for people with Threshold 40 bequest motives.[22] By far the largest component of the gain from annuities for people with no or weak bequest motives is the gain from trading bequests for consumption, which, for people without bequest motives, accounts for 79.8 percent of the gain from annuities. In addition to gaining less from trading bequests for consumption, people with bequest motives also gain less from annuities' consumption smoothing role

[22]The gain from smoothing consumption is the excess of the expected discounted value of the uninsured consumption path over the expected discounted value of the welfare-equivalent flat consumption path. The gain from bequest insurance is the excess of the expected discounted value of uninsured bequests and the discounted value of the welfare-equivalent certain bequest (and people without bequest motives do not value bequest insurance). The gain from trading bequests for consumption is the residual gain from annuities not accounted for by consumption smoothing or bequest insurance. Kotlikoff and Spivak (1981) decompose annuity gains for people without bequest motives, and they call the gain from smoothing consumption "the substitution effect" and the gain from trading bequests for consumption "the income effect".

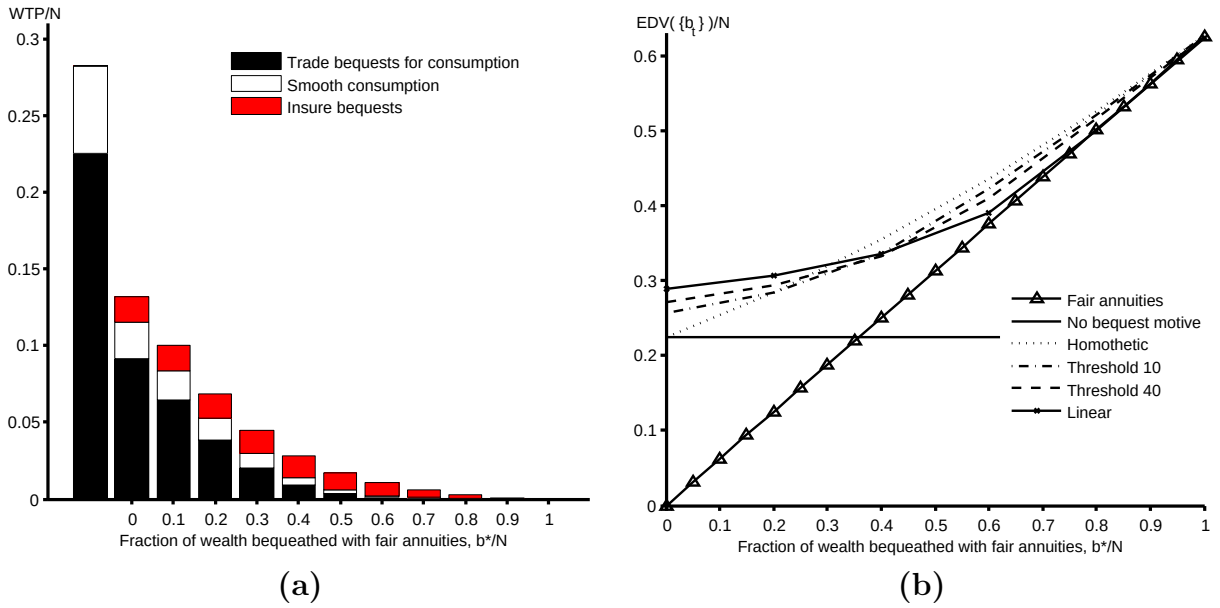

Figure 2: Panel (a): Components of the gain from actuarially fair annuities for an individual without a bequest motive (first bar) and for an individual with Threshold 40 bequest motives (roughly the bequest motives of an altruist who has a single, selfish heir with a 40-year planning horizon). Panel (b): Expected discounted bequests as a fraction of initial non-annuity wealth.

because, without annuities, bequests partially insure consumption. Finally, Panel (a) shows that even people with Threshold 40 bequest motives, which approximate the preferences of altruists who are unusually risk averse over bequests, gain little from bequest insurance. Only in rare cases would altruists (and their heirs) be sufficiently risk averse over bequests to justify using currently available annuities to insure their bequests.

Panel (b) of Figure 2 shows expected discounted bequests by people with and without annuities as a function of bequest motives.[23] In accordance with the results in Panel (a), Panel (b) shows that much of what annuities do for people with weak or no bequest motives is allow them to convert incidental bequests into greater consumption. Without annuities, people who die young leave large bequests whether they value them or not—in the simulation, even people without bequest motives leave bequests worth 22.6 percent of their wealth on average (hence the 22.6 percent gain from trading bequests for

[23]Expected discounted bequests with fair annuities are smaller than the fraction of wealth set aside for bequests because the individual's preferences are over *real* bequests rather than the *discounted value* of bequests. Defining preferences over the discounted value of bequests has little effect on the results.

consumption in Panel (a)). Even people who would set aside one-third of their wealth for bequests had they access to actuarially fair annuities ($\frac{b^*}{N} = \frac{1}{3}$) leave bequests worth about ten percent more of their non-annuity wealth on average if they do not buy annuities than if they buy actuarially fair annuities. The value that people place on the bequests that arise incidentally from financing future consumption with non-annuity wealth is the primary determinant of the gain from annuities. People who do not wish to trade most of their (expected) bequests for greater consumption are unlikely to benefit from buying available annuities.

Because average bequests by people with weak bequest motives are much larger without annuities than with annuities, the potential heirs of such individuals would usually prefer that their benefactors did not buy annuities. Potential heirs may be able to persuade benefactors with weak bequest motives not to annuitize, perhaps in exchange for a promise of support in old age.[24,25]

Panel (b) of Figure 2 also shows how an alternative measure of the strength of bequest motives—expected bequests by people without annuities—relates to my primary measure, the amount of wealth people would set aside for bequests had they access to actuarially fair annuities. This alternative measure and the two in the Appendix all show that bequest motives that have relatively minor effects on saving can eliminate purchases of available annuities. Linear bequest motives that increase expected discounted bequests by people without annuities from 22.6 to 31.3 percent of their non-annuity wealth eliminate purchases of annuities with ten percent loads. The figures in the Appendix show that bequest motives capable of eliminating annuitization may have little effect on the optimal consumption path or on the age at which the individual exhausts his wealth.

[24]Kotlikoff and Spivak (1981) consider risk sharing arrangements of this type between selfish individuals and show that small groups can share lifespan risk remarkably effectively. Bequest motives likely facilitate such arrangements by reducing transactions costs. Whereas selfish people must secure an up-front payment or a promise of future support from their heirs, people with sufficiently strong bequest motives can support themselves by spending their "intended" bequests before they die.

[25]The standard case of gift externalities precludes gainful bargaining between givers and recipients because recipients cannot pay the givers to give larger gifts—such payments would undo some of the giving (Kaplow, 1995). The choice about how much to annuitize is different because it involves a tradable asset—the individual's lifespan risk—rather than involving only cash transfers between parties.

4 Discussion of results and conclusion

Considerable evidence suggests that bequest motives are widespread and have important effects on the economy. Compared to optimal behavior in selfish life cycle models, most households accumulate too much wealth before retirement (Scholz et al., 2006)[26] and decumulate wealth too slowly after retirement (Palumbo, 1999).[27] In fact, except in emergencies—especially a spouse's death or admission to a nursing home—many retirees *actively save* (spend less than their after-tax income) during retirement (Butrica et al. (2005)). Inter-household transfers are common and large (Gale and Scholz, 1994). Ameriks et al. (2007) conclude from a survey designed to separately identify bequest motives and precautionary motives for saving that "strong bequest motives are too prevalent to be ignored". Dynan et al. (2004) conclude that bequest motives are part of the reason the rich save a larger fraction of their permanent income than the poor. De Nardi (2004) shows that bequest motives help make model-predicted saving behavior and wealth distributions more consistent with the data.

Moreover, people with the bequest motives estimated in the saving literature would gain little from actuarially fair annuities and would be better off not annuitizing any wealth at available rates. A 65-year-old with $200 thousand in non-annuity wealth and $15 thousand in income who had the (linear) bequest motive that matches Hurd and Smith's (2002) estimates of anticipated bequests in the Health and Retirement Study, or the (threshold) bequest motive that De Nardi (2004) shows to be consistent with the distribution of wealth in the US and Sweden,[28] or the median (threshold) bequest motive that Ameriks et al.

[26]Some economists disagree that people are saving enough for retirement. See Skinner (2007).

[27]One manifestation of slow wealth decumulation is that people rarely spend their home equity, especially absent shocks such as nursing home admission or a spouse's death (Venti and Wise, 2004). Davidoff (2009) shows that housing wealth can substitute for annuities and long-term care insurance if people sell their house only if they live a long time or require long-term care. As he notes, this raises the question of why people do not take out reverse mortgages. My results suggest that just as people need not wish to bequeath all of their non-annuity wealth to be better off not buying annuities, so too people need not wish to bequeath all of their home equity to be better off without reverse mortgages, whose primary benefit is to increase consumption at the expense of bequests.

[28]De Nardi's (2004) bequest motive also matches the transfer share of wealth and the share of households that leave small bequests.

Parental status			Importance of leaving an inheritance			
	% of sample	Own annuity		Children	No children	Own annuity
Children	92.4%	4.8%	Very important	22.8%	20.4%	4.5%
No children	7.6%	5.7%	Somewhat important	44.2%	34.4%	5.0%
Full sample	100%	4.8%	Not at all important	28.6%	42.8%	5.1%
			Spouses disagree	4.5%	2.4%	3.3%

Table 1: Proxies for bequest motives and ownership of life annuities in the Health and Retirement Study (HRS). All data are weighted using HRS household weights.

(2007) estimate based on survey responses designed to separately identify precautionary and bequest motives would be willing to pay less than two percent of his wealth for access to actuarially fair annuities and would not annuitize any wealth at five percent loads.

The evidence above suggests that bequest motives are widespread and have important effects on behavior, and that people with representative bequest motives are likely to be better off without available annuities. Yet proxies for bequest motives have little predictive power for annuitization decisions. Two of the main variables used as proxies for bequest motives are whether someone has children and the self-reported importance of leaving bequests. Table 1 summarizes these measures and how they relate to ownership of life annuities in the Health and Retirement Study, a representative sample of people over 50 years old in the US.[29] Annuity ownership is only slightly greater among households without children than households with children (5.7 percent versus 4.8 percent), and is only slightly greater among households who say that it is not at all important to leave bequests than those who say it is very important (5.1 percent versus 4.5 percent). These patterns in the raw data are repeated in regressions that include the simulated annuity equivalent wealth as a control. Brown (2001a) finds that whether households have children and how important they say it is to leave bequests have little explanatory power for whether people

[29]The question about the importance of leaving an inheritance is: "Some people think it is important to leave an inheritance to their surviving heirs, while others don't. Do you (both) feel it is very important, somewhat important, or not at all important, (or do you differ in how important it is)?" The possible answers are that (both) think it is "very important", "somewhat important", or "not at all important", or that the respondent and his or her partner disagree. This question was asked only in 1992, when most of the sample was between 51 and 61 years old. Because this is likely too young to get an accurate measure of annuity ownership, I measure annuity ownership rates in 2006. About two-thirds of annuities continue for life, and only about one-fourth stop payments when the owner dies (most make payments to the owner's spouse or heirs after the owner dies). The measure in the table corresponds to private (non-pension) annuities that last for life.

plan to annuitize the balances of their defined contribution (DC) employer retirement plans.

The failure of proxies for bequest motives to predict annuitization decisions is likely due at least partly to failures of the proxies to identify people who place especially little value on wealth left over when they die. Not having children does not imply not having a bequest motive. About 55 percent of people without children say it is somewhat or very important to leave bequests (versus 67 percent of people with children), and Hurd (1987) and Kopczuk and Lupton (2007) find that people with and without children have similar saving behavior in old age.[30] Similarly, reporting that it is not important to leave bequests does not imply not having bequest motives. Laitner and Juster (1996) find that some couples who say that it is not important to leave bequests choose joint life annuities with substantial guarantees, thereby reducing their income in exchange for bequest potential.[31]

Bequest motives strong enough to eliminate purchases of available annuities are likely much more prevalent than the reported importance of leaving bequests suggests. As Dynan et al. (2002) emphasize, non-contingent saving buys future consumption and medical spending in some states and bequests in others. For someone who faces significant spending risks, as retirees in the US do, the precautionary motive may dominate the bequest motive in determining how much he saves, even if he values bequests. Indeed, survey responses and calibrated life cycle models both indicate that for most people life cycle and precautionary motives are the primary determinants of saving (Dynan et al., 2002). My results show, however, that even bequest motives that have little effect on saving relative to life cycle and precautionary motives can play a key role in determining the optimal mix of annuity

[30]The last surviving members of households with children leave the large majority of their estates to their children (92 percent); the remaining goes mostly to other relatives (5 percent) and friends (2 percent); and less than one percent goes to charity (all statistics in this footnote are from Hurd and Smith (2002)). The last surviving members of households without children leave bequests mostly to their siblings (39 percent) and other relatives (45 percent), and also give more to friends (10 percent) and charity (6 percent) than people with children. Even households with a surviving spouse give away about 20 percent of their wealth on average (to children if they have them and charity if they do not) upon the death of the first-dying spouse.

[31]An annuity with a guarantee pays the heirs of the annuity owners' estates for the remaining guarantee period if the owners die within the guarantee period. As Davidoff et al. (2005) and others have noted, guarantees are a strange way to buy bequests because they involve paying insurance loads to buy risky bequest prospects. But it is much harder to understand why people without bequest motives would reduce their income to increase their expected bequests.

income and non-annuity wealth. Even people who would leave small bequests were perfect insurance markets available or whose bequest motives have little effect on their saving—in other words, people who could rightly say that leaving bequests is not important to them—may be better off without available annuities. People need not have strong bequest motives or even value bequests per se to gain little from annuities; they need only view spending as having an opportunity cost that is not entirely contingent on their being alive.

The simulation results together with the evidence about bequest motives suggest that many people would not annuitize any wealth at available rates even if there were no reason other than bequest motives not to annuitize. That most people have family members with whom to share their lifespan risk (Kotlikoff and Spivak (1981) and Brown and Poterba (2000)), are fairly well annuitized by public and employer pensions (Dushi and Webb, 2004), and face significant medical spending risk (Sinclair and Smetters (2004), Turra and Mitchell (2007), and Ameriks et al. (2008)) limits the market for annuities still further. It may be that more people than the few who do annuitize could benefit from annuitizing their wealth at available rates. Their failure to annuitize may be partly due to the disadvantages inherent in fringe markets such as the inability to reap economies of scale, greater consumer search costs (including the cost of learning about an unfamiliar product), and norms against participation.[32] Yet given that at least modest bequest motives appear widespread, that non-annuity wealth has benefits other than being bequeathable, and that most potential recipients of bequests would be better off if their benefactors annuitized less wealth, it seems likely that the potential gains from encouraging or mandating greater annuitization are small.

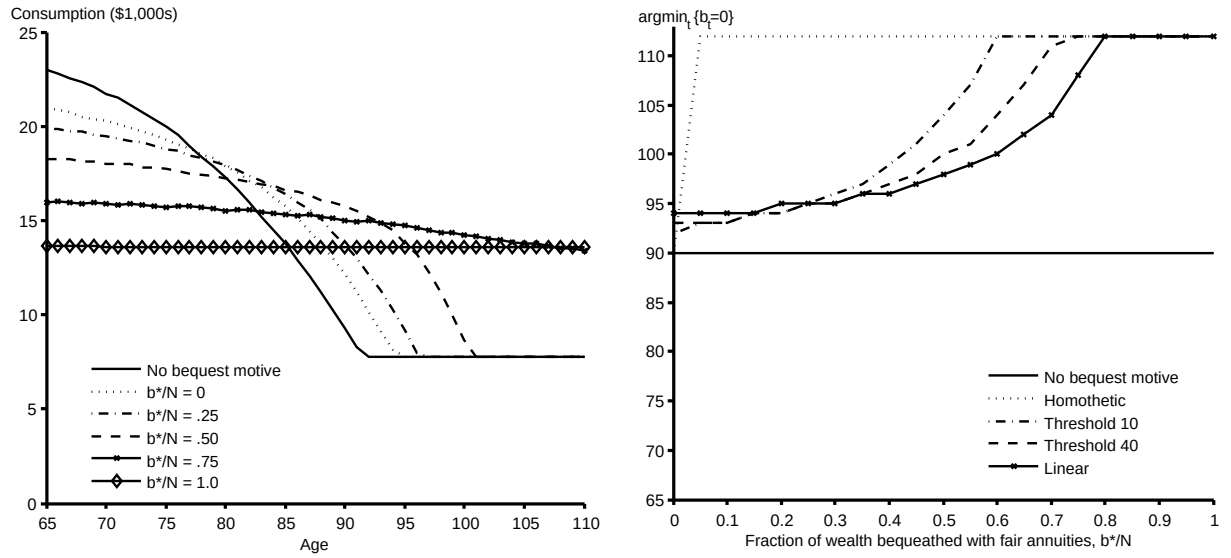

Figure 3: Panel (a) shows how the consumption path of an individual with $300,000 of total wealth, one-third of which is annuitized, depends on the strength of his Threshold 40 bequest motive (roughly the bequest motive of an altruist who has a single, selfish heir with a 40-year planning horizon). Panel (b) shows the minimum age at which an individual exhausts his non-annuity wealth as a function of his bequest motive. In both panels, one-third of wealth is already annuitized.

Appendix: The strength of bequest motives

In the main text, I measure the strength of bequest motives by the fraction of their non-annuity wealth that people would bequeath had they access to actuarially fair annuities. Figure 3 shows the correspondence between this measure and two alternatives. Panel (a) shows how bequest motives affect the optimal consumption path without annuities. The individual begins with $300,000 of total wealth, one-third of which is annuitized, and has Threshold 40 bequest motives. Stronger bequest motives encourage the individual to postpone consumption—to consume less early on and *more* in later life—because money saved for consumption in old age has the added benefit of increasing bequests should the individual die before consuming it. The consumption path of an individual who would bequeath half of his wealth had he access to fair annuities and the

[32]Mitchell et al. (1999) find that annuity prices in the private US market in 1995 varied by 20 percent, which suggests that search costs were substantial. Search costs may have declined since then because of the spread of the internet. See Brown and Goolsbee (2002) for evidence that the internet reduced search costs for term life insurance.

consumption path of an individual without bequest motives are qualitatively similar. In both cases, consumption basically declines at an increasing rate until it equals income, which occurs well before the maximum lifespan.

Panel (b) shows the age at which people without annuities exhaust their wealth (and thereafter leave zero bequests) as a function of how much they would bequeath were fair annuities available. People without bequest motives exhaust their wealth by age 90 and consume their income thereafter. People with stronger bequest motives save more and so take longer to exhaust their wealth, if they ever do: people at the 111 position at the top of the y-axis leave bequests even if they live to the maximum age, 110. Aside from the Homothetic case, bequest motives that would lead people to bequeath one-fourth of their wealth had they access to fair annuities ($\frac{b^*}{N} = \frac{1}{4}$) delay the age at which people exhaust their wealth by five years relative to people without bequest motives, from 90 to 95 years old.

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