ATTACHMENT 3 – THE DETERMINANTS OF ANNUITY DEMAND: A LITERATURE SURVEY

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The Determinants of Annuity Demand: A Literature Survey

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Abstract

Decades of economic analysis starting with Yaari (1965) have pointed to annuities as a major component of optimal retirement consumption plans. Yaari showed that a retiree with no desire to leave a bequest should annuitise all retirement savings. However, the insurance industry has long faced the dilemma that most retirees do not convert any retirement assets into annuities: the so called annuity puzzle.

The paper begins by presenting the key theoretical models and their normative implications. Following this, the literature explaining the annuity puzzle is reviewed. The paper concludes that, given the rational explanations, full annuitisation is unlikely to be optimal; however the irrational or behavioural biases evident in consumers facing the annuitisation decision are more than sufficient to prevent an optimal welfare outcome.

Given Australia's ageing population, and the effects of the Global Financial Crises on Superannuation balances, the importance of understanding the annuity puzzle is clear: if individuals are irrationally undervaluing annuities then there exists the potential to implement policy which is particularly welfare increasing.

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1. Introduction

The economic literature provides a strong theoretical foundation for the normative conclusion that annuities ought to be of substantial value to retirees. It also has the positive empirical implication that we should observe annuities comprising a large component of individual and household portfolios (Brown, 2007).

However, it is clear that there is a large discrepancy between the theoretical result and empirical findings: the demand for annuities is particularly thin, implying that individuals do not value annuities highly; and therein lies the 'annuity puzzle.'

Annuities play a central role in the economic theory of wealth decumulation. By trading a stock of wealth for a life contingent income stream, or a 'life annuity', healthy individuals are able to sustain a higher level of consumption than in the absence of annuities, and are assured that this income cannot be outlived.

If individuals do not have access to annuitisation, then they must allocate their retirement wealth in a manner that trades off two competing risks. The first is the risk that if they consume too aggressively, they increase the likelihood of facing a future period in which they are alive with little or no income. The second is the risk that if they self-insure by setting aside enough wealth to be certain it cannot be outlived, then they risks dying with assets that could have been used to increase consumption while alive (Brown & Warshawsky, 2004).

Also, increasing average longevity and the trend towards earlier retirement presumably makes the problem of ensuring adequate resources throughout individuals' old age more widespread among the population. The adequacy of old age income directly affects the extent of poverty rates among the elderly (Brown & Warshawsky, 2004). In addition, if individuals fail to adequately provide for retirement consumption needs, this could increase the financial pressure on social welfare programs.

Understanding why the annuity puzzle exists is important because there are large potential gains to annuitisation. Mitchell, Poterba, Warshawsky and Brown (1999) have shown substantial gains to annuitisation 'even if the present discounted value of payments from the annuity is no more than 75% of the purchase price'. Typical results suggest that a 65 year old man who does not have access to an actuarially fair annuity market would be willing to forgo roughly one third of his wealth so he could purchase an actuarially fair annuity with his remaining wealth (Brown & Poterba, 2000). Also advocating the welfare benefits on annuities, a sample calculation by Scott (2008), using actual annuity prices, found that a 65 year old male retiree could increase his guaranteed spending by over twenty-one percent by allocating less than eight percent of his portfolio to an age 85 longevity annuity.

The importance of these results is clear: if individuals are irrationally undervaluing annuities then there exists the potential to implement policy which is particularly welfare increasing. The remainder of the paper is divided into 4 sections. Section 2 summarises the theoretical literature pertaining to the optimal level of annuitisation. Section 3 details the irrational, or behavioural, factors which help to explain why individuals (incorrectly) undervalue annuities. Section 4 summarises the reasons explaining the annuity puzzle which are considered rational within the theoretical framework. Concluding remarks are the content of section 5.

2. Theoretical Findings

Yaari (1965) noted that few discussions of consumer allocation over time consider the problem that consumers do not know for how long they will live. As such Yaari set out to address this problem specifically by employing an expected utility framework in which the investment term (i.e. life expectancy) is a random variable with a known distribution. The consumer's optimal choice is then the strategy that maximises his expected utility. Considered a seminal work in this area, Yaari's widely cited result is that certain consumers should fully annuitise all of their savings. To understand this result, Brown (2007) provides the following explanation:

> *Consider an individual without a bequest motive who cares only about his consumption in the current period and one period hence. If this individual invests $1,000 in a non-annuitized asset with a rate of return 8 percent, then next period he will be able to consume $1,080. On the other hand, if the individual invests $1,000 in an annuity, and if with probability 0.03 the individual will not survive to receive the payment next period, then the insurer is able to pay $1,080/(1-0.03) = $1,102 to the annuitant, conditional on survival. The extra return provided to surviving annuitants is sometimes called the 'mortality premium' or 'mortality credit', because it is provided in return for giving up one's right to the wealth upon death. For an individual who does not value bequests, the fact that the rate of return on the annuity is greater than the rate of return on the non-annuitized asset for individuals who survive, the decision to fully annuitize is rational.*

Critics suggest, however, that these consumers were supposed to satisfy several very restrictive assumptions. In response, numerous studies (Brown, 2003; Brown & Poterba, 2000; Dushi & Webb, 2004; Milevsky, 1998; Turra & Mitchell, 2004) have explored the gains from annuitisation under a less restrictive range of assumptions. These papers find that there are substantial gains to annuitisation, but that full annuitisation is not always optimal.

In what is perhaps the best response, Davidoff, Brown and Diamond (2005) note that the literature subsequent to Yaari's result occasionally relaxed one or two of these assumptions, however the generality of his result had not been formally shown in the literature. Davidoff et al. (2005) present sufficient conditions, substantially weaker than Yaari's, under which full annuitisation is still optimal.

In a world where only individual mortality is uncertain, Davidoff et al. (2005) find that there may be considerable individual heterogeneity in the value of annuitisation. Heterogeneity in annuity valuations is driven by variation in the willingness to substitute late consumption for early consumption. Davidoff et al. (2005) find that even for preferences that stretch the bounds of plausible impatience, a large fraction of wealth is optimally placed in a constant real annuity.

Furthermore, Davidoff et al. (2005) relax the market completeness assumption[1] and find that positive annuitisation remains optimal widely, but complete annuitisation does not. By extending the framework to incorporate other considerations of consumers, Davidoff et al. (2005) find that the rational agents will still demonstrate a considerable preference for annuitisation. Their simulations show that it is "extremely difficult" to find situations where less than two thirds of retirement wealth should be invested in annuities. Given their lack of success in explaining low annuitisation from a rational perspective, they suggest that the observed limited annuity purchases are plausibly due to psychological or behavioural biases.

> *The near absence of voluntary annuitization is puzzling in the face of theoretical results that suggest large benefits to annuitization… These results suggest that lack of annuity demand may arise from behavioural considerations, and that some mandatory annuitization may be welfare increasing.*
>
> (Davidoff, et al., 2005)

Brown (2007) agrees with these findings, stating that even when considering that the annuity market is incomplete, simulations still show that there is an extreme mismatch between the annuities provided by the market and the desired consumption path. That is, a risk averse consumer would still find it optimal to annuitise the majority of their wealth.

[1] A market is complete if agents can buy insurance contracts to protect themselves against any future time and state.

3. Behavioural Biases

The empirical evidence on annuitisation suggests that individuals do not behave as if they value annuities as highly as theory would predict. This section summarises the documented behavioural biases which have been proposed to explain this discrepancy.

3.1 Framing

Brown, Kling, Mullainathan and Wrobel (2008) argue that the context in which annuities are presented to consumers is crucial in explaining why so few choose annuities despite there welfare advantages.

> *Traditionally, economists have had the underlying view that people are hyper-rational and are trying to maximize their happiness (what economists call utility). If you believe that, then how you package the information shouldn't impact their decisions. But, you have huge swings in how people behave depending on how the information is packaged.*
>
> - Jeffrey Brown in Adler (2009)

In their paper, Brown et al. (2008) compare the responses to surveys which emphasize two competing frameworks: consumption and investment. The investment framework focuses on the classic risk and return characteristics of competing financial products, whereas the consumption framework seeks to present different investment options in terms of what level of ongoing consumption they provide through the annuitants retirement.

The aim of their paper was to see whether the framing of the annuity decision had a material impact on the choices made by potential consumers and the authors find survey participants are significantly more likely to choose an annuity in a context that emphasized spending over the lifecycle as opposed to one that emphasized risk and return.

This line of work was extended by Brown, Kling, Mullainathan, Wiens and Wrobel (2009) in a more robust setting where purchase prices were also mentioned in the consumption frame. Their result confirmed that the main driver of the effect is the overall difference in framing language and not specifically the mention of the purchase price.

Adler (2009) agrees with these findings, commenting that consumers view annuities as risky gambles rather than insurance: “if I die early, I lose; if I live a long time, I win”. On the other hand, economists, and insurance companies, view annuities as insurance: not against dying but against the risk of outliving your wealth.

3.2 Cumulative Prospect Theory and Mental Accounting

Over the past few decades researchers have accumulated a large body of experimental evidence on attitudes to risk. This evidence reveals that, when people evaluate risk, they often depart from the predictions implied by expected utility.

In an effort to capture the experimental data more accurately, economists have developed ‘non-expected utility models’. Perhaps the most prominent of these is Kahneman and Tversky’s (1992) Cumulative Prospect Theory (CPT). CPT’s concepts of loss aversion and the subjective probability weighting can be used to explain why retirees avoid annuities even when longevity risk is the only risk.

CPT posits that gains and losses are valued through a nonlinear value function given which is concave for gains and convex for losses, thus yielding a property often called ‘diminishing sensitivity’. The convexity in losses can give rise to risk-seeking behaviour, which is at odds with expected utility maximization with a concave utility function. CPT also argues that objective probabilities are weighted by a subjective function which results in the overweighting of low-probability events and underweighting more frequent events. Applied to the annuity puzzle, this suggests that people overweight the probability of dying early and hence losing money on an annuity investment.

Mental accounting attempts to describe the process whereby people code, categorize and evaluate economic outcomes. A now common interpretation of mental accounting, provided by Shefrin and Thaler (1988), is that people mentally frame assets as belonging to either current income, current wealth or future income and this has

implications for their behaviour as the accounts are largely non-fungible and the marginal utility received from consuming out of each account is different.

The notion of mental accounting suggests that risky outcomes are not always evaluated in terms of potential outcomes for total wealth, but often as outcomes more narrowly defined within their own subjective accounts. For example, a person considering a gamble which puts $10 at risk should, according to expected utility theory, evaluate the overall impact on total wealth; however, behavioural research points to a pattern in which individuals are more likely to evaluate the $10 gamble in isolation. Any annuity evaluated narrowly as a gamble in its own mental account will look more unattractive, because an annuity shifts money from the present into the future.

In focus groups conducted by the American Council of Life Insurers, some participants viewed the purchase of an immediate annuity as 'gambling on their lives' (Brown & Warshawsky, 2004) implying, incorrectly that annuities increase overall risk in retirement. Hu and Scott (2007) explain this by suggesting that mental accounting can cause a retiree to consider an annuity to be a distinct, risky gamble instead of a way of lessening of the risk of having to reduce spending if one lives beyond their life expectancy. Brown (2007) gives more depth to the explanation by suggesting that the result may be due to both mental accounting and CPT's loss aversion concept.

> *Rather than evaluating the annuity as part of an overall optimization exercise, individuals may use a narrow framing along the lines of 'will I live long enough to make back my initial investment?' If the question is framed in this manner, it is easy to then see why the product is viewed as a risky gamble. Without the annuity, the individual has $100,000 for certain. With the annuity, in contrast, there is some positive probability that the individual will receive only a few thousand dollars in income (if he were to die within a few months), some probability that the individual will receive far more than $100,000 (if he lives well past life expectancy), and a full distribution of possibilities in between. This line of reasoning suggests that if one applies the cumulative prospect theory approach to a narrow framing of the annuity, annuities do not look attractive because the "losses" from the annuity (if one dies young) loom larger in the individual's value function than do the potential "gains" from living a long time.*

3.3 The Availability Heuristic and the Conjunction Fallacy

The availability heuristic describes the phenomenon whereby events or facts that are more easily imagined carry greater salience and hence are assigned greater likelihood (Hu & Scott, 2007). In the case of annuities, the availability heuristic may play a role in overemphasizing the possibility of dying shortly after the annuity is purchased, because there are many ways an individual can imagine their imminent demise. This exaggeration of the likelihood of early death would make annuities appear worse.

Gazzale and Walker (Gazzale & Walker, 2009) discuss similar, yet distinct bias referred to as the risk ordering bias. In this case, retirees effectively overweight the early risk (an early death) relative to the later risk (a longer than anticipated retirement) simply due to their temporal order.

The conjunction fallacy (Tversky & Kahneman, 1983) leads individuals to mistakenly believe that a combination of events is more likely than either event alone. In their classic experiment individuals were presented with the following description of a hypothetical woman: "Linda is 31 years old, single, outspoken, very bright and she majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations." Most individuals believed that it was more likely that Linda was both a bank teller and active in the feminist movement than that she was a bank teller. For an annuity purchaser, this anomaly in probability assessment can lead to an overstatement of the likelihood of early death.

Thus, the conjunction fallacy combined with the availability heuristic can lead to a greater emphasis on the potential losses due to early death, without a similar overemphasis on the potential gains from outliving one's life expectancy (Hu & Scott, 2007).

3.4 Ambiguity Aversion

Ambiguity aversion describes the phenomenon whereby individuals are more averse to uncertain gambles (where probabilities of outcomes are unknown) than to risky gambles (where probabilities of outcomes are known).

According to Langer (1974) people do not know the relevant probabilities of survival and so must be uncertain about the probability of potential outcomes. As such it is straightforward to infer that retirees who are uncertain about survival probabilities will be more averse than is optimal.

3.5 Fear of Illiquidity and the Illusion of Control

A significant feature of annuities is their illiquidity: once an investment is made, it is usually very costly to withdraw funds (beyond regularly scheduled payments). In a Society of Actuaries (2004) survey, among workers who were asked what factors were important in choosing a retirement plan payout option, 61% responded that "being able maintain control of your investments" was very important. While the potential requirement for liquidity is certainly a valid reason not to annuitise all retirement savings, it should not be a significant concern when evaluating whether to annuitise modest fractions of retirement wealth. However, similar to the behavioural mistakes individuals make when assessing probabilities of dying at early ages, it is quite possible that individuals also overstate the likelihood of catastrophic events that may require sudden spending that could not be met after annuitisation (Brown, 2007; Hu & Scott, 2007).

In regards to the desire to maintain control, to the extent that individuals are expressing a concern about liquidity, there is a rational element to this objection. It may also be rational to be concerned about control if one is concerned about entering into a long term contract with an insurance company that may go bankrupt sometime during the life of the annuity contract. However, the strength of the objections often registered about control suggests that there is something deeper than a rational concern about liquidity.

It is possible that these objections may be related to the large psychology literature on the "illusion of control" (Langer, 1974) or the tendency of individuals to believe they can control outcomes even when they have no such control. Individuals may well believe that they have more control over their financial future by holding wealth rather than by receiving income. Brown (2007) notes that during a person's working life, much of the financial advice received emphasises individual choice and control. Thus, it would not be surprising to think that individuals would have a difficult time handing over their wealth to an insurance company in exchange for a monthly income stream over which they have little control.

3.6 Denial

A common psychological notion suggests that individuals do not like to think about unpleasant events (e.g., dying young, or being old but poor). As such, this bias will lead fewer individuals to even consider the annuitisation decision.

4. Rational Explanations

To this point the reasons given for the observed sub-optimal level of annuitisation have been behavioural, or reasons which are considered irrational within the theoretical framework. This section brings to light factors, which are considered rational, that are able to partially explain the relative lack of annuitisation. It is thus generally agreed that partial rather than full annuitisation is optimal (Davidoff, et al., 2005).

4.1 Adverse Selection and High Prices

It has been well documented that annuity prices tend to be higher than actuarially fair levels. These higher prices, sometimes referred to as the 'annuity load' are typically explained by constraints placed on annuity providers and adverse selection. As an example of institutional constraints, several authors cited in Brown (2007) argue that part of the annuity load may also arise from the fact that insurance companies are unable to adequately hedge aggregate mortality risk in the population, and therefore must charge a higher price to compensate for bearing this risk.

The term adverse selection was originally used in insurance and describes a situation where an individual's demand for insurance is positively correlated with the individual's risk of loss. In the case of annuities, it suggests that those who purchase annuities tend to live longer than average. While an in depth discussion of this point is beyond the scope of this paper, it can be understood by way of a simple example: wealthier people tend to purchase annuities; and, wealthier people tend to have access to better health care and hence live longer than average. As a result, annuity providers have to incorporate this phenomenon into the price of their annuities, and so the prices are higher than actuarially fair for the general population.

Regardless of the source of the price mark up, however, the implicit assumption behind the belief that prices drive down annuity demand is that consumers are sensitive to price. Indeed, Friedman and Warshawsky (1990) suggest that such high prices, and low average yields have, in the past, been sufficient to explain the absence of annuity purchases in early retirement. While very little empirical work has been conducted to determine an annuity's price elasticity of demand, there are several pieces of data that suggest that existing loads are not the most important explanation of limited demand. Contrary to the result of Friedman and Warshawsky (1990), the simulation work of Brown, et al. (1999) suggests that the loads are not large enough to offset the utility gains from annuitisation.

4.2 Risk Sharing in Couples

By pooling their resources, a married couple is able to capture a large share of the gains from a formal annuity market. As a result of this risk sharing potential, a couple's willingness to pay for joint and survivor annuities is substantially lower than a single individual's willingness to pay for an annuity (Brown & Poterba, 2000).

An auxiliary to this result is that annuity demand should be higher for single individuals than for couples, which is confirmed by Dushi and Webb (2004). One implication of this is that individuals choosing to annuitise upon the death of a spouse should be observed, yet it is not (Dushi & Webb, 2004).

4.3 Complexity and Confused Consumers

Asset allocation and consumption towards the end of the life cycle is complicated by the uncertainty associated with the length of life. Although this risk can be hedged with life annuities, empirical evidence suggests that voluntary annuitisation amongst the public is not very common, nor is it well understood (Milevsky & Young, 2007).

Behavioural economists and empirical researches have shown that the general population are not particularly good at handling their retirement savings, either because they lack the necessary cognitive ability to solve the optimization problem, because they have insufficient will power to execute it, or sometimes because they are overconfident (Tapia & Yerm, 2007).

An excerpt from Brown (2007) highlights that individuals do not fully understand the annuitisation decision:

> *In addition to the puzzle that individuals do not annuitize as often as theory would predict, a secondary puzzle pertains to those who do annuitize: the prevalence of guarantees. This feature is somewhat puzzling in the standard life-cycle framework because it is easy to show*

that a life annuity with a 10-year period certain guarantee is simply a combination of a two distinct products: (i) a non-life contingent bond that pays back its principal plus interest over 10 years, and (ii) a life annuity with a deferred payout date of 10 years. Given that the loads charged for annuities with a 10-year guarantee are not substantially different from the loads charged for products that are entirely life contingent, it is not clear why individuals want to purchase the first of these products at existing loads, when plenty of alternative investments exist that would provide a better payout at comparable risk for the period of the guarantee.

Brown (2007) suggests that, in general, complexity and information problems may be a rational barrier to annuitisation if the transaction costs associated with obtaining the necessary information are sufficiently high. In this context, however, where the potential welfare gains from optimizing an individual's retirement income plan are quite large, it is unlikely that consumers are making a fully rational decision to forgo educating themselves about annuities because of the perceived costs of doing so. More likely, the average individual may simply lack the financial sophistication to make a fully informed decision about payouts. Smith and Stewart (2007) confirm this suspicion documenting that financial illiteracy is widespread.

Furthermore, anecdotal evidence suggests that the lack of clarity on the benefits of annuities in reducing longevity risk also applies to financial planners and others who are engaged in the business of advising clients on how to prepare for retirement (Brown, 2007). Many financial planners simply ignore the uncertainty about mortality, or they handle it in a naïve way, such as by creating a financial plan with a horizon equal to one's average remaining life expectancy plus five or ten years. Because these approaches ignore uncertainty, the retirement planning process becomes framed in a manner that does not provide a clear role for insurance against low consumption at advanced ages.

4.4 The Bequest Motive

Naturally, if a person wishes to leave an inheritance to a beneficiary, then the individual will not find it optimal to annuitise all of their wealth. This is why the classic full annuitisation result of Yaari (1965) requires that there be no bequest motive. Confirming this theoretical and intuitive result, many early empirical responses to the annuity puzzle, including Friedman and Warshawsky (1990) document that a bequest motive decreases the attractiveness of annuities.

There are problems, however, with viewing bequest motives as the only answer to the annuity puzzle. While bequests clearly lead one away from the full annuitisation result, it does not mean that individuals will not value partial annuitisation. Indeed, under certain assumptions, an individual will simply wish to divide their wealth between their 'own consumption' and their heir's consumption and then fully annuitised the 'own consumption' piece (Brown, 2007).

Simulation analysis by Davidoff, et al. (2005) show that while a bequest motive reduces the demand for annuities, it does not eliminate it in general. Agreeing with this result, Feldstein & Ranguelova (2001) show that even in consideration of a bequest motive 'it is unequivocally clear that annuities enhance retiree wellbeing irrespective of risk aversion'. Contrary to the prevailing view, Lockwood (2009) demonstrates that people with plausible bequest motives are likely to be better off not annuitising any wealth at available rates, yet it is conceded that this result depends crucially on the degree to which people value the large bequests that may arise incidentally from self insuring lifespan risk.

4.5 Incomplete Annuity Markets

Recent theoretical work shows that as long as markets are complete, full annuitisation is optimal (Davidoff, et al., 2005). In reality, however, existing annuity markets are far from complete: most of the life annuity products that are sold today offer a fixed nominal payout, which leaves individuals exposed to other risks, such as from inflation or unexpected medical expenditures (Brown, 2007).

A second problem with incomplete markets is that most annuity contracts are structured in a manner that imposes constraints on the degree of liquidity provided. It is generally not possible to borrow against the future value of an annuity, or to alter the timing of annuity payouts once a contract has commenced. Reversing an annuity, such as by selling it to a third-party buyer, is quite costly and often is not possible (Brown, 2007).

4.6 Pre-Existing Annuitisation

Finkelstein & Poterba (2004) note that the small size of the voluntary annuity market could, in part, be explained by public sector social security programs and private deferred benefit and pension schemes.

Brown (2007) comments that numerous authors have made the point that high levels of pre-existing annuitisation from Social Security or private defined benefit plans may lead to low demand for additional annuitisation:

> *For individuals at the low end of the wealth distribution, this explanation certainly rings true. For example, the Social Security Administration states that 21% of married couples and 43% of unmarried persons rely on Social Security for more than 90% of their income. It should not be surprising that these households would not wish to annuitize what little savings they have remaining. Higher up the wealth distribution, however, where Social Security represents a much smaller portion of wealth, it is more difficult to argue that all private annuity purchases are crowded out. As recently noted, "it would be a miraculous coincidence if the optimal partial annuitization strategy equalled the amounts provided by Social Security and defined benefit pensions for the vast majority of retirees."*

4.7 Poor Health

Turra and Mitchell (2004) show that annuities become less attractive to people facing uncertain medical expenses. They find that the value of annuities to those in poor health is much lower when compared to persons in good health.

Sinclair & Smetters (2004) report similar findings: individuals of poor health face a higher risk of health shocks which may incur large uninsured expenses and shorten the life expectancy. The value of a life annuity then decreases at the same time as the need for cash increases, undermining its effectiveness in providing financial security.

5. Conclusion

The arguments presented herein suggest that while full annuitisation result of Yaari (1965) is unlikely to be optimal, the behavioral biases evident in consumers facing the annuitisation decision result in a level of annuitisation that is lower than required for optimality.

As such it is proposed that measures which seek to increase the level of individual annuitisation be investigated, as this will likely lead to an increase in individual welfare.

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