

A PATHWAY TO FINANCIAL STABILITY IN RETIREMENT? ANNUITIES AND CONSUMERS' PREFERENCES

A Thesis

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ABSTRACT

In this thesis, we attempt to determine the nature and degree of consumers' inhibitions to annuitization. We find potential answers under both the rational frame and what appear to be psychologically induced behavioral biases to what would otherwise be an unimpeded valuation of the product, the features that comprise it, and their covert NPV. We find that consumers' valuative decision-making process and subsequent degree of elicited preference appear to not be fully rational and that the inhibitors we identify vary in scope and degree between demographic indicators and psychographic markers. These should remain mostly unchanged as we move to constrain our observations to these groups if consumers were evaluating the products within a fully rational frame of valuation. That said, the preliminary nature of our results require we refine our means of observation and analysis before we are able to make a more final assertion as to consumers' degree of rational valuation versus their potential behavioral inhibitions. These improvements will permit us to better confirm the presence of those biases and more accurately determine the extent of their role, if indeed present, in the misvaluation of the annuity as an investment vehicle and its perceived reliability to smooth consumption. In full acknowledgment of the work that remains to be done, we look forward to more conclusive results.

BIOGRAPHICAL SKETCH

Michael Alexander is from the windy city that is Chicago. He received his bachelor of science degree in Agricultural and Consumer Economics with a concentration in Environmental Economics and Policy from University of Illinois at Urbana-Champaign. He is currently attending Cornell University for his masters degree in Applied Economics and Management. Upon completion, he will spend some much needed time with his family.

This thesis is dedicated to my Mentors, my Friends, and the Family that have uplifted me in this process. Your support will be forever treasured.

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TABLE OF CONTENTS

Biographical Sketch	iii
Dedication	iv
Acknowledgements	v
Table of Contents	vi
List of Figures	viii
1 Introduction	1
2 Review of the Relevant Literature	11
2.1 Rational Model Literature	11
2.2 Behavioral Model Literature	15
3 Methods	24
3.1 Selection of Product Features/ Attributes	30
3.2 Heterogeneity in Participant Responses	34
3.3 Bundle Features/ Attributes and Valuation	38
3.4 Bundle Valuation	39
3.5 Estimation Model	40
4 Results	44
4.1 Pre-model analysis	44
4.2 Post-Model analysis	53
4.2.1 Base Model	54
4.2.2 Demographics Added	57
4.2.3 Psychographics added, NPV added	60
4.2.4 Subgroup Analysis	64
5 Discussion	69
5.1 Summary	69
5.2 Trait Analysis: Start-age	74
5.3 Trait Analysis: Monthly Income	79
5.4 Trait Analysis: Annual Increase	81
5.5 Trait Analysis: Period-Certain and Survivor Guarantee	83
5.6 Trait Analysis: NPV	87
6 Alternative Explanations	90
6.1 Overview	90
6.2 Framing Phase	91
6.3 Valuation Phase	92
6.3.1 Loss Aversion	93
6.3.2 Framing Effects	95
6.4 Additional Biases	97
6.4.1 Source Dependence	98

6.4.2	Risk Seeking	98
6.4.3	Mortality Salience	101
6.5	Conclusion	102
A	Appendix	109
A.1	Issuer and Policy Recommendations	109
A.2	Opportunities for Improvement	113
A.3	Additional Figures	117

LIST OF FIGURES

3.1	Sample Bundle Presentation, Bundle G	25
4.1	Layered Model	53
4.2	Layered Model	54
4.3	Layered Model 2	64
4.4	Layered Model 3	65
5.1	Full Model	74
5.2	Layered Model 2	75
5.3	Layered Model 2	75
A.1	Bundle A Valuation	117
A.2	Bundle B Valuation	118
A.3	Bundle C Valuation	118
A.4	Bundle D Valuation	119
A.5	Bundle E Valuation	119
A.6	Bundle F Valuation	120
A.7	Bundle G Valuation	120
A.8	Bundle H Valuation	121
A.9	Bundle I Valuation	121
A.10	Bundle J Valuation	122
A.11	Bundle K Valuation	122
A.12	Bundle L Valuation	123
A.13	Bundle M Valuation	123
A.14	Bundle N Valuation	124
A.15	Bundle O Valuation	124
A.16	Life Expectancy by Gender	125
A.17	Life Expectancy by Income	125
A.18	Life Expectancy by Partner	126
A.19	Life Expectancy by Race	126
A.20	Money's Worth Ratio by Total Sample	127
A.21	Money's Worth Ratio by Degree	127
A.22	Money's Worth Ratio by Income	128
A.23	Money's Worth Ratio by Loss Aversion	128
A.24	Money's Worth Ratio by Partner Status	129
A.25	Money's Worth Ratio by Race	129
A.26	Bundle A Traits and NPV	130
A.27	Bundle B Traits and NPV	130
A.28	Bundle C Traits and NPV	131
A.29	Bundle D Traits and NPV	131
A.30	Bundle E Traits and NPV	132
A.31	Bundle F Traits and NPV	132
A.32	Bundle G Traits and NPV	133

A.33	Bundle H Traits and NPV	133
A.34	Bundle I Traits and NPV	134
A.35	Bundle J Traits and NPV	134
A.36	Bundle K Traits and NPV	135
A.37	Bundle L Traits and NPV	135
A.38	Bundle M Traits and NPV	136
A.39	Bundle N Traits and NPV	136
A.40	Money's Worth Ratio by Race	137

CHAPTER 1

INTRODUCTION

The initial imprint of an annuity is a product that is disfavored, mysterious, or at best, one that returns firm indifference upon its appraisal. [21] (Lambregts and Schut, 2020) These sentiments are starkly contrasted by those associated with the employer sponsored pension, for the employees who will still be able to draw one, and to the highly prized social security entitlements. These two seemingly divergent frames of attributed utility employed to evaluate what are in essence the same product showcase the potential for greater financial stabilization with what is generally regarded as a favorable consumption smoothing mechanism presently available and relatively accessible to most consumers. Under its more appreciated name, social security or a pension, the annuity as a product has earned the status of a right; it is a benefit that is sufficiently enshrined in its status as a right that the ailment of unelectability is conferred upon anyone who would dare propose a reduction in what retirees would receive upon their cessation of employment. In its most public and popular form, the annuity is prized for its continued stream of benefits and particularly so for the fact that this continued stream of benefits is for one's lifetime. [23] (Lloro et al. 2022) To a rational market participant, this guaranteed stream of revenue is a superior risk hedge against one's longevity and is expected to be preferred over a market-based investment vehicle with comparable risk. Yet the product when proposed as a private option under the title of annuity fails and continues to fail to establish popularity among retirees [19] (Inkmann 2010).

Since the inception of Old-Age, Survivors, and Disability Insurance in 1937, annuities have been established as the staple of a stable in retirement for those of

lower socio-economic status (SES) and those that have have a modest nestegg alike.[36] (Shrider 2023) As a larger proportion of our population approaches retirement age, the issue of solvency of the OASI fund and its solvency has come to the fore of the debate with respect to how benefits are to be maintained or increased. This issue is compounded by the aforementioned neutralization that the proposition of a reduction in benefits level would bring to the suggesting policymaker. The blighted status of the subject leaves little other optionality besides inflation-linked adjustments, implemented as COLAs or a maintenance of current payment schedules with changes deferred until conditions are more politically beneficial. With OASI's insolvency projected to occur in 2033, an increase in benefits, while certainly more amiable to the Nation's largest voting block, is financially infeasible.[1] (Social Security Administration 2023).

As we near this target-date, the question remains of how a stable and dignified retirement is to be provided for the millions approaching and already well beyond the full retirement age of 67. This situation is particularly dire for those entering this period of their life with very little savings or no assets whatsoever to speak of and who are and will be increasingly reliant on social security payments as their primary means of funding for food and housing.[29] (Nguyen 2023) As such, we seek to determine the basis for consumer's preference and dispreference for the product and add these findings to the larger discussion of the private annuity as a feasible solution to financial instability in the late stage of consumption [15] (Goedde-Menke et al. 2014).

While most realistically expect to have enough assets saved from their period(s) of productivity so that pre-retirement standards of living in their post-employment consumptive stage are maintained, rates of contribution and sav-

ing are reported as woefully short. [36] (Shrider 2023). Ever expanding swaths of our country's retirees are entering this phase with little to no savings at all and increasingly expect to subsist off of their expected social security payments as that target date approaches [29] (Nguyen 2023). What is more, the vast majority elect sub-optimally commence benefit uptake and further diminish their capacity to smooth consumption via this stream for the lifecycle of their public annuity. While rational explanations for such shortfalls abound in a below parity money's worth [43] (Wettstein et al. 2021) [27] (Mitchell et al. 1999), undesired exposure to firms' default risk [3] (Alcalde and Vial 2022), asymmetry of information between firm and purchaser [13] (Finkelstein and Poterba 2014), bequest motive [32] (Peijnenburg 2016) and [24] (Lockwood 2012), as well as partially predicted to fully expected health expenditures [33] (Peijnenburg et al. 2017), it is quite important to consider our bias toward the default as a disinhibitory mechanism in the commencement of retirement portfolio contributions [21] Lambregts and Schut (2020), our differentiated evaluative frame induced by resource scarcity conditions and the associated temporal discounting that under-weights deferred benefits [17] (Griskevicius et al. 2012), choice complexity and its prevention of proper product valuation [8] (Brown 2017), and our distinct disfavor to relinquish presently possessed resources for contribution toward a retirement vehicle due to an over-weighted psychological ownership. [5](Beshears et al. 2012) It is these phenomena that are likely co-conspirators in the low rates of annuitization researchers continue to observe in spite of the modeled rates and continue to remain perplexed by.

Such obstacles therefore bring us then to the possibility of the private annuity as a means to reduce longevity-risk and to the annuity as a potential mechanism to mitigate our retirement system's expanding levels of dysfunction.

While it is likely that major barriers to investing into and stabilizing one's retirement with annuities are the high-upfront cost [5] (Beshears et al. 2012), which serves to invoke the aforementioned scarcity frame within which the decision to annuitize is viewed as an all-or-nothing investment, rather than consumption, choice [17] (Griskevicius et al. 2012), and a lengthily extended payout stream [9] (Brown 2008), which invokes a heightened temporal discounting of those future benefits and devaluation of the choice to invest relative to the capacity to satisfy immediate expenditures [38] (Shu and Shu 2018). We must also consider that the effects of a desire for the maintenance of one's present investment and consumption statuses [4] (Benatzi et al. 2011), which invokes a strict preference for one's default, as well as a general lack of information regarding the annuity as a viable option available to market participants [8] (Brown 2017), which inhibits proper evaluation of the product's features, purposes, and payout mechanism as additional avenues of apprehension. Although quite high in the effort required, particularly with respect to the psychological inhibitions, these barriers are not impossible to surmount. With such behavioral inefficiencies serving to prevent a dignified, stable, and ultimately enjoyable retirement, we look to this product as a long forgotten and oft overlooked investment vehicle that can overcome these detriments to such a life.

The annuity as a retirement vehicle, in the absence of a motive to leave one's wealth to a spouse or children, has been largely proposed as a vehicle that would be selected over and above self-investment in a bond or indexed portfolio due to the guaranteed increase in yearly payments and reduced exposure to risk the product affords [39] (Shu et al. 2016) [44] (Yaari 1965). The superior rates of return annuities can offer are due to a distributive mechanism most commonly associated with health care in that much the same as how health

insurance subsidizes the costs of the sick with the contributions of the healthy, annuities pay out its contractually obligated lifetime benefits with the forfeited funds of participants that die early. Yet the question remains: for a product with a stream of income guaranteed for life, why has the rate of participation remained staggeringly low?

Although the rationally oriented explanations as to the low rates of uptake do well to cover some of the gap between what are the expected rates and the observed rates, these explanations do not fully account for the confirmed discrepancy in uptake. It is very likely that market information asymmetry between purchaser and issuer [13] (Finkelstein and Poterba 2014), extended lifespan [12] (NIH 2022) due to technological advances [22] (Lindgren 2016), bequest motives of the purchaser [32] (Peijnenburg 2016) and [24] (Lockwood 2012), health cost risk of the purchaser [33] (Peijnenburg et al. 2017), and even the financial literacy rate of the purchaser [15] (Goedde-Menke et al. 2014) do capture some or even most of this difference, but the observed behavioral irregularities of temporal discounting [39] (Shu et al. 2016), scarcity framing [17] (Griskevicius et al., 2012), reduced cognitive function [26] (Anandi Mani et al. 2013), perceived fairness [40] (Shu et al 2014), and mortality salience [35] (Salisbury and Nenkov 2016) may be able to explain just as much, or at least complete our understanding of why such a discrepancy between modeled expectations and observed reality exists. The answers to this decades-old puzzle, now known as the “Annuity Puzzle” after Franco Modigliani’s coinage in 1985, may indeed require a more robust examination that includes our behavioral inefficiencies as credible factors in the prevention of a rational evaluation and decision by our market’s participants to or to not annuitize their wealth.

This paper's aim is to determine consumer preferences for private life annuities as a viable mechanism of wealth decumulation and an integral category of financial product that supports a stable retirement. This paper also attempts to establish the preferences for the underlying attributes that modify products to appropriately meet consumers' needs and expectations in an annuity when considered as a retirement stabilizer. As a continuation of, Shu, Zeithimer, and Payne's employment of a choice-based conjoint analysis to determine product affinity levels [39] (Shu et al. 2016), we implement a ratings-based conjoint analysis in order to confirm the degree consumers' preferences for the product and each individual trait and in order to relate those preferences to the products' net present value (NPV). Our presentation of the annuity as overtly differentiated by its options (monthly payment, riders, inflation protection etc.) and concealing its underlying NPV provides favorable conditions for ratings-based conjoint modeling given that the annuities as complete products and individual attributes themselves can be differentiated by their NPV and measured against participants' stated preferences and revealed utilities [39] (Shu et al. 2016). This ability to confirm a product and attributes NPV versus its expected increase or decrease in preference enables us to see if an attribute influences a market participant's demand solely through its addition to the total NPV or if the trait in question encompasses an additional psychologically-based value that moves beyond the product's monetary worth [39] (Shu et al. 2016).

Upon analysis of our results, we do not find that the typical market participant forms their preference for the annuity as a viable investment vehicle for retirement and consumption smoothing mechanism singularly anchored to what they expect as the NPV of the product and underlying attributes subject to evaluation. The general expectation a market participant would hold that

bundles with the higher NPV would be preferred to bundles with lower NPV, yet we observe instances of irrational stated preferences for the annuity bundles we present; a number of bundles with lower NPV, but have attributes that are highly prized by consumers and would appear to be valued beyond what rationality would and should dictate, are preferred to their higher NPV counterparts presented as absent of those same features with additional psychological value. We also find that bundles with higher NPV relative to the total bundles presented are strongly dis-preferred when age is delayed or no payout guaranteed, which is an additional longevity hedge, even though their total payout stream should suggest otherwise.

These contrast with the preferences one would expect of a rational participant and leads us to believe that there may be behavioral biases responsible for these instances of dispreference. Instead, we find the average consumer establishes their preference for the annuity, as compared with the option to self-investment, based on the composition of and subsequent psychological value ascribed to the presented attributes of the annuity in addition to the product's expected financial value. Notable instances of this behavior are captured in participants' stated preference for a collection of product attributes that go beyond what would be expected for the product's financial value for product bundles whose options denote a negative, break-even, or near-break-even net present value in dollars, but whose attributes are strongly preferred or strongly dis-preferred, relative to what that dollar value rationally elicits in a prospective purchaser.

As demonstrated by stated preferences, what should be considered as neutral or negative preference due to the NPV being at or below the break-even

point are shown to be preferred at a positive level for bundles that have a highly preferred feature like the period certain guarantee or the survivor benefit. These benefits do not confer additional value beyond the principle paid, as their purpose is to hedge the risk of early death and loss of said principal, and as such a preference for bundles with these attributes is indicative of preference beyond the calculated NPV of the product. The reverse can be said of highly disfavored delayed start age wherein a bundle that is worth well beyond the principle in NPV is strongly dispreferred compared to a lower value bundle with an earlier start age. We find this expression of preference to be evidence of product valuation that moves beyond the impact of the attributes' strict financial value and is an attribution or diminishment of the psychological weight ascribed to the bundle's underlying attributes which causes an over-valuing or under-valuing of the attribute's proper NPV and thus the product bundle as a whole. As such, the confirmation of variance in consumers' degrees of psychology weighting, both in the positive and negative directions, will permit issuers to revise what is presently offered in the market so that product uptake can be maximized or, stated differently, product rejection can be minimized.

This paper attempts to confirm the preferences of annuities target market, pre-retired adults aged 45 to 65, by employing a ratings-based conjoint analysis and an Ordinary Least Squares regression analysis to determine the attributes most and least valued as well as demographic and psychographic trait impact on that valuation. This paper also attempts to establish the features of annuities most similar to what is presently offered on the market that are the most favored and disfavored in order to foment that increase. This is so that policy makers and product issuers alike can attune product requirements and offerings in support of a rapidly aging population increasingly unable to rely on social security

for a stable retirement. We intended to contribute to the substantive body of literature on this topic by establishing which particular features consumers do prefer and further specify demographic and psychographic indicators that can be applied to better predict the grounds for that affinity so that we may help promote a full and impartial consideration of the annuity as a financially stabilizing investment vehicle for those retirees.

This contribution is supplemented by the aforementioned demographically attributed preferences based on education level, children, socio-economic status, and race. In our determination of the particular features included in the market, we intend to expand the field's understanding of which rational explanations and which behavioral biases are at play in the annuity puzzle and the role those behavioral biases play in what is all too often registered as outright and fully rational dispreference for this class of product when presented on the private market, but engenders strict preference when presented as social security. These identifiers are collected and analyzed with the intention of elucidating for those that offer these products as means of enhanced inclusion within an underused and misunderstood market. In establishing the presence and nature of the biases of this market's potential participants, as well as the specific features that invoke these biases, we hope to provide the industry that provides these investment vehicles to the market at large and the regulatory agencies that provide the governing investment frameworks the opportunity to review, revise, and reinforce what will enable retirees to live with greater agency. In better understanding what participants want, and confirming what they don't, we hope to establish an avenue by which retirees may retire with dignity and avoid poverty.

This paper will proceed as follows: section 2 will provide a review of previous and related findings in the relevant literature, section 3 will detail our research methodology to include our presented product's attribute selection process, our participant selection process, and a description of the model for estimation, section 4 will detail the specifics of our model-free and model-based findings, and section 5 will conclude with a discussion of the results as well as recommendations to policy makers and plan providers as to how annuity uptake might be augmented with changes to the inclusion and supplementation of the attributes provided. Section 6 will detail alternative explanations in order to complete our discussion of the annuity puzzle's components in addition to an examination of how the mechanisms by which consumers may be better nudged to invest can be better implemented.

CHAPTER 2

REVIEW OF THE RELEVANT LITERATURE

2.1 Rational Model Literature

Annuities' low rate of uptake in the private market has remained a point of perplexion for economists attempting to determine what constitutes efficient investment vehicles for retirement, even in the wake of Yaari's 1965 paper "Uncertain Lifetime, Life Insurance, and the Theory of the Consumer." [44] (Yaari 1965) This paper, along with the subsequent contributions by Brown, [7] (Brown 2007) and [9] (Brown et al. 2008) serve as major portions of the foundation from which much of this field establishes the rational expectations of high or near-complete annuitization when constrained by one's uncertain life expectancy and with no motive to bequest. The grounds to assert that a rational market participant with no such motive stands to maximize their utility by purchasing an annuity with the totality of wealth saved for retirement has been widely accepted as valid, however the reasons for the disparity between predicted and observed take-up remains largely open to debate [19] (Inkmann 2010).

The rational explanation of what is quite the wide gap in expected annuitization and observed participation in this market is generally contained to pricing inefficiencies due to incomplete information in the insurance markets by suppliers [14] (Fong 2011) or a lack of sufficient optionality from which potential annuitants may select [32] (Peijnenburg 2016) when full rationality is the assumption. The incomplete information hypothesis is a most compelling argument in that the proposal that because insurance suppliers are unable to determine a more accurate prediction of would-be participants mortality risk profiles based

on what information is legally permissible to collect, the pricing of annuities is not optimally set and thus participants are engaging with inefficiently priced vehicles relative to their actual underlying risk levels. It is therefore proposed that issuers are overpricing their products relative to what consumers believe or fully know to be their health-based risk level and with suppliers unable to incorporate more information as it relates to participants' health-related demographics (Zip Code, Health Conditions, SES ect.), more actuarially fair prices are withheld from the market and a majority of consumers are offered annuities priced at actuarially unfair rates [13] (Finkelstein and Poterba 2014).

In "Testing for Asymmetric Information Using "Unused Observables" in Insurance Markets: Evidence from the U.K. Annuity Market," by Finkelstein and Poterba were able to establish the presence of information asymmetry between the issuer and the purchaser as a reason as to why some of this annuity puzzle remains unsolved. In a review of the united kingdoms' annuity market data, Finkelstein and Poterba were able to confirm the the absence of one's postcode, and the relative over-pricing for those of lower socio-economic status, or under-pricing for those of higher socio-economic status, dissuaded or incentivised a purchaser to uptake a product. The later inclusion of one's postcode into the market data with the widespread adoption of the collection of this information by issuers pre-product purchase saw a reduction in this discrepancy. [13] Finkelstein and Poterba 2014. This was explained by the fact that one's postal code could serve as a reliable proxy for one's health status and thus a postal code was a relatively fairer representation of one's longevity, thus providing a more efficient pricing opportunity for those of lower socio-economic status.

To expand on potential rational explanations for the reductions in annuiti-

zation, “The Value of Annuities” [43] (Wettstein et al. 2021) additionally does well to cover the absence of pricing adjustment for possible purchaser’s socio-economic status as a reason for low uptake. Alcalde and Vial [3] (Alcalde and Vial 2022) propose that firms’ low margins, and the subsequent inability to raise payout amounts in accordance with additional desired compensation for increased longevity risk due to longer life expectancy, reduce consumers’ utilities and thus preference for the product. Fong [14] (Fong 2011) further establishes this heightened exposure to longevity risk and increased heterogeneity in consumers’ mortality, and the skewed, unrefined pricing that results, as the likely culprits. Peijnenburg, Nijman, and Werker [32] (Peijnenburg et al. 2016) examine background product risk, default risk, bequest motives, and incompleteness in annuity menus and found that full annuitization of assets post-employment remains optimal if the saving of those assets is a possibility so as to satisfy liquidity concerns. This remains another major point of dispreference for the product given the expectation that the product’s revenue stream is to be completely used for consumption-supporting activities. Additionally, product menu completeness, to include differing investment options and types that hedge for inflation risk, was not found to mitigate reduced preference levels associated with the base product due to the ability of a consumer to save portions of their current revenue stream and invest in equities of their choice without the barrier of a high principal.

Lockwood’s “Bequest Motives and the Annuity Puzzle” [24] (Lockwood 2012) is a firm establishment of the bequest motive as well. Here, Lockwood accounts for the bequest motive as a heightened barrier that is unable to be overcome with the current rates of payment for products on the market. Although the rational buyer is better off annuitizing some of their wealth, the bequest motive

is found to be significant enough to establish a sizable loss of utility should the annuity contract actually be entered into. Inkmann, Lopes, and Michaelides [15] (Inkmann 2010) second this finding of the bequest motive as a primary reducer in consumers' preference for the annuity in addition to a lower life expectancy, a lower education level, and the receipt of other sources of income, particularly pensions.

Peijnenburg, Nijman, and Werker [33] (Peijnenburg et al. 2017) found that a participants' health cost risks, especially when that cost is beyond the amount received in the stream of revenue, reduces the optimal allocation of one's retirement savings and excludes annuitization as a potential vehicle. This health cost risk was significant enough so as to only permit a minimal increase in utility when annuitization rates were allowed to increase in the face of this risk without incurring the associated cost, thus establishing the risk of expected health emergencies, particularly for those of poor health, as a potentially major piece to the annuity puzzle. Goedde-Menke, Lehmensiek-Starke, Nolte [15] (Goedde-Menke et al. 2014) excellently cover all of the aforementioned barriers and the majorly competing hypotheses in the rational realm of explanations and find annuity illiteracy, and financial illiteracy more generally, to be a major feature in the total dispreference for the product in the German market. These findings are particularly important for the domestic market insofar as increasing possible annuitants' financial literacy can increase the grounds for preference simply by enabling a more comprehensive understanding of the product's compensatory mechanics, potentially leading to higher investment and savings rates to meet product minimums.

2.2 Behavioral Model Literature

Although these rational explanations are quite compelling and likely do capture some pieces of the annuity puzzle, Goedde-Menke's aforementioned work clearly highlights the additional room left by what can be explained using rational models. We must then turn to the observed behavioral inefficiencies in our investment selection processes as the irrationality of annuity market participants may indeed be the explanation required to fill the distance between what is predicted and expected in Yaari's, Brown's, Modigliani's, and Davidoff's works and the observed participation rates we see presently permeating in the economy. Shu, Zeithammer, and Payne [40] (Shu et al. 2014) establish fairness, or in this case participants' perceived degree of unfairness anchored to the product's compensatory mechanism, the mortality premium, as a major point of dispreference for the annuity as a vehicle to smooth consumption and thus a major barrier to include annuities in a participant's decumulation strategy. Harvey, Lynch, Fernbach, and Jhang [18] (Harvey et al. 2023) find that brochure or product information length serves as a major determinant in maintaining or degrading the possible participants attention and capture the degradation in attention levels as pages of information increase. They find that the decreased levels of attention that result from a heightened state of perceived complexity of disclosure materials, simply based on document length, works to increase the innate level of dispreference for the product. Beshears 2012 "What makes annuitization more appealing?" [5] (Beshears et al., 2012) asserts that the frame with which the product is presented, particularly when the product is framed around flexibility, control, and investment, significantly alter the rate of annuitization.

Agnew's 2008 study [2] (Agnew 2009) investigated possible gendered dif-

ferences in the evaluative frame market participants employ when deciding to annuitize wealth and established differences in risk aversion and differences in financial literacy as biases responsible for a heightened perception of associated risk with the decision to annuitize. The aforementioned frames in this case were shown to reduce the rates of annuitization while a framing of a bonus at the end of the year in Beshear's work is shown to be highly preferred and something that results in increased annuitization rates. Griskevicius' 2012 work on scarcity [17] (Griskevicius et al. 2012) establishes one's socio-economic status, and the frame within which they engage with the market, is a determinant of the rate at which funds are saved for retirement. This work confirmed that market participants who grew up in a lower socio-economic status were more risk preferential and accepted temptations much more rapidly than their higher socio-economic status counterparts. This translated into lower rates of savings reported and holds significance in the discussion around annuities given the fact that fair degree of savings for most potential annuitants are required to meet the initial purchase minimums, thus excluding a large swath of participants who would greatly benefit from such a stream of revenue had they the resources to meet those minimums.

A prominent behaviorally based explanation to the difference in observed and expected uptake rates is the phenomenon of aversion to loss. Chen, Anran, and Haberman's 2016 work "Cumulative Prospect Theory, Deferred Annuities and the Annuity Puzzle"[11] (Chen et al. 2016) distinctly highlights the role that Cumulative Prospect Theory (CPT) plays in explaining the level of consumer's dispreference for an investment framed as an immediate loss and the rate of discounting applied to such a degree that the investment is rendered as a present movement into the realm of loss, rather than be registered, as it should under

the rational model, in the domain of gain. This reframe as a loss, which invokes a heightened negative response as compared to that which registered with a potential gain, is a most likely suspect in the exacerbated levels of apprehension toward annuity uptake. This is particularly so given that the product's stream of benefits carries on longer into the future and beyond what most expect they will actually live to, inviting hefty and overstated discounts of those future benefits and an erroneous calculation of the annuity as a sure loss to the detriment of the participant.

CPT is quite important to mention as it possibly stands to explain not only the lack of investment in annuities, but also the lack of investment in one's retirement as well. CPT, established by Tversky and Kahneman in 1992 in their paper "Advances in Prospect Theory: Cumulative Representation of Uncertainty," [42] is defined as a behaviorally-based model that captures market participants values for the coefficients in their mental model of valuation under sufficient conditions of uncertainty and risk taking. The theory asserts that an investment that is risky in nature has its value set as a determinant of three components: a reference point or point at which the investment is anchored, a value function, and a set of decision weights that alter the degree of loss or gain and thus the loss or gain of utility. This theory of valuation is commonly compared with the rational model's expected utility theory in which the utility function assigns and expects equal weights for losses and gains in the lost or gained utility.

CPT is distinct from this method of account in that the participant's value function is based on the distance between the outcome in investment and our starting point or reference point, as opposed to just the participants final outcome as a result of the investment. With this reference point in mind, a prospec-

tive investor subtracts the principal from the expected value of the investment at the end of the selected time period and derives the gain in utility from the funds acquired in excess of that perceived loss, rather than considering the investment outcome as an outright gain. Additionally, CPT holds that a participant's value function is concave for positive values, or values above the reference point, and as a convex function for those values framed as a loss and sit below the reference point. This outsized impact of losses compared with gains provides us with the standard assertion that losses loom larger than gains in the mind of a participant. Tversky and Kahneman (1992) set their function as:

$$v(y) = y^\alpha \text{ if } y \geq 0, v(y) = -\frac{\lambda(-y)}{\beta} \text{ if } y < 0$$

and define the level of loss aversion as λ and the level of diminishing sensitivity to losses and gains as α and β with $v(y)$ set as the value function and y as the distance from reference point to a set gain or loss from investment. These coefficients are estimated to be $\lambda = 2.25$ and $\alpha = \beta = 0.88$.

Expected utility theory would weight the utility of a participant at their differing states based on the unaltered, correct, and objective probability assigned to each state, yet Tversky and Kahneman (1992) establish that for prospective investments, both as a loss and as a gain, the prospective investors assign weights to low probability events far in excess of their actual rates of occurrence and under-weight events that have a high likelihood of occurring. CPT provides us with a method to capture the perceived probabilities represented as decision weights and as altered by the participant's biases, but are based on the true percentage changes with which the event is expected to occur. Chen's 2016 [11] (Chen et al. 2016) work relates this to annuities in that it is determined that although the annuity as an investment option is designed and intended to reduce

longevity risk or risk of outliving one's assets, prospective purchasers tend to perceive the annuity as a risky investment and thus frame it as a potential loss. Chen finds that consumers have the tendency to fixate and overweight the risk of an early death and overlook the degree of probability that it is possible to live beyond the life expectancy set for themselves [11] (Chen et al. 2016). In the former situation, the participant, framed around the extended ownership in a bequest to their beneficiaries, would receive less than the invested amount and move into the realm of loss while in the latter they would receive more and move into the realm of gain. This research helps to confirm that the perceived rate of loss as a result of investing in the annuity looms large over the potential and very likely gain, resulting in the low demand that stands contrary to the rational model's expectations. This research suggests that this demand can be improved if the issuing companies were to provide a guaranteed period of payments that does not depend on the survival of annuitants and make that provision more commonplace.

To continue with the idea that loss aversion is the primary explanatory mechanism for the below-prediction levels of annuitization, the low rate of plan contribution, and the at or near zero levels of savings retirees report as they enter that phase of their life looks to be one of the major inhibitors to full uptake. Particularly for low SES retirees, the savings amount required to purchase an annuity constitutes an all-or-nothing risk which subsequently inhibits possible participants from entering, or even considering entering, into an annuity contract. Although the product is actually a longevity risk hedge, enabling retirees to reduce risk of outliving the drawdown of their assets, the product is seen as a gamble due to the incomplete information of total life expectancy and the investment frame with which the product is generally presented. Lambregts and

Schut (2020) ([21]) provide what is likely the most broad evaluation of the competing hypotheses for the observed differences in product uptake as compared with the rational model's expectations.

From a search that returned almost 4,000 unique results and upon review of the findings of almost 200 studies, Lambregts and Schut establish [21] (Lambregts and Schut 2020) that the receipt of a continued stream of revenue for the rest of one's life in social security, the adverse selection of product attributes, the non-standard preferences and biases of participants, and a limited level of rationality due to low levels of financial literacy and objective representations of risk, or its unawareness, greatly hinder and ultimately prevent one from making the decision to annuitize one's wealth; to the point of financial literacy, Shu, Zeithammer, Payne [39] (Shu et al. 2016) found that an inclusion of a cumulative payout amount reduced the rate of under-valuation for the inflation hedge provided by increased payments by a factor of 2 for bundles with the same trait composition while Brown [8] (Brown et al. 2017) found that increased product complexity reduces the prospective participant's ability to value the annuity in question. Lambregts and Schut [21] (Lambregts and Schut 2020) also find that the purchasing of annuities is hyper-concentrated in the population of individuals of high socio-economic status and of strong health status. Lambregts and Schut [21] (Lambregts and Schut 2020) assert that a comprehensive address of all four of these reasons for low rates of uptake may result in the increases in annuitization we expect from the result of the rational model, particularly for those of lower socio-economic status.

An additional and very likely contributor to the low rates of annuities and retirement investment overall is the inconsistency with which default options

are implemented for defined contribution plans. In Benartzi, Previtro, and Thaler's "Annuitization Puzzles" [4] (Benartzi et al. 2011), the existence of issues with participants degrees of self-control, the inertia required to overcome defaults set for saving and investment, and a marked lack of financial literacy are found to be major factors in the low rates of annuitization observed, ultimately leading to inadequacies in the amount dedicated toward retirement. While it was found that an automatic enrollment mechanism could overcome this barrier, the element of financial literacy remains a distinct and pervasive issue in the uptake of such products. In Butler and Teppa's "The choice between an annuity and a lump sum: Results from Swiss pension funds," [10] (Butler and Teppa 2007) a selection rate of 73% was observed for the annuity option when set as a default with the next largest contingent being 17% for a mix of the annuity and a lump sum payment. Interestingly, the remaining 10% that selected a lump sum payment were primarily retirees with no spouse or children, which would seem to indicate that the bequest motive, and thus the guarantee to be able to leave a bequest in the event of an early death, stands to be a strong motivator to annuitize one's wealth. Given that the framing of the option as a default elicits a notable increase in the participation rate, almost to completely normalized levels, the aforementioned framings of the investment as a gain, as denoted by complete payment information, versus a perceived loss, as denoted by incomplete presentation of the information, is noted to have a substantial effect on the uptake rate as well.

Finally, a behavioral concept to consider as a major component of the sentiment toward annuities is a frame of scarcity that is used to bound the decision to annuitize one's wealth. This frame of decision making may be critical in making the final determination as to why annuitization rates are so low and as one

of puzzle's major features. A large contingent of current and future retirees are and will continue to enter that phase with no or very low levels of savings. This extended period of low-income induces the scarcity frame of decision making and induces the associated behavioral biases levied upon the decision to annuitize. As established in Griskevicius' work [17] (Griskevicius et al. 2012) the markers of a scarcity frame, a shorter time horizon, higher rates of impulsivity, and a great propensity to assume risk in search of the associated and perceived increases in rewards, induced by the extended time at a low income level, or resource scare environment more generally, are likely and potentially quite substantial contributors to the low rates of annuitization we see today. This is of particular interest as the cost level of most products presently offered constitute a high or near total consumption of one's present level of savings and therefore fully inhibit uptake. Although the stream of benefits will eventually return more than the principal paid, the decision to invest is evaluated from a position of substantial loss that is interpreted as too significant a risk to assume when the discounted revenue stream is evaluated for purchase.

Given the aforementioned rational explanations and behavioral inefficiencies, that when combined are likely to represent the full list co-conspirators in the low uptake of annuities, we attempt to make progress on the question of how to discern what is likely to increase participation in this market by confirming consumers' degree of affinity of product attributes, particularly as they can be demographically specified and psychographically differentiated. As stated in the title of Lambregts and Schuts 2020 paper, annuities are generally regarded as a class of financial product that is "[d]isplaced, disliked and misunderstood." [21] (Lambregts and Schuts 2020) We hope to begin to alter this class of product's standing as such by determining the traits of consumer's affinity and points of

product dispreference so that uptake rates may improve and higher rates of saving for retirement follow.

CHAPTER 3

METHODS

We collected this data by partnering with the Debra Paget and Jeffrey Berg Business Simulation Laboratory to manage the posting, payment, and general facilitation of the survey itself on Amazon Mechanical Turk (AMT). Participants were only demographically limited by the self-designation male and female gender indicator (limited to a 50/50 split) and age (qualified participants were aged 45 to 65) as recorded on their AMT profile and capture on the survey. Beyond this, no demographic indicators were limited or restricted and were permitted to be fully randomized. The time required to complete the survey time was estimated to be 12 to 15 minutes and participants were compensated \$5 for their time. We conducted a pilot of the survey for 20 participants in April of 2023 in order to confirm functionality of the survey, the software, and the facilitator as well as to provide a preview of the survey's results. These participants were excluded from the final sample. As a result of the pilot, we confirmed a randomized order of bundles with respect to NPV, controlled male/female split, orthogonal experiment design, and a randomization of the remaining demographic indicators. We opened the total survey for full participation in June of 2023 and concluded collection in early August. We captured a total of 511 unique respondents upon conclusion. We were required to further reduce this to 492, our final total sample size, due to questions omissions, time outliers, and disingenuous ratings. The remaining sample exhibited minimal irregularity and was confirmed to be suitable for our analysis.

We approached the possibility of differentiated preference for and valuation of attributes by recording participants' rating level of product affinity and per-

forming a sub-group analysis so as to capture heterogeneity of preference based on demographic and psychographic factors. We acquired the total sample's degree of product affinity by employing a ratings-based conjoint analysis wherein participants were hypothetically endowed with \$100,000 and required to choose between investment in an annuity or self-management of the funds. (see 3.1 below) Participants denoted their choice as a scaled rating between 0 to 100 for a series of bundled annuity traits against the option of self-management in each instance of rating. We selected this experimental format due to the relative ease with which we could establish a representative valuation of individual annuity attributes [28] (Moore 2004), for the ability to confirm total preference, or dispreference, for the product at large without substantial cognitive taxation, but also for the ease with which we could confirm if the product as a class was being valued solely on its NPV or if additional psychological weights were interfering with participants rational evaluative mechanisms.

If you were 65 and considering putting \$100,000 of your retirement savings into an annuity, and this annuity was the only one available on the market at this time, how likely would you be to consider the annuity shown below?

Use the slider to indicate your rating of this annuity vs. self-management, with 0 indicating "I would definitely self-manage", 100 indicating "I would definitely choose this annuity", and all numbers in between indicating how much you prefer the annuity or prefer self-management.

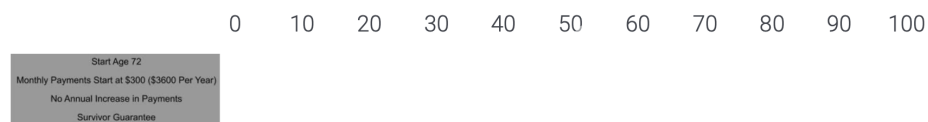


Figure 3.1: Sample Bundle Presentation, Bundle G

If there were indeed factors that would indicate valuation beyond what the

rational model would propose, we expected that we would be able to highlight some of the behavioral biases that are potentially responsible for the inhibition of that wholly rational valuation with such a rating scheme and subsequent subgroup analysis, to include separation by the psychographics we capture. Additionally, we expect that these stated preferences will enable us to estimate and establish a robust model that is predictive of what a participant's individual preferences for annuities are grounded in, alongside a more specified profile of what are a sample consumer's unique demographic factors that indicate a proclivity to elect annuitization overall. This is an important determination to make in our attempt to discern ways in which more support might be garnered for the product class as a whole and from groups that are typically under-represented in the spheres of investment and wealth accumulation for retirement. This is particularly the case when such under-representation is due to a lack of funds outright, a lack of general knowledge with respect to the sector, or a lower degree of financial literacy as compared to the representative investor [15] (Goedde-Menke et al. 2014).

An additional reason for our selection of this experimental methodology was for the ability to better establish the comparison between a consumer's rational affinity for the product class as established by its strict financial value and the additional psychological weight as elicited in the change in rating for bundles with mirrored NPV but differentiated attributes. In being able to determine the financial value of each annuity and each corresponding attribute, we expected to be able examine the degree to which a mix of features in the ranked annuity influences demand and if that influence is just by way of its added financial value alone or if this demand is influenced by a valuative weight that goes beyond its underlying NPV and is subsequently influenced by behavioral biases.

In being able to determine both changes in preference based on overt changes to bundle attributes and covert alterations to NPV between bundles, we predict we will be able to better capture shifts in rational value and psychological value. In capturing these changes, we attempted to help identify and determine how to remedy the observed shortcomings in this market as represented by far lower than expected annuitization rates.

With respect to our evaluations, preferences that should be solely linked to changes in financial value, if the consumer's fully rational is assumed, would be captured with changes to a bundle's NPV while the changes to psychological valuation would be displayed through differences in elicited preference for bundles with parity in NPV but differentiated traits. In determining which attributes are favored, which are not, and in helping to determine the origins of what would seem to be consumers' innate disfavor with the product as a class of investment vehicle, as specified by selective trait preference but overall dispreference, we intend to support both the institutions offering the products themselves and the policy makers that regulate this market so that debiasing alterations to what is on offer can be better informed and consumers' preferences can become more normalized. With a movement to a more accurate position of initial valuation, we expect that expenditure and consumption in retirement can be better smoothed without an associated increase in product cost due to the exploitation of what is a more appropriate and more "valuable" attribute mix as determined by a potential annuitant's demographic and psychographic proclivities.

There are 15 unique bundles that we present to the participant in this experiment. Each bundle presented frames the decision around a well-endowed

choice environment as established by the question: “If you were 65 and considering putting \$100,000 of your retirement savings into an annuity, which of the following would you choose?” The participants then complete their bundle choice by selecting a value between 0 and 100 with the value of 0 indicating a complete preference for self-management, 50 indicating perfect indifference between self-management and the purchase of the annuity in question, and 100 indicating complete preference for the purchase of the annuity. This sequence of preparation, evaluation, and selection was repeated for each bundle.

The participants then followed their bundle ranking with a series of questions pertaining to bequest motives, their perceived product fairness, and their life expectancy. Representative questions include “It is important to me to leave behind inheritance money to organizations that I care about,” rated from strongly disagree to strongly agree in order to determine the degree and type of a respondent’s bequest motive, “I like being able to control how quickly I spend my retirement money,” rated from strongly disagree to strongly agree in order to capture a respondent’s degree of preference for liquidity, and “It is fair that the company is allowed to keep the excess funds,” rated from strongly disagree to strongly agree in order to capture the degree of fairness associated with the compensation mechanism inherent to the annuity as a product class. All but one of these questions were represented numerically on a scale from 1 to 7 with 1 signifying complete disagreement, 3 perfect neutrality, and 7 complete agreement. Overall, we expected that these questions would permit us to capture a fairly high degree of consumer sentiment with respect to both the product and the general market for annuities. In capturing these differentiated attributions of preference for or dispreference against, we intend to provide product issuers and the field a better picture of what aspects associated with mar-

ket participation increase or decrease preference for the product and determine how consumers' psychological barriers to product uptake might be minimized if present.

We then collected the stated probability of participants' life expectancies by asking what is the "chance that I will live to be 65/75/85/95 years of older" [31] (Payne et al. 2013) and converted these estimates into a Weibull-estimated single-year life expectancy value. This question affords a key demographic measure that is generally barred from collection by issuing companies in that this estimate serves as a proxy for one's health status. As established with the aforementioned postal code study, uncollected data with respect to possible participants, either barred by law as with gender in the European Union or not yet industry practice, can help to refine the pricing one receives for their individualized annuity contract [13] (Finkelstein and Poterba, 2014). This potential for a refinement of this pricing is what establishes the importance of such a designation as one's expected live-to age due to the present price mismatch caused by information asymmetry. In the absence of this participant data in contract-price determination, healthy participants are likely to be found in receipt of over-priced annuity contracts given their above average live-to age and thus grounds for the product to be considered unfair are maintained rather than reduced.

The survey continued with a series of gambles in which the participant chose between a 'loss' or riskier gamble and a 'gain' or less risky gamble. These gambles were presented as to elicit a participant's aversion to loss, thus determining a possible addition to the mechanisms by which participant disfavor to annuities can be explained. The general preference for the guarantees, particularly the survivor benefit, may be captured here as indicators of the desire to better

hedge one's longevity risk and might also explain a loss averse participant's dis-preference for annuities in the absence of that benefit. Our survey then continued with additional demographic questions so as to capture participant gender, marital status, child status, education level, income level, and total saved for retirement. These demographics, particularly with respect to education level, child status, and income level were of great interest as these aspects of a potential consumer were expected to capture a large degree of variance in the preference for the product given that one's education level was expected to correlate with financial literacy and thus increased preference for the product as a class and child status to serve as a proxy for the presence of a bequest motive and thus pressure to leave accumulated assets to heirs. Our survey concluded with a series of numeracy questions so as to serve as a proxy for the financial literacy of our respondents. This was another piece of data that was of great interest given its potential in answering why such low uptake rates are observed for this market when predicted rates are much higher when modeled. The avenue of participants' financial literacy levels, both reported and observed, is a point of interest for continued research and represents a major opportunity to help solve this puzzle.

3.1 Selection of Product Features/Attributes

In order to best represent the features and options presently available on the market and offered to most consumers by the issuing company, the attributes participants evaluated were: 1. The annual income provided by the annuity, 2. The presence or absence of a monthly payment increase, 3. The presence or absence of a period certain or survivor guarantee, and 4. The presence or absence

of a delayed start to the annuity's payment stream. While the annual income is the feature that is most commonly associated with annuities and the most understood, the others are less so and are the subjects of inquiry for this paper. This is because the annual income level and associated change in preference is rationally explained by the NPV of the annuity while the additional features' preferences or dispreference capture the additional behavioral irregularities of the participant. Of the attributes evaluated we expected an annuity's annual payment increase as the attribute to have the highest degree of preference among all consumers. This expectation was derived from the fact that annuities with such an increase have the highest NPV among the bundles presented for comparison and the expected strict preference for higher NPV bundles over lower NPV ones. Additionally, given that the increase is quite a substantial one as compared with the monthly income level and start age as NPV increasing traits, we expected the guaranteed increase in payout to invoke a heightened degree of psychological ownership in the consumer.

Generally, an annuity's payment amount is a flat for the entire duration of the policy unless the plan participant elects to include an annual increase. This increase can also be selected as a flat amount or can be offered as a percentage increase of the total payout per month, per year, or held with inflation. Issuers generally offer this so as to help adjust for reductions in purchasing power as a result of inflation which also serves to alleviate a prospective participant's liquidity concerns. We chose the flat amount chosen for this experiment so as to reduce the impact of numeracy issues on a participant's accurate valuation of the annuity. We also chose to include annual payment increases so as to determine the degree to which consumers value an inflationary hedge and if this mechanism would be enough to overcome the dispreference for liquidity

constraints given it is one of the largest inhibitors to the purchase of annuities.

A major criticism of the product is its inability to provide flexibility in expenditure should a financial shock event occur. Given that the terms of the annuity prevent early or variable withdrawal under the standard agreement, a participant's aversion to a loss of agency and the perception of loss of ownership as a result, can biases the decision to annuitize to such an extent that once likely participants can forgo the consideration of the product as a viable consumption smoothing mechanism all together. In addition, with a relatively firmly fixed amount of income per year, the decaying purchasing power of an annuity with no payout increase feature can be perceived as an investment that will slowly fail to fully meet the consumption requirements of the annuitant over the course of his or her life span. An increase in monthly payments seeks to mitigate these issues and thus warrants inclusion as an attribute for consumers' consideration and an expectation as a highly weighted attribute by the participants.

The period certain guarantee and survivor guarantee are both attributes that we expected to have a modest weight in preference. This expectation was derived from each guarantee's capacity to de-risk the potential loss of a participant's investment in the event of an early death and the guarantees' ability to mitigate participants' perceptions of unfairness that surround the means by which life annuities are able to offer above market returns in implementing the survivor premium to some degree. While similar in overall outcome, the two guarantees slightly differ in how they reduce risk of losing one's investment and thus warranted separate inclusion in our survey. The period certain guarantee, as the name implies, guarantees to the annuitant, or the annuitant's beneficiary(ies), continued receipt of the stream of benefits for a designated period

of time. For this survey, we chose a 10-year period-certain guarantee, which means that for the first 10 years of the annuity, disbursement of payments will be guaranteed and beyond which, the payments will be subject to mortality risk, ceasing if the annuitant has indeed died. This feature, while shielding some of the mortality risk, still permits the possibility to have a negative return if the monthly payments are sufficiently low. The period-certain guarantee differs from the survivor guarantee in that this option guarantees payment until the total amount paid to the annuitant equals the initial principal paid. Of the two, we expected the survivor guarantee to have the higher degree of preference given a negative return's elimination as an investment outcome.

The final feature of evaluation is the delayed or deferred start of the annuity. This was expected to be the least favored, if not an outright disfavored, feature offered to participants to be evaluated as the delay increased. This is due to the fact that with the delay of benefits, a participant could die before they ever receive their first payment after committing their principal. In addition to this heightened exposure to longevity risk, the delay of benefits runs counter to what we expect would be a consumers' desire to immediately receive benefits as displayed in the predominance of early social security taking [37] (Shu and Payne 2023). The vast majority of retirees claim benefits well before the age where the maximum amount is guaranteed. Even in the face of receiving 124% of the benefit at 70, it is exceptionally rare for retirees to delay their taking of benefits to that age with a large contingent claiming benefits as early as possible (age 62) and exhibit a willingness to incur a fairly severe penalty for an early draw. We expect that what appears to be a behavioral inefficiency, the sacrifice of the total benefits paid to over the life of the retiree in exchange for immediate satisfaction of consumption demands or a desire to not lose out on benefits

perceived as owed and owned, will be mirrored in a low or outright dispreference for the deferred start feature increasing in degree as the start age is further delayed.

It should be noted that the annuities presented for evaluation have NPVs and total payout streams that are well above what would normally be offered to potential annuity purchasers for the proposed amount of \$100,000. While these offerings are divergent from the reality of what is presently offered on the market, our decision to alter our bundles and design the experiment in this way enables us to identify, separate, and confirm the individual impacts of each attribute and subsequently determine the significance with which these preferences correlate to the demographic data collected concurrently relative to a consistent purchase price. We expected numeracy issues to arise should the pricing of each product vary with what would be actuarially fair given then expected payout of each mix of attributes. Additionally, this experimental design decision allows us to assert the accuracy in the stated preferences based on the data collected, rather than being forced to rely on an extrapolation of the results. The continuity in estimation of product purchase cost combined with our stated-preference experiment design serve as this paper's strengths.

3.2 Heterogeneity in Participant Responses

An additional point of strength for our experiment is the multiple rankings provided by the same respondent for each bundle presented. In being able to record each ranking of the same bundle by each respondent, as opposed to an incomplete presentation of the bundles to randomized sample subsets, we are able

to establish an estimate of the degree to which each attribute impacts the a respondent's total preference of the annuity as a total product. This is due to the fact that the total payout of the product can be differentiated by its components and in having each respondent rank each bundle, the respondent's degree of preference ascribed to each of those components can then be derived based on how respondents change their stated preference. The expected payout of each product is based on the life expectancy tables provided by the SSA and the subsequent live-to ages of each respondent and thus maintains relevance to the total U.S. population [25] (OMB, 1994).

Given that our survey is nationally representative, we expected a fair degree of heterogeneity in our responses. So that we may explain and control for some of this heterogeneity's effect on preference, multiple demographic and psychologically-oriented product preference measures were collected for each participant. Representative demographics collected pertained to participants' gender, child status, income level, and educational level, attributes that should hold some explanatory power for the degree of one's preference for annuities. When we control for the variability with our demographic controls, the national representation of our survey's respondents permit us to establish a broadly applicable degree of, and begin to determine the mechanisms by which, preference for annuities as a product class is built or degraded. This broadly applicable investigation into a nationally representative audience's preference will be particularly helpful in determining how best to approach reformations to the annuity as an investment vehicle for retirement, the policies that surround the construction and composition of the products offered to best satisfy the consumers' preconditions for an investment, and the means by which regulators might approach reducing the magnitude of retirees entering into that phase of

life with \$0 saved.

An additional aspect of a potential purchaser's profile we collected was the participants' predictions of years lived-to represented as a probability. These estimates were deemed significant due to the fact that a potential purchaser's life expectancy is expected to have a sizable impact on the perceived fairness of the product. In addition, one's perception of the stability and length of life expectancy has implications with respect to whether or not an annuity is ultimately purchased [16] (Greenberg et al. 2017). This is due to the length of time one requires to sustain themselves on the funds accumulated and the subsequent degree of longevity risk that someone of high health status or the perceived unfairness an individual with poor health status would associate with the product. In order to capture and evaluate this, we asked participants to estimate the probability of survival to ages 65, 75, 85, and 95 [31] (Payne et al. 2013). It can be expected that the longer one expects to live, the greater the preference for an annuity given its ability to provide lifelong returns, the greater the value placed on inflation protection given the extended exposure to this type of risk, and greater the reduction in the preference for a period-certain guarantee given the perceived reduction in risk of an early death.

Another aspect we tested for impact on product preference was a participant's degree of numeracy. The importance and interest here is in the fact that annuities are generally regarded as complex financial instruments and thus a participant that has a higher level of numeracy can be expected to have a higher preference for the product [34] (Peters et al. 2006). This is due to some of the fundamental mechanisms and attributes of the annuity being tied to continued, but presently discounted, revenue streams and the commonly available oppor-

tunity to have increases to those continuous streams of revenue which then must also be discounted. In order to properly evaluate participant numeracy, we included eight cognitive and numerical ability questions. In order to supplement this capture, we included additional questions designed to measure other individual differences perceived as relevant to the selection process and ultimate preference for annuities. These included questions about perceived product fairness, presence and degree of one's bequest motive, and the participant's aversion to loss.

We also measure perceived fairness with respect to the product, the system that supports the product, the companies that issue the products, and the mechanisms by which annuitants are compensated with a series of questions based on Kahneman, Knetsch, and Thaler's "Fairness as a Constraint on Profit Seeking: Entitlements in the Market" [20] (Kahneman et al. 1986). Additionally, we attempt to measure participants' level of loss aversion by recording their response to a set of ten mixed gambles with a gain and loss option as based on Brooks and Zank 2005 work "Loss Averse Behavior" [6] (Brooks and Zank 2005). We evaluate loss aversion due to the fact that its presence as a trait has been posited as a potential explanation for why consumers do not like to purchase annuities in general given that the purchase of an annuity is regarded as an investment activity would move the potential participant into the realm of loss, rather than the purchase being perceived as a presently discounted gain. The collection of this information is significant in explaining the degree of influence such aversion to loss has in trait preference in addition to total product preference.

3.3 Bundle Features/Attributes and Valuation

Our study's 15 bundles consist of four different choice criteria: start age, income, annual increases, guarantees (period certain, survivor, or none). Start age was differentiated at 65, 68, and 72 so as to better conform to ages consistent with the age of retirement and the distance one is reasonably expected to experience from retirement to payment of such a product. Therefore, we expect this to be an accurate representation of participants' degree of preference for such a start age. Income is differentiated by annual income levels of \$3,600, \$4,800, \$6,000, and \$7,200, and while they move into payout ranges far beyond what one would expect of a \$100,000 investment, they do well to capture the levels of preference expected of a rational participant in accordance with the increasing amounts of income and the irregularities of reported preferences based on the inclusion of additional traits i.e. a \$4,800 payout bundle with the survivor benefit being preferred to a \$6,000 bundle with the same traits, but no such benefit.

Annual increase in benefits was differentiated between "None" and an annual increase of \$300. This is in line with current market offering and was expected to be a point of observed rational preference between the two options. The final trait was differentiated between "No Guarantee," "10-Year Period-Certain Guarantee," and "Survivor Guarantee." No guarantee bundles were expected to be the least preferred and to be viewed as the most unfair given the perceived increase in exposure to longevity risk. Survivor bundles were expected to be the most preferred and to be seen as the most fair due to their ability to not only break-even, but to guarantee payments to beneficiaries and this satisfy the participant's bequest motive.

3.4 Bundle Valuation

In order to establish a valuation baseline, we determined the net present value of our bundles by calculating the stream of income derived from the bundle's designated start age, its income generated per month at the 300, 400, 500, and 600 levels, the presence of a guarantee, a period certain, survivor, or the lack thereof, and an annual increase at the 300 level or with none all discounted by δ at a rate of .97 as per the 1992 social security benefits table standards (Social Security Administration, 1992) for n th annuity "V". The formula is designated by the function below:

$$V_n = \sum_{age=65}^{65+pc_n} \delta^{(age-65)} (12 * income)_{n,age} + \sum_{age=66+pc_n}^{120} \delta^{(age-65)} pr(aliveatage) (12 * income)_{n,age} \quad (3.1)$$

where the guaranteed income a consumer would receive during period certain pc_n is the length of the guarantee (if any are a feature of the bundle selected), one's $Pr(aliveatage)$ is the probability of the consumer being alive at a given age past 65 (conditional on the subject being alive at 65), and $income_n$, age is the monthly income provided by the n th annuity when the consumer reaches the given age. Additions to income are calculated by inputting the starting monthly income and combining that with an annual increase should one be included with the bundle. It must be noted that for bundles that include a survivor guarantee, their NPV cannot fall below the invested principle of \$100,000. It must also be noted that for the bundles that include a period certain guarantee, it is assumed implicitly that the annuity buyer is indifferent about payout to themselves or to their beneficiaries in the event of the consumer's early death and

satisfaction of bequest motive.

Additionally, it is assumed that prospective buyer strictly prefers the net present gain expected as a result of product uptake over the principal invested as determined by $V_n - price_n$. For the bundles presented, values ranged from \$73,000 to \$278,000, with 8 of our presented bundles being above the break-even threshold and the remaining bundles being at the threshold or moving into negative return territory. Negative NPV and break-even NPV bundles with respect to invested price were included so as to determine preference for the product traits in an negative return environment in support of the confirmation of psychological value beyond NPV. We included 5 pairs of bundles that mirrored each other exactly with the exception of the 10 year period certain guarantee and the survivor guarantee so as to better gauge the preference for this new trait.

3.5 Estimation Model

In order to estimate the coefficients of each trait and demographic category, we employed an ordinary least squares regression. We regressed our start ages, monthly income, annual increases, guarantees, bundle NPV value, a vector of demographics, and a vector of psychographic variables on the recorded bundle value. Our model is represented as follows:

$$R_n = \alpha + \beta_1 S_{65,72} + \beta_2 M_{300,500,600} + \beta_3 A_{300} + \beta_4 G_{s,p} + \beta_5 V_n + [Demographics] + [Psychs] \quad (3.2)$$

With R_n representing the total point rating R of the n th bundle, S representing a start age of 65 or 72 levels, M representing monthly increases at the 300, 500, or 600 levels, A representing the annual increase of 300 attribute, G representing a survivor or period certain guarantee, and V representing the NPV of the n th bundle. For our regression, we omitted the specific trait levels that corresponded to our break-even bundle (Bundle G with an NPV of \$102,000) in order to establish our reference group as the bundle that a respondent should be rationally indifferent towards. This is due to the fact that the NPV is equivalent to the principal invested and thus a full rational consumer should be indifferent between the choice to annuitize the wealth or self-manage. The traits omitted were thus a bundle with the start age of 68, a monthly income of \$400, No Annual Increase, and No Guarantee and represent a choice that should be bounded by rational indifference due to relative parity between principal paid and asset NPV.

The demographics included for evaluation were participants' ethnicity status as a minority group as derived from the self-reported race question, participants' status as single as derived from the marriage status question, participants' degree of wealth status as derived from income level question, participants' status as poor established as 250% above the federal poverty level and as derived from our income level question, participants' degree status as derived from our education level question, our participants' gender as derived from our gender question, and our participants' child status as derived from our child question. Each demographic variable was coded as a binary categorical variable for our regression analysis.

Our vector of psychological variables consisted of our weibull-estimated

live-to year as derived from respondents' reported expected live-to ages 65, 75, 85, 95 (lifeexpect), participants' status as loss-averse as derived from their selected games in our series of gamble questions and coded as a binary categorical variable (lossaverse), participants' self-reported level of annuity market knowledge (knowmark), participants' self-reported level of belief that the annuity system should change (syschange), participants' self-reported level of belief that annuity companies should be avoided (avoidcomp), participants' self-reported level of belief that they know how they are paid (knowpay), participants' self-reported level of belief that it is fair for the company to keep the excess profits upon an early death (absent a guarantee) (fairkeep), participants' self-reported level of belief that an annuity reduces agency of their funds (nofundagn), participants' self-reported level of belief in their concern for adequate funds to last retirement (selflongrisk), participants' self-reported level of importance for a bequest to their family (bqfam), participants' self-reported level of importance for a bequest to an organization (bqorg), participants' self-reported level of belief that there is no familial longevity risk (nofamlongrisk), participants' self-reported level of belief that their own usage of funds to satisfy desired levels of expenditure is more important than that leaving those funds to their heirs (selfheirs), participants' self-reported level of importance for liquidity of funds (liquid), participants' self-reported level of importance for management of funds (mgmt), participants' self-reported level of importance for financial independence from their heirs (indep), participants' self-reported level of favorability towards annuities as a product class (negpos), participants' self-reported level of belief that the annuity is fair to the customer (faircust), and participants' self-reported level of belief that the annuity is fair to the company (faircomp). These variables were primarily rated on a scale of 1 to 7, 1 being the rating of high-

est disagreement with the statement, 7 being the highest degree of agreement with the statement, and 3 being perfectly indifferent with the exception of company fairness whose rating of 1 corresponds to completely fair and rating of 4 corresponds to completely unfair.

CHAPTER 4

RESULTS

4.1 Pre-model analysis

See A.1 through A.15 in Appendix for Ratings, A.16 through A.19 in Appendix for Life Expectancies, A.20 through A.25 in Appendix for Money's Worth Ratios

The demographic distribution of our responses permit us to draw an array of accurately specified differentiations in preference based on a prospective annuitant's designators. The admissible portion of our sample, sized 492, was able to capture broadly representative contingents of males and females, majority and minority racial groups, married, divorced, and single persons, those with children and those that are childless, and persons earning below \$20,000 per year to those earning above \$200,000 per year. The average respondent age was 52, which works to capture the most likely demographic that would exhibit an interest in purchasing an annuity and would have had the time to accumulate the funds to expend on annuitization. With such sample heterogeneity, we expect the provisioning of a fairly accurate depiction of the levels total product and individual trait preference as these specified by the aforementioned groups.

Less than 5% of our respondents reported themselves as being totally proximal to the age of retirement or the first age when one could begin to draw social security benefits: greater than 60 years old and 62 respectively. This prevents us from being able to establish with full certainty what one's financial needs and levels of desired expenditure are within the retirement phase per se. This group would also be expected to have the most accurate representation

of life expectancy or anticipated health conditions, and thus enable quite the accurate prediction of one's health-related expenditures as that phase continues, as they relate to liquidity requirements and preferences, to longevity risk management mechanisms, and to the full or partial satisfaction of one's bequest motives. Broader representation here would enhance our ability to accurately determine changes in product preference levels and individualized attributes given their payout stream proximity.

Men over-represent our sample by only 1% (51/49), while we recorded no non-binary persons as respondents. Our survey's almost-even distribution does well to help establish gender-based preference differentiation which issuers will find helpful when attempting to tailor the trait-mix presented to a potential client based on volunteered information. We recorded a near-even distribution between those who reported having one or more children (55%) and those who reported themselves as having none (45%). To have relatively equal representation within this demographic group, couples with an average age of 52, permits us to accurately establish the effect of both a child-based bequest motive, and possible overall preference, or, in their absence, completely partner-based or extended family-bequest motive on total product and individual trait preference. Additionally, having captured a fair split between both populations permits us to confirm or deny the impact of what may be a reduced, or increased, exposure to longevity risk due to possible expenditure supplementation by one's children, or inability in their absence, and how such a hedge influences shapes which features issuers offer.

With this distribution, we were also permitted to analyze the degree to which a secondary bequest motive to a spouse or partner, one that a possible purchaser

would have a great desire to satisfy and would perceive as inhibited by an annuity without a survivor or period-certain guarantee, curtails product preference. This permitted us to examine the possibility of a dual longevity risk, established as a result of the formation of a joint financial decision-making unit and as differentiated from a single person's single longevity risk, as an impetus for annuitization. As it relates to the coverage of that joint financial decision making unit, the overwhelming majority of our sample were married or partnered, with over 80% reporting that they were either married with children, married without children, or living with a partner. Just over 15% of our sample reported themselves as being single which we classified as being divorced (13%), widowed (1.5%), or separated (1%). This split permits us to have a more robust insight into the preferences of the contingent of the population at large that would most likely be purchasing an annuity which supports our results applicability and the magnitude of the effect of these identifiers on degree of product preference, particularly with respect to both partner-based and child-based bequest motives.

The income differentiation captured in our survey does span the full range from those earning below the poverty line [23] (Lloro et al. 2022), set as earning at or below \$30,000 for a family of 4, to those above the top 10% of earners in the U.S., set at those earning above \$200,000, but the relatively low number of participants reporting their yearly earnings as below \$19,999, coded as poor, and below \$49,999, coded as low-income, do not permit a fully accurate determination of what impact belonging to a lower-income group has on annuity preference. These contingents constituted approximately 4% and 13% of our sample respectively which do not align with the current U.S. income and earnings pools associated with these brackets, which is 11% of all working age

adults and a further total 34% earning at or below 49,999 [36] (Shrider 2023) and thus confirms a significant under-representation in our sample. With such an under-weighting, our ability to firmly establish those economic conditions' degree of impact was reduced.

We experienced a fair degree of over-representation for our middle income (\$50,000 to \$99,999) and upper income (\$100,000 to \$199,999) groups which were sampled at 39% and 23% respectively and are represented at 25% and 23% of the national population respectively [23] (Lloro et al. 2022). Our wealthy group, those earning over \$200,000 per year, returned an equivalent representation to the national adult working age population (10%.) These over- and under-representations mean that our confirmation of preference impact based on income group membership will be more reliable for some and less for others, but also introduces possible skewing of the total level and trait-specific preference impacts as well. Given the majority of respondents self-report as members of these groups, their preferences and dis-preferences for the specific product features and the product itself will represent an outsized effect and reduce our ability to extrapolate these results to the general population. As such, an over-representation among these upper income groups might result in what will be inflated levels preference and an overall facade of what will be interpreted as a healthy affinity for the product as a whole. Furthermore, such an over-representation might result in an inflation beyond what a national representation would return due to what we expect to be elevated levels of financial literacy, or at the very least is an increased exposure, with respect to the product's features as compared with communities with a lower socio-economic status. This is also to say nothing of the imposition of a scarcity frame of product evaluation that would be distinct from the upper income group's.

Due to an error in our survey software and certainly a most unfortunate one, a large portion of our respondents did not complete the education response question. Approximately 70% of respondents answered this question, which reduces the strength with which we are able to assert a change in preference due to degree group membership and the magnitude by which these preferences change based on that designation. Likely an effect of over-representation in our upper income and wealthy income groups, 68% of our respondents self-reported as having a bachelor's degree or above while the remaining reported their highest level at no degree, a high-school degree, or vocational training. As with our income level question, the disproportionate concentration of respondents with degrees, given the total U.S. population with those same level of educational qualifications is 38% [23] (Lloro et al. 2022), may indicate, to a weak degree at least, that the one's education level permits additional exposure to, interest in, and possible increased preference for annuities as a product class and the concept more broadly given it was over-representations of these educational groups the elected to participate in the study.

This error was also observed in our saving for retirement question to which approximately 75% of our total sample responded. As with the above, the degree of reliability with which we are able to attribute a change in total product preference and in trait-specific preference due a respondent's membership in a corresponding retirement wealth bracket and the magnitude by which these preferences change based on those designations is degraded. Of those who responded, we do observe a more representative distribution as compared to our other income measures with approximately 27% of the respondents reporting themselves as retiring with \$25,000 and below, designated as retiring poor, approximately 15% reporting their retirement wealth as between \$25,000 and

\$75,000, designated as retiring low income, 10% reporting themselves as retiring with between \$75,000 and \$150,000, designated as retiring middle income, 25% reporting their retirement wealth as between \$150,000 and \$500,000, designated as retiring upper income, and 15% reporting their retirement wealth as above \$500,000, designated as retiring wealthy. A more representative allocation such as this permits us to assert the changes in preferences we observe based on these different levels of wealth accumulation at the national level with greater strength and accuracy and works to confound some of the aforementioned sample-based narrowing of interest in the product simply based on wealth level or its proxy by way of education level. Those that preferred not to say were recorded as just over 5% of the sample size and did not work to significantly skew the results.

In order to establish the general level preferences, trait impacts, and demographic effects, we conduct a model-free analysis of our responses first. With respect to the overall sentiment toward the product, we found that respondents held a generally negative perception of the product, even among the rate of return that would outpace current market offerings. The mean level of preference for all bundles held a fair 9 points below perfect indifference while no bundle ever moved into the realm of even a slight preference. Interestingly, our negative NPV bundles, the bundles that would earn one less than the principal invested, returned a higher preference rating than our break-even bundle, with bundles A through F scoring an average of 2 points higher than bundle G. We expect this to be due to the presence of period guarantees and survivor guarantees on those negative bundles which look to be major components of preference for the product. As expected, our bundles with positive NPV approached indifference, but never surpassed a rating of 50.

To our surprise as well, our low-NPV bundles, bundles H, I, and J returned a higher average rating than even the middle- and high-level NPV bundles, bundles K, L, and M, and bundles N and O respectively. While our low-NPV bundles only ever approached 50% rates of return and high-NPV bundles surpassed rates of return above 100%, it appears that the presence of survivor guarantees and period-certain guarantees promoted a significant level of preference for the product, while their absence sabotaged any possibility of affinity, even in the face of above-market rate compensation. The clearest example of such a preference is the difference between bundle H, a survivor guarantee bundle with a very modest return of \$30,000 and bundle O, our highest ranked bundle by NPV worth over \$270,000 but was without a guarantee of any kind, which were rated with parity. Rationally, bundles L, M, N, and O should all be clear favorites as their NPVs far surpass any of those on offer, but it appears that the absence of a survivor guarantee an annuity may only be doomed to dispreference.

In order to determine the level of fairness, we also conducted a kernel density analysis of our demographics money's worth ratio. A participant's Money's Worth Ratio is indicative of an annuity's actuarial fairness and is calculated by dividing the product's NPV (its discounted stream of future income) multiplied by the probability of survival for recoupment by the principal paid [27] Mitchell et al. (1999). Here, we observe the average density to fall between .75 and .8 which signifies a perceived level of unfairness with respect to the return on investment as tied to life expectancy. While we did not observe significant difference between most demographic groups, we did observe notable differences between the majority and minority group, with the minority group actually returning a higher money's worth ratio due to an inflated life expectancy as compared to the majority group, a slightly leftward shift in the curve and

fairly shorter peak between the partnered and unpartnered group, a slight leftward shift between the child and no child group, a lower peak between the loss averse and non-loss averse, and a leftward shift between the low income/poor demographic and the and wealthy/upper-class group. While the general levels of unfairness we observe are quite on par with respect to what the literature proposes as the norm in the sub-1 rations, we did not expect to observe notable differences between the demographics. As such, this avenue will warrant a more concentrated approach with respect to what extent the money's worth plays a significant role in determining the preference for the product.

On an individual trait level, a monthly income of 500 accounted for the largest capture of preference being worth 15 point increase with a monthly income of 600 only able to return a 10 point increase if present. This was quite a subversion of our expectations as the additional level of compensation provides a far superior rate of return, particularly when combined with an annual increase. Monthly incomes at the 300 and 400 level were observed at near parity at an average of 3.89 and 3.88 which might indicate a minimum level of compensation required in order for the annuity to be considered viable to a prospective annuitant. Possibly credited to participants' general aversion to loss, the observed preference added for an annual increase was approximately 5 points while its absence returned an amount of dispreference by more than double. The preference increase in the presence of a guarantee varied greatly based on guarantee type. Reported as the more desirable of the two, the presence of a survivor guarantee increased preference by 4.2 as opposed to the near negligible increase of .08 that the period certain guarantee affords. Somewhat surprising, the absence of a guarantee did not reduce the level of preference by as much as we expected, returning only a 2.2 point reduction. While it does remain to be fully

determined whether the level of observed dispreference was due to a negative predisposition to the product, possibly captured by an additional survey section dedicated to capturing preconceived bias, whether the reported aversion to the product was due to behavioral biases that prevent a fully rational evaluation of the product NPV compared to the principle, or whether the evaluation was indeed fully rational and the product was rated low due to informational asymmetry preventing an adequate level of compensation for the risk of premature death and the opportunity cost of alternative investments, the results do appear to show and confirm the distinct existence of an inhibitory factor to annuity uptake that has yet to be determined.

4.2 Post-Model analysis

VARIABLES	Layered Model		
	(1)	(2)	(3)
	initial estimation	with demographics	adding NPV
Start Age 65	2.575** (1.127)	2.412* (1.264)	2.903*** (1.108)
Start Age 72	-3.918*** (1.221)	-4.244*** (1.371)	-4.182*** (1.181)
Monthly Income 300	-4.722*** (1.023)	-4.662*** (1.148)	-4.120*** (1.020)
Monthly Income 500	6.672*** (1.469)	7.319*** (1.649)	4.293** (1.912)
Monthly Income 600	12.967*** (1.223)	13.655*** (1.373)	8.277*** (2.658)
Annual Increase 300	5.258*** (1.040)	5.395*** (1.168)	0.550 (2.369)
10-Year Period Certain Guarantee	6.730*** (1.622)	6.299*** (1.821)	8.078*** (1.733)
Survivor Guarantee	8.251*** (1.708)	7.774*** (1.917)	10.007*** (1.884)
Gender		-1.704** (0.783)	-2.156*** (0.713)
Minority Race		8.840*** (0.929)	0.176 (0.873)
Poor		3.145** (1.358)	2.076* (1.208)
Low-Income		-4.735*** (1.307)	-2.428** (1.142)
Upper-Income		4.721*** (1.015)	1.711* (0.897)
Wealthy		4.625*** (1.642)	0.960 (1.444)
Retire Poor		-6.460*** (1.297)	-4.155*** (1.163)
Retire Low-Income		-3.264** (1.383)	-3.485*** (1.207)
Retire Upper-Income		-9.266*** (1.222)	-2.815*** (1.090)
Retire Wealthy		-15.338*** (1.490)	-3.758*** (1.328)
Holds Degree		-2.986*** (0.762)	-2.697*** (0.675)
Single		-2.607*** (0.982)	-0.628 (0.888)
Child		1.650* (0.952)	2.679*** (0.958)
Life Expectancy		0.027	-0.132***

Figure 4.1: Layered Model

		(0.033)	(0.029)
Current Age		-0.309***	-0.206***
		(0.073)	(0.065)
Loss Averse			6.615***
			(1.944)
Knowledge of the Market			0.637**
			(0.295)
Knowledge of Compensation			-1.851***
			(0.251)
System Should Change			3.267***
			(0.343)
Avoid the Company			-0.381
			(0.308)
Fair the Company Keeps Funds			0.191
			(0.233)
Fair to Customer			2.314***
			(0.387)
Fair to Company			-0.179
			(0.322)
No Agency Over Funds			-2.665***
			(0.328)
Self Over Heirs			-0.225
			(0.298)
Longevity Risk			1.522***
			(0.278)
No Familial Longevity Risk			0.498**
			(0.236)
Familial Bequest			-0.297
			(0.245)
Organizational Bequest			0.469**
			(0.214)
Prefers Liquidity			-1.880***
			(0.378)
Prefers Self-Management			0.585
			(0.404)
Prefers Independence			-2.653***
			(0.350)
Sentiment			4.660***
			(0.417)
Net Present Value (in 10,000s)			0.544**
			(0.239)
Constant	28.678***	48.459***	37.600***
	(1.065)	(5.232)	(6.614)
Observations	7,297	5,551	5,551
R-squared	0.061	0.125	0.354

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 4.2: Layered Model

4.2.1 Base Model

See 4.1 and 4.2 (Above, Column 1)

The model selected for regression analysis was an OLS regression model

with bundle value (*bundle_v*) selected as the dependent variable. In order to capture the degree of departure from the bundle that should rationally assert itself as being perfectly indifferent due to a break-even NPV, the reference group for each regression employed were the traits comprising bundle G. Given bundle G's NPV being the closest to \$100,000, \$102,000, we expected participants to rate this bundle with a or near a score of 50. Thus deviations that were higher or lower from this bundle's traits should capture as close to the baseline utility of each trait as possible and should face minimal interference from biases. As such, the traits removed to establish the reference group were \$400 monthly income, start age of 68, no annual increase, and no guarantee. Our estimation results provided a mixture of expected and quite perplexing results. To our surprise, the mean of the bundle rating for bundle G was 28.67 which indicates a fairly high degree of dispreference across our sample and a fairly high degree of compensation or assurances beyond breaking even that a potential consumer would require before a positive degree of preference could be elicited by the traits presented. In-line with our expectations were the direction of virtually all coefficients, but those same coefficients exhibited a fairly unexpected degree of deviation in their magnitude and significance as we expanded the model's controls.

Our initial model's independent variables consisted of the bundle traits start age 65, start age 72, monthly income at the 300 level, monthly income at the 500 level, monthly income at the 600 level, annual increase at the 300 level, 10-year period guarantee, and the survivor guarantee. This was conducted so as to isolate the explanatory power of the traits themselves without interference from the demographics or psychographic variables which would prove to introduce a fair degree of noise. The start age traits, while oriented in the direction we pre-

dicted, had a coefficient magnitude below our expectations. This was particularly so with respect to the start age 65 trait which exhibited a 2.5 point increase against the baseline. We expected to elicit a stronger preference modification rather than the relative levels of indifference that result here. For the monthly income traits, the direction of the coefficients and their magnitude were quite in-line with our expectations, with the exception of the jump in degree of preference being doubled between the monthly income of 500 and 600 levels from 6.67 to 12.97.

Our annual increase trait was another that was in the direction expected but lower than the magnitude expected, being under the monthly income of 500 level of preference at 5.26. Both guarantees returned expected levels of preference and made for firm representations of consumer's desire to hedge longevity risk when possible with preference increases observed to be 6.7 and 8.25 for the period-certain and survivor guarantee respectively. What is quite telling of the consumer's level of dispreference is that the hypothetical maximal bundle representing well more than a doubling of one's investment, a bundle with a start age of 65, a monthly income of 600, an annual increase of 300 and a period-certain or survivor guarantee would only elicit a fair preference for annuitization from the baseline with a score of close to 58. While the r-squared value was quite low for model, this regression's coefficients also proved to be the most statistically significant of the models tested with all coefficients holding at below the 5% confidence level.

4.2.2 Demographics Added

See 4.1 4.2 (Above, Column 2)

Our model's second specification included demographic controls so as to capture the impact of consumer characteristics on the degree of annuity preference. We introduced respondents' self-reported status as belonging to minority racial group (minority) and respondents' self reported wealth group bracketed into income quintiles of poor ($< \$19,999$), low-income ($\$20,000 - \$49,999$), middle-income ($\$50,000 - \$99,999$), high-income ($\$100,000 - \$199,999$), and wealthy ($\geq \$199,999$), with middle income being employed as the comparison group. We also included respondents' self-reported status as degree holders, respondents' self reported current age, respondents' self-reported gender designation (1 if male and 0 if not), respondents' self-reported status as having a child or children and not, and respondents' self-reported life expectancy as calculated by a weibull estimate. Introducing these measures did not reduce the explanatory power of the initial model's coefficients with the exception of start age 65 whose direction remained unchanged but was reported outside of the 5% level of significance. With respect to the variables' magnitude, a monthly income of 600 and an annual increase of 300 were the only two that returned slight increases with values of 13.65 and 5.39 respectively, while both guarantees reported slight decrease in impact with values of 6.3 and 7.77 respectively. The remaining bundle traits maintained their pre-demographic degree of preference impact relative to the baseline.

Quite interestingly, respondents' status as a racial minority corresponded with the highest level of impact of the demographics evaluated at 8.98. While we expected some degree of increase in preference, we did not expect this single

demographic trait to hold parity with a bundle trait as valuable as a monthly income of 500 (7.32). To our surprise as well, respondents' status as being single denoted a more mild decrease in preference with a value of -2.5 where we expected something more moderate. This might be explained by the fact that in being single at or approaching retirement, the desire for an income stabilizing mechanism that would enable long term levels of care as one's faculties diminish is not as pronounced as expected and is in fact less than that of one that has a partner with their own level of financial risk whose care requirements must still be met. Respondents' reported their income status as far below the federal poverty level returned a significant and positive degree at a value of 3.16, but the next quintile up returned a significant and greater negative at -4.69 which we did not expect. Respondents' status as upper income denoted a positive orientation and moderate degree at a value of 4.75, which were in line with our expectations, but surprisingly a respondent's status as wealthy corresponded with a slightly smaller increase at 4.16. The identifiers that returned the greatest shifts in preference were the retirement wealth indicators, retiring wealthy returned the largest at -15.02, followed by upper, poor and lower-income at -9.27, -6.52, and 3.36 respectively.

We find these nonlinear shifts in preference may be explained by participants of the lower-income group desiring an alternate use of or more immediate and liquid vehicle for the funds, but this is confounded by the poor group in their exhibition of a positive and significant coefficient whose conditions are presumed to be more scarce than the next quintile up. The upper-income group the heightened preference may be explained by having the present needs met and engaging the decision from a non-scare frame, while the participants of the highest bracket with sizable assets allocated for the purposes of consump-

tion smoothing in retirement might be explained by the existence of an already highly funded retirement plan that satisfies the function of a well-paying annuity and thus lowers the utility of the product relative to their present measures of hedging longevity risk for themselves and satisfaction of bequest motives.

As an additional surprise, respondents' degree status was quite sizable and negative at a value of -2.94. This deviation from expectation might be explained by participants with a degree already having an employer sponsored retirement plan with active contributions or assets already invested in a personal retirement account. Supporting this explanation is the moderate and positive direction in impact for the highest income group on preference which one would expect would also capture participants with those same conditions. Confounding this explanation is the negative and sizable coefficient associated with the lower-income group which one would expect to correlate with lower rates of degree attainment. Current age was an additional demographic measure that subverted expectation in its orientation at -.32, however this might be explained by the fact that as one approaches their expected age of death, the less years one has to recoup their investment, thus reducing the relevance of a longevity risk-reducing vehicle like an annuity. The presence of a child and respondents' reported gender conformed to our expectations in both magnitude and orientation with values of 1.76 and -1.76 respectively. Respondents' self-reported life expectancy was not statistically different from 0 and represents a sorely-missed source of explanatory power. We found the bundle G to slightly surpass the break-even level at 51.05 which would indicate heightened demographic impact on product valuation and to be of importance to issuers when collecting potential indicators to refine offerings.

Of the demographic variables added, the child and life expectancy were the only two reported above the 5% level of significance and life expectancy was the only variable not statistically different from zero, which might be explained by gross overconfidence by some respondents with respect to their live-to probability at each age interval. Upon adding this second specification, we noted that some observations were dropped due to lack of survey response. We observed a substantial increase in our baseline level of preference which was much closer to an expected level of slight dispreference below perfect indifference in addition to some shifts in magnitude with respect to our initial bundle traits. We attributed these shifts in statistical significance as well as the shift in degree of preference to these dropped observations. Additionally, the inclusion of these demographics only constituted an increase in the explained variance from .06 to .12 which would indicate that preference heterogeneity may be captured in our psychographics.

4.2.3 Psychographics added, NPV added

See 4.1 4.2 (Above, Column 3)

This minor addition to the variance as explained by the variables tested led us to add and test the degree to which the NPV, superficially kept hidden from the respondent by only denoting the monthly (or annual income) among the traits listed, of each bundle increased preference as a third specification and the addition of our psychographic measures as a fourth specification. Here we introduced a per \$10,000 increase in our presented bundles NPV, gamble election-elicited degree of loss aversion, market knowledge, desire for the annuity sys-

tem to change, desire to avoid companies offering annuities, and knowledge of annuities' payment mechanisms. Additionally tested in this specification of the model were a variety of sentiment measures which included respondents' perception of fairness with respect to the company' retention of funds upon death, perceived lack of agency over their funds, perceived longevity risk, bequest motives, perceived absence of familial reliance under longevity risk, placing one's own expenditure requirements over their heirs, reported importance of liquidity, management, and independence, reported level of overall sentiment in quintiles from bad to good, and perceived fairness to customers and the issuing company.

While our initial model's traits did not change in their magnitude or orientation, our previous demographic measures did. Respondents' status as a minority, while remaining positive, decreased significantly in magnitude to a value of .047. Single and poor also decreased in magnitude by a notable degree as well to -.523 and 1.8, while low income and upper income virtually remained unchanged. One's reported life expectancy increased in magnitude to -.17 and became very significant, while the effect of respondents' status as a degree holder, having a child or children, their current age and gender status on level of preference remained relatively unchanged. Of the variables tested, the orientation of the loss aversion coefficient is what subverted expectations to the greatest degree. This is because an investment activity generally frames the participant around an activity that forces them into the domain of loss and thus a participant established as being averse to loss should not display a preference for a vehicle that requires them to expose or risk entry into that domain; someone that is risk averse would be expected to display heightened dispreference for an annuity given it would be classified as an investment activity, but this was

not found to be the case given the trait's value of 6.57. Participants' knowledge of the market was quite in line with our expectations with a value of .65, while knowledge of the vehicle's payment mechanisms subverted our expectations due to its fairly high and negative magnitude with a value of -1.88. Our pre-analysis expectation arose due to the notion that an increased self-perception of knowledge of payment would indicate a participant's level of total product knowledge and thus result in an increased degree of preference. Instead, it is possible the level of participant's self-reported knowledge of payment worked to capture an element of their perceived unfairness in the mortality premium as a compensation mechanism, resulting in the observed negative coefficient.

This was also true for participants' belief that the system should change as one would expect the degree to which one believes this to be true would indicate dispreference with a value of 3.29 as one would expect that a position in the affirmative that one believes the system should change should elicit a negative preference impact. The reported overall sentiment toward the product and the perceived level of fairness toward the customer met expectations with respect to their orientation and magnitude with values of 4.69 and 2.3 respectively. Our fairness measures, the perceived fairness of the company retaining invested funds upon death and the products fairness toward both the customer and the company, seemed to vary with respect to what was captured and may benefit from a change in description due to the changes in orientation observed.

The reported perception of an investment in the annuity guaranteeing a marked lack of agency, concern with respect to longevity risk, and the reported importance of a bequest motive toward organizations held with our expectations of impact on preference with values of -2.66, 1.49, and .49 while impor-

tance of a bequest to family members did not with its value of $-.29$ and it not being statistically different from 0. This may have been due to the feature of a guarantee being presented as not inherent to the product and thus the established perception that one's family member is not a likely recipient of the funds on death, but this is confounded by the positive orientation of the importance of a bequest motive to an organization. This difference in results versus expectation was mirrored in the negative orientation of respondents' preference for their own expenditure over their heirs with a value of $-.16$ which one would expect to be larger and positive. The belief of no familial longevity risk, the importance of liquidity, and the importance of independence all met expectations in their orientation and magnitude with their values of $.48$, -1.86 , -2.6 with the exception of the respondents' reported degree of importance for management which was smaller than expected and not statistically different from 0.

The statistical significance of our psychographic variables were quite high with loss aversion, belief in the system should change, knowledge of how the vehicle pays, the beliefs in no agency over funds, the concern for longevity risk, the importance of liquidity, the importance of independence, overall sentiment, and fairness to customers all being below the 1% level. The belief of no familial longevity risk, respondents' knowledge of the market, desire to bequest to organizations were less so, but all only below the 5% level. Problematic variables exhibiting no statistical difference from 0 were importance of bequests to family, the belief in avoiding the issuing company, the belief that it is fair for the company to keep funds, the prioritization of oneself over their heirs, the importance of management, and their perceived fairness toward companies due to their statistical significance being above the 15% level. The discrepancies in statistical significance here is likely due to unforeseen interaction between terms and

capture of sentiment beyond what was intended with the question. NPV per \$10,000 elicited a value of .55. While the increase in variance explained as a result of the introduction of the NPV measurement was expected, the level of the increase was far from our expectations. This same division between results expected and those recorded occurred upon adding our psychographic variables, as although the variance explained resulted in a significant increase, the amount of variance unexplained by the variables regressed remained quite high.

4.2.4 Subgroup Analysis

See 5.2 5.3 (Below)

Layered Model 2								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Majority	Minority	Wealthy/Upper-Income	Lower-Income/Poor	Child	No Child	Male	Female
Start Age 65	2.665* (1.414)	2.556 (2.733)	2.539 (2.051)	3.991 (2.565)	2.332 (1.585)	3.620* (2.176)	3.736** (1.743)	1.497 (1.857)
Start Age 72	-3.753** (1.507)	-4.496 (2.913)	-3.166 (2.185)	-5.818** (2.730)	-3.289* (1.690)	-5.267** (2.318)	-3.146* (1.858)	-4.681** (1.980)
Monthly Income 300	-4.033*** (1.302)	-3.939 (2.516)	-4.321** (1.886)	-5.311** (2.359)	-3.886*** (1.459)	-4.101** (2.003)	-4.373*** (1.605)	-3.568** (1.709)
Monthly Income 500	4.342* (2.441)	3.571 (4.714)	4.949 (3.540)	0.765 (4.423)	4.154 (2.736)	4.042 (3.751)	5.618* (3.006)	2.621 (3.207)
Monthly Income 600	8.342** (3.388)	9.287 (6.590)	8.489* (4.921)	3.938 (6.129)	9.006** (3.805)	6.132 (5.208)	9.819** (4.182)	7.009 (4.455)
Annual Increase 300	-0.064 (3.020)	2.905 (5.866)	1.413 (4.384)	-0.690 (5.462)	0.665 (3.390)	0.212 (4.642)	0.508 (3.727)	0.585 (3.970)
10-Year Period Certain Guarantee	7.362*** (2.211)	8.949** (4.280)	7.235** (3.203)	10.892*** (4.012)	8.298*** (2.480)	6.367* (3.398)	7.073*** (2.725)	8.327*** (2.905)
Survivor Guarantee	9.056*** (2.404)	11.425** (4.652)	8.288** (3.485)	12.726*** (4.363)	10.662*** (2.698)	7.379** (3.694)	7.741*** (2.963)	11.413*** (3.161)
Net Present Value (in 10,000s)	0.605** (0.305)	0.211 (0.593)	0.226 (0.443)	1.136** (0.552)	0.429 (0.343)	0.813* (0.469)	0.303 (0.376)	0.741* (0.401)
Constant	19.364*** (4.039)	33.512*** (7.843)	28.488*** (5.858)	11.810 (7.325)	24.054*** (4.537)	16.879*** (6.202)	24.762*** (4.978)	20.006*** (5.315)
Observations	4,736	1,353	2,363	1,535	4,086	1,841	3,165	2,924
R-squared	0.070	0.044	0.045	0.099	0.051	0.105	0.061	0.064

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Figure 4.3: Layered Model 2

VARIABLES	Layered Model 3						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Partnered	Single	Degree	No Degree	Loss Averse	Not Loss Averse	Life Expectancy Per Year
Start Age 65	2.288 (1.585)	3.412 (2.089)	2.946* (1.696)	3.024* (1.549)	3.302** (1.354)	2.174 (2.101)	3.027*** (1.155)
Start Age 72	-3.139* (1.690)	-5.347** (2.226)	-3.589** (1.808)	-4.016** (1.650)	-3.619** (1.442)	-4.273* (2.242)	-3.982*** (1.231)
Monthly Income 300	-3.663** (1.459)	-4.505** (1.923)	-3.694** (1.562)	-4.738*** (1.425)	-4.214*** (1.246)	-4.248** (1.935)	-4.338*** (1.064)
Monthly Income 500	4.651* (2.736)	3.479 (3.602)	4.805 (2.926)	3.535 (2.672)	3.651 (2.334)	5.641 (3.631)	4.233** (1.994)
Monthly Income 600	9.407** (3.805)	6.841 (5.005)	8.854** (4.066)	7.763** (3.713)	8.089** (3.244)	8.996* (5.043)	8.388*** (2.770)
Annual Increase 300	1.524 (3.389)	-1.443 (4.463)	-0.035 (3.624)	2.109 (3.309)	0.465 (2.891)	2.708 (4.497)	1.230 (2.469)
10-Year Period Certain Guarantee	6.105** (2.480)	10.699*** (3.264)	7.241*** (2.651)	9.082*** (2.421)	8.444*** (2.116)	7.341** (3.285)	8.019*** (1.806)
Survivor Guarantee	7.569*** (2.697)	13.361*** (3.550)	9.136*** (2.882)	10.902*** (2.635)	10.061*** (2.301)	9.835*** (3.572)	9.895*** (1.964)
Net Present Value (in 10,000s)	0.221 (0.343)	1.120** (0.451)	0.545 (0.366)	0.396 (0.334)	0.424 (0.292)	0.572 (0.455)	0.456* (0.249)
Constant	28.621*** (4.534)	9.934* (5.965)	20.990*** (4.843)	24.565*** (4.426)	25.623*** (3.866)	15.601*** (6.006)	22.713*** (3.301)
Observations	4,045	2,029	3,589	3,708	5,295	2,002	7,055
R-squared	0.042	0.120	0.063	0.060	0.054	0.090	0.064

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 4.4: Layered Model 3

We then conducted a subgroup analysis for the populations self-reported as being a minority, as having children, as being single, and as being low-income, with our full model so as to determine the degree of change in level of preference if there was such a difference to be established. In working to confirm this difference, we intended to support revisions to annuity issuers' product offerings with respect to the features included so as to tailor the product more accurately to the preferences of the potential purchaser as they differentiate based on reportable and collectable information. In having their preferences better established, we expect product uptake to increase given the higher utility version of the products that can be offered to the prospective annuitant based on their respective demographic designator.

Broadly, we expected the minority and the low-income subgroups to have a particularly higher preference for the start age given the reduced health out-

comes in lifespan as compared to the total population. We expected the population that reported the presence of a child or children and the population that reported themselves as being single, to include both never married and those persons divorced, to have a heightened preference for the monthly income of 500 and monthly income of 600 and a heightened dispreference for the lower spectrum of monthly incomes due to the relatively higher demand on expenditures and the higher propensity of a strong bequest motive. We expected both guarantees to remain relatively unchanged in preference among the additional populations analyzed with a slight preference from within minority and low income groups due to the shortened life expectancy compared to the total population average.

Upon completion of the subgroup analysis for the minority-identifying contingent of our respondents, we observed a relatively unchanged preference for the earliest start age and a notable increase in dispreference for the delayed start age. This may be explained by the broad preference for an early start age across all groups, but a greater exposure to longevity risk among minority groups in addition to a greater exposure to mortality risk for this subgroup. To our surprise, the subgroup analysis also returned a marked decrease in impact on preference by the monthly income levels in both directions; they reported both a reduced dispreference for the lowest level of monthly income and a decrease in preference for the higher and highest level less. We believe this reduction in impact for both directions might be due to an overall dispreference for the product as a concept, possibly anchored to the concept of loss and the subsequent aversion to that domain, or the mechanisms by which the product compensates its purchasers which increases in the product's NPV does not work to capture. The traits that returned the highest increases within this group were the guarantees,

particularly the survivor guarantee. This sizable increase in impact on product preference might be explained by the same mechanism by which the product is dispreferred to a higher degree and the later start age exhibits a heightened dispreference in that the higher probability of early death establishes a greater degree of perceived unfairness which the guarantee works to mitigate [30] (O'Dea and Sturrock, 2023).

The subgroup analysis for the combined low-income group returned results that were closer to our expectations. This subsample of our population exhibited dispreference for the later start age by approximately the same amount as the total population, but displayed a significant increase in preference for the earliest start age. This marked change in trait magnitude might capture the increased importance for a more immediate receipt of benefits in light of a reduced life span we expected to be observed in the minority group while also capturing the heightened preference for immediate benefits overall. Outside of our expectations, the NPV related traits did not elicit outsized increases in product preference, but rather returned significant decreases in preference, resulting in negative coefficient for all monthly incomes except our 600 level trait. Additionally, the annual increase of 300 displayed a negative coefficient which we found quite perplexing, but might be explained by the overall dispreference for the totality of the product within this subgroup. As expected, the guarantees exhibited a slight increase in preference for this subsample which might capture the increased perception and cognizance of mortality risk and an increased importance of a bequest motive.

The child and female subgroups exhibited the least degree of differentiation from the total population evaluated. There was virtually no change in the

preference for start age with only a slight increase in dispreference for a delayed start age among the child having population and a slightly higher preference for an earlier start age established among females. The NPV related traits remained identical with no changes observed except for a small and negative coefficient for the child having population, which might be explained by the higher overall dispreference for the product overall this group displayed. While the period-certain guarantees' preference impact held parity with the total population, the child having population displayed a significant increase in preference for the survivor guarantee. This increase might be explained by a heightened bequest motive that is not as salient in the total population. Overall, our subgroup analysis returned and confirmed preference indicators that will prove useful in tailoring the product offering the prospective annuitant and thus maximizing the utility perceived by the potential purchaser.

CHAPTER 5

DISCUSSION

5.1 Summary

See 5.1 (Below)

With this study, we attempt to determine both trait-specific preferences for market-representative bundles of annuity attributes as well as a nationally representative level of preference for the product as an overall class of investment vehicle. Additionally, we attempt to discern the differences in trait and total product preference based on what issuers and policy makers would consider to be demographics of interest. In attempting to determine both total population-level preferences and those that may be demographically differentiated, we aim to provide parties concerned with the present rates of under-investment among retirees, the prevalence of sole subsistence on social security, and what appears to be a clear, present, and system-wide challenge for the current incarnation of our social security and retirement infrastructure with data that will support their swift mitigation.

One can expect that these issues' importance will increase exponentially as the upper portions of the aging pyramid shift such that the burden of support on the working age population grows to an unsustainable level and our approach to the Social Security Administration's target date of default draws nearer [1] (Social Security Administration 2023). And while quite minute, and even uncertain in some respects, we also attempt to make a contribution to the solving of the question behind the sub-optimal rates of annuitization observed in the

current market. As something that continues to perplex the field and despite what would appear to be steady progress in direction of a solution, we believe a portion of the answer to the ever-persistent annuity puzzle may lie in the difference in preferences we observe between the demographic groups captured in this study, rationally anchored inefficiencies in some areas of the market, and potential psychological biases at work in the very individuals issuers would find among those counted within their target population.

We attempted to normalize the choice environment within which participants provided their response so that the elicited ratings would not be externally subjected to unnecessarily heightened levels of behavioral bias. Yet even with what we endeavored to be a relatively choice-neutral environment, the participant's total reported level of preference never surpassed the break-even rating amount of 50, even for the bundles that would compensate an annuitant well in excess of the principal. Such a result, and that is to say nothing of the fairly low rating for what should be a bundle capturing perfect indifference given the principal's parity to its NPV, might lend credence to the notion that there are indeed biases which inhibit a completely rational evaluation of the product or at the very least that a fully informed evaluation of the product is inhibited by the current configuration of informational display. In fact, no average rating for any bundles evaluated rose above 35, with most average ratings being returned closer to 28.

The question that still remains ever-present, and what we attempt to discern with this study, is whether this observed degree of dispreference is rooted in a rational frame of evaluation germane to the annuity itself or if the observed dispreference is anchored to a potential purchaser's behavioral biases based within

an alterable frame. Additionally, the question might be better answered by asking if such biases can be overcome with simple changes to what is presented to whom, how then might those biases be better surmounted based on demographic information the issuer can actively collect or passively receive. These observed baseline levels of preference are a fair indication of an inherent dispreference for the annuity as a class of product and should prompt issuers to consider alternative means of product presentation at the very least.

We attempted to normalize the conditions under which our ratings were elicited by restricting respondent age and attempted to control for some life expectancy outliers, which in turn was corrected for our money's worth analysis, by truncating the life expectancy such that the response maximum was 120. In restricting the survey to those aged 45 to 65, we attempted to elicit the preference of those who would be most likely to purchase an annuity, given the appropriate degree of discounting due to retirement proximity, and thus return results that would be the most accurately representative of this product's market. We hypothesized that because we excluded persons younger than 45 we would be able to better avoid the problematic contingent of those who would be financially capable of purchasing the product due to years worked, and thus considered eligible by an issuer, but would have an elevated propensity to severely discount the annuity's payout stream, as compared to that amount's present utility, and thus rate the product far poorer than normal and by effect skew the bundles' ratings.

Similarly, we hypothesized that by excluding those older than 65, we would avoid the preference impacts of persons that would in effect have delayed their start of benefits, as compared to what are the current product's attribute-mixes

on the market. This decision was also prompted by the desire to avoid a capture of the preferences of those who would have already reached full retirement age for social security taking purposes and return a poorer rating than normal given the increased likelihood for concurrent annuity payment streams. Additionally, we observed a fair contingent of outlier life expectancy based on the underlying methodology of the weibull estimation. Here, participants who were likely not acting in good faith reported a live-to age for the upper age questions at exceptionally high levels, or reported low live-to percentages for the early ages and absolute certainty for the later ages. Subsequently, some of the weibull estimates reached into the 200+ year range and were responsible for significant skewing of any variable relating to or reliant on life expectancy pre-exclusion. We limited the life expectancy to a maximum of 120 in order to account for this cohort and normalize the related variables. Normalization of the maximum life expectancy to the age of 120 falls in accordance with standard practice for calculation of NPV and with the Census Bureau's life expectancy calculation measures for social security payment [25] (OMB 1994).

We attempted to further normalize the total product and individual attribute ratings by maintaining a consistent level of institutional rating (at the AAA level.) We hypothesized that by maintaining the same degree of default risk between the products, and removing the additional model specification, we would aid in the reduction of beyond-norm behaviorally-biased ratings. We expected such a broad reduction among our participants due to what would be considered a lessening of the product's perceived financial complexity and an elimination of the opportunity to overweight product riskiness as expected of a more risk averse population in those that are approaching retirement or already have retired. In addition, we weighed the product mix presented to participants

as a majority of actuarially fair and more-than-fair bundles in order to balance what we expected to be a heightened dispreference for the bundles that were actuarially unfair (bundles A through F.) We hypothesized that in distributing the bundle compositions to favor an even mix of actuarially unfair, fair, and more-than-fair bundles that our mean rating would be at or near a break-even rating. In spite of these controls, the ratings were fairly low, even as we isolated ratings to only our most favorable bundles.

5.2 Trait Analysis: Start-age

Full Model	
(1)	
VARIABLES	coefficient estimates
Start Age 65	2.903*** (1.108)
Start Age 72	-4.182*** (1.181)
Monthly Income 300	-4.120*** (1.020)
Monthly Income 500	4.293** (1.912)
Monthly Income 600	8.277*** (2.658)
Annual Increase 300	0.550 (2.369)
10-Year Period Certain Guarantee	8.078*** (1.733)
Survivor Guarantee	10.007*** (1.884)
Low-Income	-2.428** (1.142)
Upper-Income	1.711* (0.897)
Retire Low-Income	-3.485*** (1.207)
Retire Upper-Income	-2.815*** (1.090)
Holds Degree	-2.697*** (0.675)
Child	2.679*** (0.958)
Current Age	-0.206*** (0.065)
Loss Averse	6.615*** (1.944)
Net Present Value (in 10,000s)	0.544** (0.239)
Constant	37.600*** (6.614)
Observations	5,551
R-squared	0.354

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Figure 5.1: Full Model

Layered Model 2								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Majority	Minority	Wealthy/Upper-Income	Lower-Income/Poor	Child	No Child	Male	Female
Start Age 65	2.665*	2.556	2.539	3.991	2.332	3.620*	3.736**	1.497
	(1.414)	(2.733)	(2.051)	(2.565)	(1.585)	(2.176)	(1.743)	(1.857)
Start Age 72	-3.753**	-4.496	-3.166	-5.818**	-3.289*	-5.267**	-3.146*	-4.681**
	(1.507)	(2.913)	(2.185)	(2.730)	(1.690)	(2.318)	(1.858)	(1.980)
Monthly Income 300	-4.033***	-3.939	-4.321**	-5.311**	-3.886***	-4.101**	-4.373***	-3.568**
	(1.302)	(2.516)	(1.886)	(2.359)	(1.459)	(2.003)	(1.605)	(1.709)
Monthly Income 500	4.342*	3.571	4.949	0.765	4.154	4.042	5.618*	2.621
	(2.441)	(4.714)	(3.540)	(4.423)	(2.736)	(3.751)	(3.006)	(3.207)
Monthly Income 600	8.342**	9.287	8.489*	3.938	9.006**	6.132	9.819**	7.009
	(3.388)	(6.590)	(4.921)	(6.129)	(3.805)	(5.208)	(4.182)	(4.455)
Annual Increase 300	-0.064	2.905	1.413	-0.690	0.665	0.212	0.508	0.585
	(3.020)	(5.866)	(4.384)	(5.462)	(3.390)	(4.642)	(3.727)	(3.970)
10-Year Period Certain Guarantee	7.362***	8.949**	7.235**	10.892***	8.298***	6.367*	7.073***	8.327***
	(2.211)	(4.280)	(3.203)	(4.012)	(2.480)	(3.398)	(2.725)	(2.905)
Survivor Guarantee	9.056***	11.425**	8.288**	12.726***	10.662***	7.379**	7.741***	11.413***
	(2.404)	(4.652)	(3.485)	(4.363)	(2.698)	(3.694)	(2.963)	(3.161)
Net Present Value (in 10,000s)	0.605**	0.211	0.226	1.136**	0.429	0.813*	0.303	0.741*
	(0.305)	(0.593)	(0.443)	(0.552)	(0.343)	(0.469)	(0.376)	(0.401)
Constant	19.364***	33.512***	28.488***	11.810	24.054***	16.879***	24.762***	20.006***
	(4.039)	(7.843)	(5.858)	(7.325)	(4.537)	(6.202)	(4.978)	(5.315)
Observations	4,736	1,353	2,363	1,535	4,086	1,841	3,165	2,924
R-squared	0.070	0.044	0.045	0.099	0.051	0.105	0.061	0.064

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 5.2: Layered Model 2

Layered Model 3							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Partnered	Single	Degree	No Degree	Loss Averse	Not Loss Averse	Life Expectancy Per Year
Start Age 65	2.288	3.412	2.946*	3.024*	3.302**	2.174	3.027***
	(1.585)	(2.089)	(1.696)	(1.549)	(1.354)	(2.101)	(1.155)
Start Age 72	-3.139*	-5.347**	-3.589**	-4.016**	-3.619**	-4.273*	-3.982***
	(1.690)	(2.226)	(1.808)	(1.650)	(1.442)	(2.242)	(1.231)
Monthly Income 300	-3.663**	-4.505**	-3.694**	-4.738***	-4.214***	-4.248**	-4.338***
	(1.459)	(1.923)	(1.562)	(1.425)	(1.246)	(1.935)	(1.064)
Monthly Income 500	4.651*	3.479	4.805	3.535	3.651	5.641	4.233**
	(2.736)	(3.602)	(2.926)	(2.672)	(2.334)	(3.631)	(1.994)
Monthly Income 600	9.407**	6.841	8.854**	7.763**	8.089**	8.996*	8.388***
	(3.805)	(5.005)	(4.066)	(3.713)	(3.244)	(5.043)	(2.770)
Annual Increase 300	1.524	-1.443	-0.035	2.109	0.465	2.708	1.230
	(3.389)	(4.463)	(3.624)	(3.309)	(2.891)	(4.497)	(2.469)
10-Year Period Certain Guarantee	6.105**	10.699***	7.241***	9.082***	8.444***	7.341**	8.019***
	(2.480)	(3.264)	(2.651)	(2.421)	(2.116)	(3.285)	(1.806)
Survivor Guarantee	7.569***	13.361***	9.136***	10.902***	10.061***	9.835***	9.895***
	(2.697)	(3.550)	(2.882)	(2.635)	(2.301)	(3.572)	(1.964)
Net Present Value (in 10,000s)	0.221	1.120**	0.545	0.396	0.424	0.572	0.456*
	(0.343)	(0.451)	(0.366)	(0.334)	(0.292)	(0.455)	(0.249)
Constant	28.621***	9.934*	20.990***	24.565***	25.623***	15.601***	22.713***
	(4.534)	(5.965)	(4.843)	(4.426)	(3.866)	(6.006)	(3.301)
Observations	4,045	2,029	3,589	3,708	5,295	2,002	7,055
R-squared	0.042	0.120	0.063	0.060	0.054	0.090	0.064

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 5.3: Layered Model 2

See 5.1 (Above) and 5.2 5.3 (Above)

The preference for an earlier start age, while clearly established as significant and positive as controls on the base model were layered, was not as preferential of a trait as we initially expected. Compared with the upper levels of our monthly income traits and guarantees, a delay in start age to 68 from what remains as an industry standard of 65 does not reduce the level of preference by the degree we anticipated and thus permits issuers the opportunity to reduce product cost while not incurring a corresponding reduction in product desirability. An exception to what appears to be a preference-effective means of cost-saving, and thereby enabling a potential minimization of an all-or-nothing investment decision, is the observed elevation in preference among participants that would be identified as low-income and similarly among those identified as single, divorced, widowed, or unpartnered. For these groups, we observed a heightened elevation among the earliest start age as much as or more than the highest level of monthly income and above the second-highest level respectively.

The preference split between minority and majority-identifying respondents was an additional subversion with respect to preference impact given the differences in life expectancy. Given the proclivity to indeed the ideation of a loss and the heightened exposure to mortality risk, it was quite unexpected to observe no notable change in dispreference for a delayed start age among this group. Such an absence might signify that one's status as a member of a minority group does not bring to the fore a sense of reduced health and life span as national health data would indicate [12] (NIH 2022) and thus the identifier is not an effective avenue to tailor changes in product presentation. It may also be the case that the relatively small n for this group does not permit the robust analysis such a designation requires. On the contrary, and as denoted in the income-based

subgroup analysis, preference levels for an earlier start age are quite high for the lower-income groups and thus present a difficult tradeoff to issuers seeking to improve uptake within these demographics without raising the premium to inaccessible. For the upper-income groups on the other hand, the start ages returned a lower level of impact, possibly explained by the extended life expectancy as compared with the general population. As a result, such a muted preference response may present issuers with the opportunity to reduce premiums associated with an inefficient attribute, by including deferred start age, while maximizing utility and the associated payout stream with a more favored trait.

With respect to the lower income groups, it is possible that the heightened preference is due to a perceived and confirmed reduction in life expectancy, observed here as approximately 5 years below the middle income group. As such, it is likely that the delayed start ages invoke a sense of unfairness in those potential purchasers with the reduced money's worth rating also serving as a substantiation of that unfairness. With respect to the upper income groups, it is likely that the same notion of unfairness is not invoked. As evidenced by the reduced impact on preference associated with an earlier start age, this group's perception of the deferred start levels is most likely closer to fair. Females slightly under-weighted the start age as compared to their male counterparts which is most likely due to the both perceived and recorded increase in life expectancy that females exhibit. This noted reduction in impact may be an opportunity for issuers to tailor their product offering to a more efficient mix of attributes as well, with an earlier start age for males and later start age for females so as to maximize uptake likelihood.

The partner/unpartnered subgroup analysis revealed a similar increase in preference for an earlier start age among the unpartnered cohort. As with the low-income group, the reduction in life expectancy as observed between the partnered and unpartnered groups might explain the increase, given those who perceive themselves to have a lower life expectancy attribute greater exposure to mortality risk with a deferred start age. As such, issuers may have the opportunity to accomplish greater demographic capture by opting to present only a standard start age to those confirmed to be unpartnered or developing products designed to account for this earlier death with an earlier start age than the present 65 years old. The child and no child demographics displayed a near mirroring of the preference impacts for an earlier start age as between the upper and lower income groups, muted among the child-having groups and elevated among the no child group.

While our initial thoughts led to the presence of a bequest motive reducing the impact of start age toward a heightened preference for a guarantee, these shifts may also be due to the observed reduction in life expectancy among the no child group and movement of the decision to purchase an annuity into a heightened-risk gamble frame. With almost no change in preference observed between the degree and no degree group, as with the Majority and Minority group, it may be that these demographics are of little or no consequence with respect to preferential impact. While certainly a point of further investigation, it is possible that there is an inhibition to what would otherwise be an accurate perception of the effect of a statistically significant lower life expectancy as observed in national-level health data that is not operating on the low-income, unpartnered, and childless groups. What renders the latter better identifiers for a more efficient product tailoring than the former might enable additional

progress in resolving the rates of under-annuitization and under-investment more broadly within these groups.

5.3 Trait Analysis: Monthly Income

See 5.1 (Above) and 5.2 5.3 (Above)

The observed impact for monthly income rendered these attributes the most consistently impactful, lending credence to the idea that the present rates of under-annuitization may due in part to a discrepancy between the rates of expected compensation for income deferral in lieu of lump sum receipt, illiquidity, and loss of management and what issuers currently offer. It would appear that rates of compensation below the 500 level included as a part of the attribute-mix presented to a potential purchaser would significantly reduce the likelihood of an uptake, given the associated reductions in preference recorded for those lower levels. We observed a slight decrease in the lower levels of compensation among the minority contingent which might be explained by the lower levels of money's worth or by a higher degree of discounting that renders the lower levels of compensation to be counted as a loss when outliers are controlled for. Although fairly minor compared to other changes in preference, the indication of such a change in preference may support the alternation of product offerings to exclude attributes of low or negative interest in favor of a more demographically-informed attribute mix.

To return to the trend of significant preferential change, we observed large reductions in elicited preference among the low-income group and slight reductions among the unpartnered contingent. The fairly significant reductions

in preference between levels of monthly income are also likely due to the real and perceived reduction in money's worth by the lower-income group. In being presented with heightened levels of compensation, members of this group would calculate the increase in NPV to be less impactful in the absence of a means to hedge against their increased mortality risk relative to the mean consumer. This may be supported by the observed heightened preference for both the survivor and period-certain guarantees to be discussed later. With respect to demographic capturing measures, issuers might move to include an extended period-certain guarantee in order to counter the perception of an actuarially unfair product given the lowered life expectancy.

The observed reduction in preference among the participants who reported themselves as being unpartnered might be explained by that same reduction in perceived money's worth and be balanced by the absence of a bequest motive, a known factor responsible for reductions in annuity preference. Confounding this explanation are the maintained level of preference for those designated as having a child or children given that there should be a similar impact for having a bequest motive that is anchored to one's child as with one's partner. We are thus unable to discern the degree of impact a bequest motive has with respect to the desired level of monthly income and how issuers might tailor their attribute mix differently in order to account for this large demographic of potential buyer. Interestingly, we observed slight decreases in preference impact for the monthly income levels among the female contingent. This might be explained by the overall reduction in average total rating we observe, yet this runs counter to the notion that females tend to value annuities by a slightly higher margin than males as is extensively documented in the literature. We observe no significant changes in trait preference among the no degree having cohort which serves

to support the issuers in their determination of which demographic indicators may be ignored for trait impact and reduced for cost saving measures while not lowering likelihood of uptake.

5.4 Trait Analysis: Annual Increase

See 5.1 (Above) and 5.2 5.3 (Above)

Of the traits presented, the annual increase returned the most surprising level of impact on preference. With only a minuscule increase in some cases, negative coefficients when isolated for certain subgroups, and representing the first instance of not being statistically different from zero upon introducing additional controls, respondents' disinterest was made clear. The subgroups returning negative coefficients for the annual increase trait were the majority population, the low-income and below population, the single population, and the degree holding population. This result was quite perplexing as the presence of such a trait is almost a precondition for an exceptionally high NPV. Even moving away from a strictly rational means of valuation, the perception of the product should be at a minimum slightly positive or neutral given its ability to support the imposition of a consumptive frame via the attribute's lifelong adjustment to purchasing power.

While possibly explained by the presentation of the increase in dollar terms rather than a percent and the presentation of the increase as a relatively infrequent occurrence, as compared to the monthly income, the observed reduction in impact and statistical insignificance compared to the other traits present might instead be explained a heightened preference for the accompanying traits

that directly contribute to an elevated NPV, particularly for the upper income traits, rendering the preference associated with the annual increase of little or negative interest if at all. It might be the case that a reframing of the benefit in relative terms, a percentage of the total monthly stream or a flat percentage of that stream with the premium adjusted accordingly, will better anchor the preferential impact of the inflationary hedge to its monetary value. This is particularly true for the respondents that report a higher life expectancy as they should rationally value the product more given the projected increases in total annual adjustments relative to the total population. That said, it is very likely that the inverse would be equally, if not more true given the loss induced by foregone increases due to a lower life expectancy.

While the lowest in impact and apparently of little interest to consumers, the attribute might still present an opportunity to better tailor a product's attribute mix and increase product uptake probability. As previously proposed, it would appear that those with a lower life expectancy value the trait less. In fact, it would appear that those with a significantly lower life expectancy find the attribute to be quite the unfair trade off for the premium paid. Even so, the groups we observed to have a negative coefficient defies rational expectation as a positive increase to NPV should result in at least a minimally positive increase to preference. It may well be that the bundle mix was not appropriately distributed and thus the true impact of the trait was lost. Indeed there were bundles that would serve as more favorable representations of the trait in percentage terms, but in order to reduce the survey time, the bundles that would be negative in NPV but for the annual increase were excluded given their projected level of preference was at or near perfect indifference. We expect that an expansion of the bundles we present to respondents will return more conclu-

sive results. Compounding these results' inconclusiveness and highlighting the need for an increased selection of bundles is the trait's statistical insignificance in all but the initial regressions which renders a more firm assertion of impact all but impossible. A greater opportunity to observe the variance in preference as induced by trait inclusion or exclusion, as well as the variance associated with framing the benefit in percentage and absolute terms, will permit a more valid assertion of attribute impact.

5.5 Trait Analysis: Period-Certain and Survivor Guarantee

See 5.1 (Above) and 5.2 5.3 (Above)

The period-certain and survivor guarantees presented the most promising opportunity with respect to a cost efficient mechanism of preference increase and therefore cost-effective means to increase probability of product uptake. We observed that both attributes were consistently favored at or even above the highest levels of monthly compensation. These observed elevations in preference, particularly with respect to the differences we recorded between the demographic groups evaluated, may indeed be the major determinant of product purchase and a possible avenue for a new industry standard given the overwhelming affinity these options elicit. Given that it is very likely that the heightened preference for these guarantees, noted as being preferred over and above even the highest level of monthly income for some groups, is linked to the provisioning of a hedge against mortality risk, these results might work to validate the existence of an inherent and elevated sentiment of unfairness potential annuitants of certain demographics associate with the product's compen-

sation mechanism. The results seem to suggest that the “mortality premium” is viewed as far out of these group members’ favor and that they would very much prefer to have a way to not only establish a means of reducing what would otherwise be undesired exposure to mortality risk, but also ensure their bequest motive is satisfied where it might not be otherwise. This same sentiment of unfairness might be equated to its mirror-image in the health insurance system with respect to the fact that it is an over-represented sample of healthy participants that must pay for a relatively few and quite costly ill; those that would potentially enter into the annuitant pool from groups that overtly understand their life expectancy is reduced relative to the other annuitants are likely to interpret such a decision as unfavorable in absence of means to hedge mortality risk.

The heightened preference for a mortality risk hedge might also be indicative of potential purchasers’ desire to satisfy one’s bequest motive or motives where it or they might go unmet but for the guarantee. The literature, both recent and foundational, propose that the bequest motive is an impactful financial obligation that shows itself to be quite hazardous to the decision to ultimately purchase an annuity given the product issuer’s recoupment of funds, and the compensation of the other annuitants, rests upon the annuitant’s passing. Issuers may now have the evidence to support a standardized inclusion of guarantees in all products so that the chance of uptake may be elevated without incurring a reduction in a potential purchaser’s preference given the associated increase in premium. While certainly too soon to tell, it may be the guarantee, in both the period certain form and particularly in the survivor variant, that hold some of the pieces that can solve the annuity puzzle.

Among the demographics separately evaluated and as estimated by a truncated weibull-estimated life expectancy, it would appear that respondents exposed to the greatest degree of mortality risk exhibit the highest preference for the guarantees, particularly the survivor guarantee. Minority-identifying respondents exhibited slight increases in preference for the trait, while both the low-income contingent and the unpartnered contingent exhibited notable increase in preference above the total population for the guarantees. As with the observed increases in preference for an earlier start age, the heightened preference for a hedge against overexposure to mortality risk is likely to be explained by this group's perception, or indeed a rationally made observation, of a reduced money's worth given their reduced life expectancy. One should not be surprised then that the group with the greatest reduction in life expectancy, the low-income group, also exhibited the highest preference for both guarantees. Upon our subgroup analysis, we observed that the highest and the second highest preference of all traits were allocated to the survivor and period certain guarantee respectively. This increase in impact on product preference was also observed within the unpartnered group which was noted to exhibit a reduction, though not nearly to the same degree, in their weibull estimated life expectancy.

In the case of the unpartnered group, the increase in trait preference might best be explained by the absence of an immediate bequest motive, given that there is no immediate partner to whom a bequest could be fulfilled. Furthermore, given that one's status as unpartnered does not exclude the possibility of younger extended family in one's nephews, nieces, or grandchildren, it is possible that the remaining bequest motive is not found to be satisfied with a delayed stream of benefits and represents a loss in utility as compared to the more liquid lump sum maintained with no annuity purchase. In not having a partner, to

whom an expectation to leave resources exists, and in having a reduction in utility for the delay in benefit use, one would expect that this group's preference to hedge mortality risk by transferring the revenue stream to a beneficiary to be reduced. Instead we observe an increase, which lends further strength to the idea that it is the existence of annuitants with beneficiaries, for whom a deferred payment stream to those beneficiaries does or would not represent a reduction in utility, that are responsible for the increase in preference. We observed a maintained level of preference for those denoted as among the child-having group beyond all but the highest monthly income level. Given that such degrees of preference are observed, even among groups that have no such expectation to that level of affinity, there is a clear indication that guarantees have the ability to help answer a portion of the annuity puzzle in the very least.

Confounding the broad applicability of these results are the Male cohort's, the partnered cohort's, the wealthy cohort's, and the no child-having cohort's preference levels, which we observed to have a reduction in preference for the guarantees. The aforementioned groups all preferred the guarantees just above the earliest start age and fairly below the 500 monthly income level. With respect to the male cohort, this notable reduction in preference might be explained by the risk-preferring or risk-tolerating nature this demographic has been well documented to exhibit. This is compared to the female contingent which was observed to exhibit a higher preference for the attribute and may help issuers appropriately present the attribute mix to prospective annuitants based on what is easily accessible or collectable demographic information.

With respect to the partnered cohort, the reduction might be explained by the partner's capacity to satisfy the bequest motive with a joint retirement ac-

count or beneficiary status on an employer sponsored plan, given that such a status would work to reasonably provide a comparable stream of benefits and maintain pre-death levels of consumption. With respect to the wealthy cohort, the presence of current and well-funded retirement accounts, which already enable bequest motives to be satisfied, might be what accounts for the observed decrease in preference. For the no child-having cohort, the absence of that very same motive might explain the observed reduction. The strength of bequest motives and the differences between them, as it would appear that the bequest motive attributed to a partner and the bequest motive attributed to one's child or grandchild are assigned different weightings, remains a point of additional inquiry and as an opportunity to better support issuers' product refinements.

5.6 Trait Analysis: NPV

See 5.1 (Above) and 5.2 5.3 (Above)

A fair degree of variance was observed with respect to the valuation of the bundles' NPV as differentiated by the demographics captured in our survey. We observed a slight increase and decrease among the majority and minority groups respectively. Such a change, although quite small, is most likely explained by the differences in weibull estimated life expectancy, with those of minority status exhibiting a slightly lower estimate than those of the majority. While not complicated by the observed reduction in preference among the wealthy income groups, this result and its implication is confounded by the fairly heightened degree of preference per \$10,000 in NPV observed among those within the low-income and poor wealth groups. This renders the hypoth-

esis that it is the recorded reduction in life expectancy that explains the rational dispreference for the product particularly difficult to be employed as an explanatory vehicle given the observed severity with which life expectancy lowers for this group. Instead, we hypothesize that it is a heightened scarcity frame within which the respondents of these groups evaluate the bundles and what is therefore responsible for the over-weighting of NPV relative to the reference group.

Those identifying themselves as partered were also recorded as having a reduced impact on NPV to the same degree as the wealthy group, while the unpartnered cohort was recorded as having an impact at the same level as the impoverished group. The respective decrease and increase might be best explained by the security and insecurity with which members of these two groups will experience as they enter into retirement given the presence and absence of a reliable means with which consumption can be smoothed. Such a result will enable issuers to refine the product mix, particularly for those that are unpartnered to include a more focused selection of upper-NPV options in addition to listing the lump sum return, as opposed to the monthly stream, so that the benefits stream may be more appropriately valued. A slight increase in preference was observed among the no child population, which might be explained by the increased perception of insecurity with respect to one's avenues of consumption smoothing given that those options are subsequently lessened with the absence of a child as with the unpartnered group.

A slight decrease and a near double increase in impact were observed among the male and female identifying contingent respectively. We note that these preference shifts should be subject of further inquiry. Among the degree and no degree groups, we observed an increase in preference impact for the degree-

holding group and a reduction in impact among the no degree group. These differences might be explained by the variance in financial literacy we observe between those two groups. Given that financial literacy and numeracy are excellent determinants of one's ability to value financial products [34] (Peters et al. 2006), this result may be of particular interest to issuers in their decision of whether to present the payment stream as a monthly amount or as a lump sum, thereby bypassing the requirement to perform an additional calculation and aiding participants in a more accurate product valuation.

CHAPTER 6

ALTERNATIVE EXPLANATIONS

6.1 Overview

With our coverage of the possible rational explanations in the above, we now move to a possible answer derived from the behavioral model. Tversky and Khaneman's pioneering work in determining our biases as some of the primary inhibitors to our ability to employ a fully rational frame of evaluation for an opportunity involving risk and uncertainty and the subsequent and moderately preferred reward, or what was determined to be a hefty and non-linear disutility anchored to a potential loss, associated with the assumption of that risk [42] (Tversky and Khaneman, 1991). The establishment of quadrants of behavior with respect to market participants' risk taking strategies when decision weights, and the subsequent gains and penalties, are altered under these inhibitions' restrictions. These quadrants of behavior were denoted to be: notable aversion to the assumption of risk with gains of a heightened probability, seeking to assume more risk in an environment of an equally heightened probability of a loss, the assumption of greater risk with a lowered probability of gain, and the aversion of risk when a loss of equally low probability when the options made to be chosen from. With respect to the decision process, the pair establish framing and valuation as the two-stage means by which a market participant would approach the assumption of risk for a "prospect," the aforementioned opportunity involving risk and uncertainty and the associated reward or loss. Both stages are purported to be open and exposed to the biases of the prospector and thus return fairly sub-optimal, or at the very least less than fully rational

selections given the the decision environment's optionality. As a result of this work, 5 distinct biases were established as the likely culprits responsible for the observed sub-optimality in choice in either the framing or valutive phase.

6.2 Framing Phase

Within the framing phase Tverskey and Khaneman propose Framing Effects and Source Dependence as mechanisms by which one's rational choice is skewed into the realm of the irrational. As the participant moves into the valuation phase, the pair propose Non-linear preferences, Risk Seeking, and Loss Aversion as additional co-conspirators in working to defraud the participant of their fully rational choice. With respect to the annuity and our survey results, it is very possible that consumer's dispreference for the product on the whole stems from the product forcing them to enter the behavioral quadrant of heightened risk taking associated with a perceived loss of high probability given that the perception of dying before full recoupment is overweighted relative to the realistic probability. In this case, it appears that our participants would prefer the open market and the associated risk that comes with self-management of assets apportioned to that market, even in the face of the sub-optimal returns such management likely entails, rather than endure the perception of elevated disutility with what is interpreted to be a more sure loss in annuitization.

Additionally, the authors note that participants' tendency to over-weight what are in actuality quite minimal degrees of probability for events of large payout are what constitute the basis for a popularity of the uptake of insurance. With respect to annuities however, and what is essentially another form

of longevity insurance outside of an employer sponsored pension or social security, this tendency to overweight events small in true probability seems to have an additional interaction with the “prospect” of a probabilistically evaluated lifetime stream of income. This likely due to the prospect, in this case the decision to annuitize wealth as constrained by an uncertain life-span, the risk of the loss of funds, and the reward of an extended but ultimately superior return should one live long enough, being framed as a loss due to the time between payment of principal and its recoupment and thus render the option to self-manage the investment as that of the most optimal. The reverse, market participants’ tendency to under-weight events of sure and very high probabilities, is the contributory mechanism by which participants exhibit an aversion to risk when forced to choose between a gain that is certain and a gain that has a probabilistic condition attached. The same can be said of the noted increase in affinity for risk when a prospect consists of a sure loss and a probabilistic loss [42] (Tversky and Khaneman, 1991). Here, it would appear that participants are overweighting the chance of death, and thus the possibility of a loss of funds, and under-weighting the likelihood that they will live the decade or so required to recoup the principle as evidenced in the heightened preferences for the survivor guarantees and the lackluster preference for the monthly income levels [30] (O’Dea and Sturrock, 2023).

6.3 Valuation Phase

To be discussed next is what would appear to be the varying degrees of impact the aforementioned biases act upon and partially inhibit participants’ rational evaluation of the annuity. What are likely to be the most prominent of the effects

influencing consumers' decision to reject the choice to annuitize their wealth is the Framing Effect and Loss Aversion [20]. Established as a potential bias by the duo in 1986, Tversky and Khaneman propose the Framing Effect entices differential preferences for the same prospect when that prospect is framed as a loss or gain while one's Loss Aversion, which as the name implies, entices prospects in the realm of loss to "loom larger" than prospects in the gain category in both a risky and uncertain choice environment due to an asymmetric relation that is steeper near the origin, and convex for losses, and more shallow near the origin, and concave for gains. These concepts were later confirmed in their 1991 paper cited above. Where it is likely that these effects exert influence on the consumer is in way in which a high product premium without a knowledge of the total benefit, coupled with the delayed stream of benefits and the compensation mechanism in the mortality premium which frames the decision to purchase an annuity as an investment in the domain of loss, rather than inducing a gain in ability to hedge longevity risk and therefore in the consumptive frame, expected to induce higher rates of uptake.

6.3.1 Loss Aversion

Chen, Anran, and Haberman's 2016 study [11] (Chen et al. 2016) found aversion to loss to be the primary component of the reason as to why consumers' rate of uptake was so low. Here, it is asserted that the irrational framing of what should be coded as a hedge against outliving one's resources is instead improperly equated to a gamble wherein a heightened probability of early death is used as the means of expected return [30] (O'Dea and Sturrock, 2023). In their experiment, a reservation price is used in order to determine the maximum will-

ingness to pay and as such the price is able to determine the full cash equivalent of the product. With respect to our study, a combination of traits and as such the calculated NPV, would be enough to elicit a rating of 50 would be akin to a perfect reservation price. We did not observe such a combination in our experiment. Their model, a refinement of Wei-Yin Hu and Jason S. Scott's 2007 model which was created to determine the reason for the prevalence of period-certain and deferred start annuities, established increasingly high levels of undesirability as the parameter for loss aversion was increased. As indicated by a negative coefficient for the ratio of reservation price less the actuarially versus actuarially fair price, which indicates willingness to pay above, at, or below market rate, the inclusion of that parameter for loss aversion held that ratio in the negative domain, even with an immediate start age. It was only in the absence of the option to start immediately and under the condition that the annuity was sufficiently deferred (25 year deferral) that the coefficient was observed as positive. As it applies to our research, it may be that a significant portion of our participants were sufficiently loss averse so as to preclude them from a substantial uptake and that a younger cohort of participants would better capture a more normalized level of this behavioral trait. It is also quite possible participants were sufficiently loss averse due to external market conditions so as to additionally support a preclusion them from what are expected to normal levels of annuitization. Where we most likely observe the presence of this bias is in the high degree of preference for the survivor and period-certain guarantees which work to satisfy the participant's perceived exposure to an unfavorable gamble in the product itself.

6.3.2 Framing Effects

We then come to what is likely to be a mutual partner in crime in the observed impact of a frame on ability to select the rational choice and operate at or near what theory would impose as the optimum. Established in the aforementioned 1986 study, Tversky and Kahneman propose Frame Effects as an additional mechanism by which difference in preference for equivalently probabilistic prospects can be explained [20] (Kahneman et al. 1986). As mentioned previously, the duo observe and establish that the positioning of a prospect as a gain or loss forces a separable weighting of the prospect. More recent work has been able to expand upon and partially specify the difference in preference as having been induced by a consumption frame, associated with gain and increased preference for the option, and an investment frame, associated with loss and a decrease in preference for the option of equivalent probability. As the effect relates to the purchase of annuities, the observed rates of dispreference are quite possibly to have been the partial result of being framed as an investment and as a loss that has been over-weighted in its certainty. As is to be discussed, Tversky and Kahneman also highlight the presence of an asymmetry in preference induced by disproportionate weighting of low and high probability events. Working to re-frame the annuity prospect within the consumptive frame may result in a cost-free preference increase to be regarded as an efficient means of increasing product uptake by issuers.

With respect to the observation of the framing effect, Brown [9] (Brown et al. 2008). determined a significant discrepancy in the rate of uptake when an annuity was framed as a mechanism of investment versus a consumptive frame. Here it is determined that consumers tend to narrow the focus of their decision

on the option on how best to spend and the associated assumption of the immediate risk and deferred returns, which can be coded as an exposure to loss, or what can be derived from the investment and added to one's consumptive capacity, finding that most evaluate an option from the investment frame and disregard the additional consumptive potential. Brown finds that the impact of some of the annuity's key features, to include the concept of the mortality premium which we denote as a likely contributor to the product's poor reception in our survey, shift from negative to positive when the consumer's frame is converted from one of an investment to one associated with consumption. To compound this, Soman and Cheema's 2011 work [41] (Soman and Cheema 2011) found that presenting the consumer with a physical daily reminder of their saving goal and the partitioning of funds for their specified purpose, rather than keeping them as a pooled sum, was sufficient to induce this same frame and thus increase the savings rates with little cost.

Similarly, Brown's 2017 study [8] (Brown et al. 2017) established significant framing effects in varying the complexity of the product as it is presented to consumers and by exposing them to informational stimuli that induced thoughts of decumulation rate. Here, by implementing a complex informational condition and denoting the change in sell versus buy price, Brown uncovers a causal relationship between perceived product complexity and valuation and the degree of influence information framing has on the potential consumer's ability to properly value the asset. In establishing that relationship, we are able to determine that there is a behaviorally induced inhibition to purchasing an annuity due to an improper asset valuation given that the willingness to pay is far below what the market level. The secondary finding presents a cost-efficient means by which the potential annuitant can more effectively bracket their choice in the

presentation of the decisional frame as one that can be more strongly related to the results of the annuitization of wealth and the consequences of a fast or slow decumulation. Such a solution would be favorable to firms looking to increase their rates of uptake with little or no cost.

6.4 Additional Biases

The presence and influence of Nonlinear Preferences, Source Dependence, and Risk Seeking are likely to be less in their degree of impact as compared to the above. The proposed nonlinearity of preferences, observed by the authors as being greater preference for the probabilistic increase from nearly certain to fully certain being greater than that same unit of increase but from less certain to more, is likely displayed in the preference difference between the period certain guarantee, which only raises the probability of complete recoupment, and the survivor guarantee, which makes certain the recoupment of one's funds. While the full probability is not known with respect to the increase in probability that a participant would recover funds, certainly something to derive in a future project with expanded health and life expectancy data should it be collected and available, the difference between the two leads us to believe that the bias is indeed present and acting upon the participant in a way that alters their preference.

6.4.1 Source Dependence

A dependence on the source and conditions from which the “prospect” is established is too something that is likely present but not fully tested and exposed by this survey, nor is expected to be acting with significant influence on the participants’ decision processes. The authors propose this bias influences preference in that consumers prefer to choose a prospect in their field of knowledge with unknown probability rather than a prospect of certain and equal probability outside of that sphere. This might lend credence to literacy, both overtly tested and captured by proxy via educational level, being a determinant of higher or lower preference. Here, such a bias is most likely to be exposed in the preferential differences for those of higher and lower life expectancy as well, given that those of higher life expectancy will regard their length of life with greater certainty than those of lower life expectancy due to the respective decrease and increase in health related events which in turn creates more and less certain choice environment when selecting an annuity.

6.4.2 Risk Seeking

Risk Seeking was also observed in the Tversky and Khaneman’s 1991 experiment and was denoted as the heightened dispreference for a probabilistically certain return as measured against a low probability prospect with a large reward coupled with an observed increase in preference for the assumption of greater risk when confronted with a high probability loss or probabilistically certain loss. With respect to the selection of annuities, it would appear that such a bias could be responsible for the observed levels of low preference for the

product. We propose this may be so given that the revenue stream from the Annuity is probabilistically certain and the potential gains from investment in the market, while observed as being fairly inferior to the rates of return provided by the annuity, have a small potential to bestow an extravagant level of compensation for some. It is likely and quite possible that the annuity is relegated to a disfavored status due to the “lottery ticket” like perception self-investment constructs around an over-weighted small probability event, both for the gain domain, in the return self-management is expected to bring, and for the loss domain, in the event of early passage.

The reverse side of this may be captured as a function of the impact of the compensation mechanism inherent to the annuity itself. Given that the mortality premium is most likely framed as a loss and the event of an early death prohibitive of full recoupment of principle is subsequently overweighted beyond what its probability should rationally be attributed to [30] (O’Dea and Sturrock, 2023), the heightened dispreference may be in fact be partially the result of the risk seeking for what is perceived to be a highly certain loss in the annuity, when no survivor guarantee is included as a policy rider, and a comparatively lower certainty of loss with the option for self-investment. Working in tandem, with full acknowledgment that the impact of an over-weighted loss that is likely being perceived to be certain is a hefty force to overcome on its own, the heightened dispreference we observe may well be explain by the market participants’ desire to seek additional risk and chase the potential of heighten gains and abandon the not so alluring certainty of a guaranteed stream of income. Griskevicius’ 2012 work [17] (Griskevicius et al. 2012) found notable differences in the assumption of risk, susceptibility to temptations, and fell victim to impulses between those of low and high socio-economic status when re-

source scarcity was introduced. In this study, participants were surveyed about their socio-economic background, and asked to make binary choices between a presently valued option and a deferred option with interest while under a control frame and a recession frame induced with 8 images depicting recession related scenes.

While the control condition observed notable and statistically significant differences in degree of risk taking between the two groups, with those of lower SES being will to assume less risk than participants of higher SES, the scarcity frame induced by recessionary imagery resulted in a much greater degree of risk taking as observed among those of lower SES and the tendency to select or pursue the safer option for those of higher SES. Such findings are indicative of the opportunity for issuers to better tailor the bundle options presented to prospective participants so as to elicit a more positive response and increase rate of uptake. The observed differentiation between these two groups as observed in Griskevicius' research may be mirrored in the differences we observe in degrees of preference and likelihood of uptake between the upper and lower income quintiles captured here. As such, the observed degree of preference for those of the upper quintile may be explained by the desire to assume more risk as represented in the annuity, given that the product is more often attributed to an investment activity, while those of the lower earning quintile would only take the product when the over-weighted mortality risk is hedged by the survivor guarantee.

6.4.3 Mortality Salience

Another avenue that holds some potential promise in its ability to explain the low product uptake rates, and potentially for the observed sub-optimality for retirement investing and saving more broadly, is avoidance of concepts associated with or framed around mortality. In a series of studies in 2016, Salisbury and Nenkov elicited the effect of Mortality Salience on the decision to annuitize and found that the our response as a psychological defense is to distance ourselves from or outright avoid the source of the stimulus and therefore repress the knowledge of our impending passage [35] (Salisbury and Nenkov 2016). In their first study, the authors determined an elevated level of spontaneous death ideation (40% vs. 1.5%) when participants were prompted to make an annuitization decision rather than the decision to invest in an IRA and were more likely to invest in the IRA over the annuity (38% vs. 63%). The second study employed high and low priming conditions to evoke different states of Mortality Salience and returned a reduction in annuitization between the two conditions (22% vs. 40%). The third study altered product descriptions with a high and low salient condition in order to determine a more realistic degree of respondent salience and returned an elevation of death ideation high condition (54% vs 39%) and established respondent susceptibility to framing bias. Study 4 employed the most realistic evaluation of the Salience's effect by replicating a client meeting with product brochures altered to create a high and low MS condition. The study returned a significant reduction in rates of annuitization for the high condition (26% vs 50%). With respect to our study, the evaluation of the degree of baseline mortality salience may work to explain the low rates of uptake given our product description makes explicit reference to the compensation mechanism in the mortality premium and in the explanation of period-certain and explanation of

the survivor guarantee. While our results establish a clear preference for this hedge, it may induce a subconscious repulsion to the product as a whole due to the psychological protection avoidance of the decision affords to those close to the end of their life. This is a very compelling opportunity to answer some of the annuity puzzle as it would not only help to explain the low uptake rates in both annuity products, but also the reduced rates of retirement products we observe.

6.5 Conclusion

While these biases have not been fully captured in or explained by our survey, and the experiment's replicability poses an issue to their results' robustness, they do represent a promising avenue of future inquiry. The aforementioned behavioral abnormalities, particularly with respect to Tverskey and Khaneman's Framing Effect and Loss Aversion, appear to dissipate some of the fog that surrounds some of the answers to the Annuity Puzzle [38] (Shu and Shu 2018). Long have the differences observed between what theory proposes as the optimal rate of annuity purchase and what market data expose as continually low rates of annuitization. While the rational explanations of sub-optimal pricing, sub-optimal choice, and information asymmetry do well to determine some of the disparity's origin, psychologically induced biases that appear to override market participants' ability to reach or approach the rational optimum could cover the remaining distance to the solution [38] (Shu and Shu 2018).

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APPENDIX A

APPENDIX

A.1 Issuer and Policy Recommendations

Upon review, it would appear that if one were endowed with enough funds to meet the current purchase minimum for an annuity that the attribute mix required to shift a potential annuitant's preference from being heavily skewed in favor of self-management toward a high probability of purchase would demand a level of compensation beyond what the present market could offer. That being said, there do appear to be cost-effective measures that could aid an issuer in approaching, or even surpassing in some cases, the break-even preference threshold and increase the likelihood of product purchases that have not yet been implemented or are not yet employed as standard practice. Foremost among these are the presentation of an annuity's revenue stream as a lump sum, the baseline inclusion of a survivor guarantee, and the framing of the annual increase as a percent increase rather than the total monthly amount. These measures represent the most cost-effective ones of which an issuer would be able to implement and can be expected to return mild to medium improvements in product preference. Moreover, these measures apply quite broadly to both the demographics that can be considered as the most likely to purchase: those that are majority-race, partnered, degree-holding, child-having, upper income statused with an above average life expectancy, as well as those that exhibit a fair degree of dispreference insofar as an unfair perception of the product's compensatory mechanisms would instigate: the non-partnered, non-degree holding, childless, lower-income statused with a below-average life expectancy.

Measures that are likely to be somewhat less cost-efficient, but more demographically oriented, and therefore better yielding with respect to attribute-mixes that maximize a prospective annuitant's individualized utility, are the creation of new baseline monthly income levels for the low-income contingent with a maintained pricing scheme and the establishment of earlier-than-standard start ages for those that report a lower life expectancy. With respect to a shifted compensation scheme, it would appear that for potential annuitants of lower life expectancy the money's worth of bundles with the lower monthly income levels is too low to be considered fair. In accounting for the reduced life expectancy by increasing the minimum levels of monthly compensation, and thus working to reverse the deflated money's worth associated with the current products, issuers can counter what is a relatively strong dispreference inhibiting annuity uptake for a large contingent of potential buyers. With this in mind, issuers will need to determine which mechanism is a more efficient change given the demographic make up of its potential clients as it is very likely that implementing both in tandem would render the products offered to become unprofitable.

Alternative framing options to be considered in conjunction with the two measures above include the exclusion of the highest monthly income options for the lower-life expectancy group and the removal of deferred start ages for that same contingent in order to establish reduced optionality. A choice architecture such as this would shift the payout's reference point given the lingering question of the premium's affordability in the mind of lesser-resourced clients. Additionally, such a measure is likely to alter this demographic's perceptions of unfairness associated with a lowered money's worth values and reduced life expectancy as attributed to these same groups. This would permit issuers to better exclude attributes that are under-weighted by potential annuitants while

exploiting low-cost refinements to the present offering that will result in heightened product uptake.

Measures that would certainly further maximize prospective annuitants' perceived utility but would be more invasive and less cost efficient for the issuer would be a subsidy to partially or fully cover the cost of a survivor guarantee for the aforementioned lower-life expectancy demographics and a reduction to the minimum principal required for product purchase. With respect to subsidizing the survivor guarantee, this would undoubtedly increase uptake likelihood among groups that are undoubtedly underserved by the industry. Potential purchasers of lower life expectancy prefer a hedge to mortality risk over and above and earlier start age or a higher rate of monthly compensation as it would seem that the allure of higher NPV is dominated by the ability to maintain bequest motive satisfaction and the ability to avoid the domain of loss. We observed the survivor guarantee to be the utmost preferred attribute for a fair portion of those demographics and given such an impact, issuers have the potential to capture the largest swath of non-annuitized market participants by employing changes with this trait.

The guarantee is certainly the most promising feature with respect to what might move the product from one that is a "bad deal" in the mind of the potential annuitant to one that is perceived as fair and therefore stands to significantly aid in increasing the rates of annuitization. With respect to the lowering of the minimum principal required for product purchase, this would reduce the frequency with which the decision to annuitize is framed as an all-or-nothing decision, a known inhibitor to not only investing for retirement, but for investment overall. While this does introduce inefficiency, given the reduction

of management fees on these accounts of lower principal, the industry standard of \$100,000 for such a retirement vehicle is far in excess of the savings among these populations and approaches near complete investment for the reference group. This all or nothing framing might also work to explain the general level of heightened dispreference among these demographics and the rates of annuitization that continue to fall below expectation as well.

With respect to retirement policy recommendations that would return quite favorable results is a mandate issued by the Department of Labor's Employee Benefits Security Administration requiring retirement plan sponsors to allocate a fixed percentage of an employee's contributions to an annuity by default and is set to meet the payout threshold at full retirement age. While a measure that would initially be moderately disruptive to the market, such a requirement would taking advantage of what has been well-observed to be a powerful bias for one's default selection, and the corresponding elevation of dispreference for change from the default as attributed to the effort required enact such an alteration. This revision to the current code would serve the purpose of smoothing consumption for retirement plan participants given the uncertainty retirees face with an optimal rate of drawdown and works to reduce the possibility of succumbing to longevity risk given the general and consistent upward trend in life expectancy for all groups in the U.S.. In order to permit and retain a sense of ownership and self-management, plan sponsors could permit a set of attributes that constitute the percentage minimum while also offering attribute mixes that require a larger percentage allocation beyond the mandated minimum, but are more closely aligned with what serves to maximize participants' utility.

Yet, such a mandate must also address what has become quite the press-

ing issue for policy makers in the retirement space: the millions of Americans who work without access to an employer-sponsored retirement plan. This same mandate, to dedicate a required minimum percentage of one's contributions to an annuity, may serve to enhance the current legislation to create a federal retirement system that civilian employees can participate in should they have no present ability to contribute to a retirement account. Set to start in 2025, earlier versions of the Secure 2.0 legislation included provisions to create a civilian TSP-like retirement plan, thereby enabling employees without access to an employer-sponsored plan to have access to an account with a matching contribution mechanism. The version that cleared both houses and was subsequently passed into law in 2023 has provisions for enhanced enrollment requirements for employees who work 500 hours or more for two consecutive years, down from three, but includes exemptions for smaller businesses and participation rate thresholds which exempt firms from required participation. In order to better support the contingent of participants that we observe as least likely to purchase an annuity, coupling participation with automatic 401(k) enrollment and required plan eligibility would produce outstanding results for low-income retirees who would otherwise be relegated to social security payments as their sole means of consumption smoothing.

A.2 Opportunities for Improvement

Given the presence of varied statistical significance in our result, it goes without saying that the methods employed to collect the data could be improved and would return more positive results. With respect to the collection of data, a broader survey population, possibly with geographic and income-based re-

strictions on respondents, would assist in more robust results. We do find that a certain concentration of respondent demographics which are likely contributors to some of the traits and their associated levels of preference not being statistically different from zero. This is particularly problematic for some of the psychographic measures which seem to be the most noisy of the traits evaluated. These questions, and the subsequent identifiers that can be extrapolated from their associated ratings, stood to be some of the more impactful and interesting discoveries from this survey.

Yet, it would seem that either by virtue of length of time required to fully respond to the survey or a sense of confusion associated with relevance to the subject matter and thus a lessened degree of enthusiasm in the endeavor to answer honestly were factors that presented too great a barrier to answers that conformed to a usefully predictive trend. This became starkly apparent where upon laying all three controls on our base model a drop in statistical significance was observed. The only other expectation that comes to mind here was the possibility of a correlation error in the questions that resulted from a lack of sufficient variation to capture unique and differentiated biases. In this case, a possible transformation of the currently presented questions into singular propositions that would capture the same sentiment, for or against the product's characteristics, the issuing firm's collection mechanisms, and the underlying significant of additional motives and desires in the participant so that the participant could concentrate their efforts on a wholly answered, effectively minimized, and satisfactorily differentiated group of inquiries.

In this same area, it would appear that the length of time respondents spent on the survey could be indicative of a complexity issue. Response times var-

ied from exceptionally fast at below 7 minutes to quite long at over 40 minutes. In order to not over-zealously and prematurely discard valuable results, we did not exclude results based on length of time. The relatively small sample size was also taken into consideration when making the determination to discard based on a good faith effort or a high degree of distraction. It would seem however, that if afforded the luxury of filtering results based on what would appear to have been a good faith or bad faith effort as indicated by time spent on what was estimated to be a 12-17 minute survey more consistent results would be have been achieved and thus been enabled to returned more significant coefficients. It would also appear that approximately 10% of our sample did not fully complete the survey. This contingent of respondents proved to be quite problematic in that they only gave their rating of the bundles we presented, which was certainly a valuable contribution, but were able to bypass the question and completion requirements imposed by our survey platform and receive survey credit without completing the psychographic, sentiment, and demographic questions. The absence of their responses, subsequently dropped for those traits' analysis and retained for ratings analysis, undoubtedly added to the noisiness of our regressions and the statistical insignificance of some of our coefficients when layering those specifications.

Additional improvements lie in the missed opportunities to further investigate the rational motives that inhibit uptake and the possible presence of the behaviorally induced biases that exist. With respect to the rational model, the inclusion of a question that establishes the present status of social security taking, the age of benefit commencement, and the amount of benefits received, would enable us to discern whether there exists a competing stream of revenue that would lower the utility of what would be in effect a secondary annuity. It

has been observed that concurrent benefit taking, either present drawdown of an employer sponsored plan, the distribution of a private retirement account, or receipt of social security benefits lowers the degree of preference of the product given the existence of a present stream of income that lowers the utility of additional stream that the annuity provides [21] (Lambregts and Schut 2020). While we do elicit the amount saved for retirement, we do not determine the existence of a concurrent stream of presently drawn retirement income, especially considering a contingent of our respondents are to request distribution of their social security benefits. Additionally, we do not request respondents to provide their value of the annuity so as to formally calculate utility. While certainly helpful in determining the difference between real and perceived NPV, such an inquiry would certainly introduce numeracy and survey fatigue issues.

On the behavioral end, and more specifically toward respondents' bequest motive and its degree of significance, we do not inquire about the number of children. Rather, we only ask whether the respondents have or do not have children. It has been observed that not only the age, but the number of children impacts the degree of preference for the product. In not establishing these specifics, we leave a potential explanatory avenue unexplored. Although this would have been a major addition to time, and as such relatively unimplementable due to already inflated survey length, a qualitative response portion would have done well to establish the preexisting sentiments of the product that may not have been captured in the sentiment questions or in the psychographic questions in isolation. Such an inclusion would have been the most beneficial in the preliminary survey round in order to better refine the survey when opened for all participants. An additional improvement to better capture the influence of potential biases would have been to implement two conditions of presentation,

one in terms of annual income that conforms as presently displayed to the participant as an investment and a second in terms of revealed NPV to induce the participant to consider the additional consumption available above the \$100,000 level. The creation of two treatment groups would have allowed for a greater coverage of this potential source of differentiated preference and would have not increased the time expended for survey completion.

A.3 Additional Figures

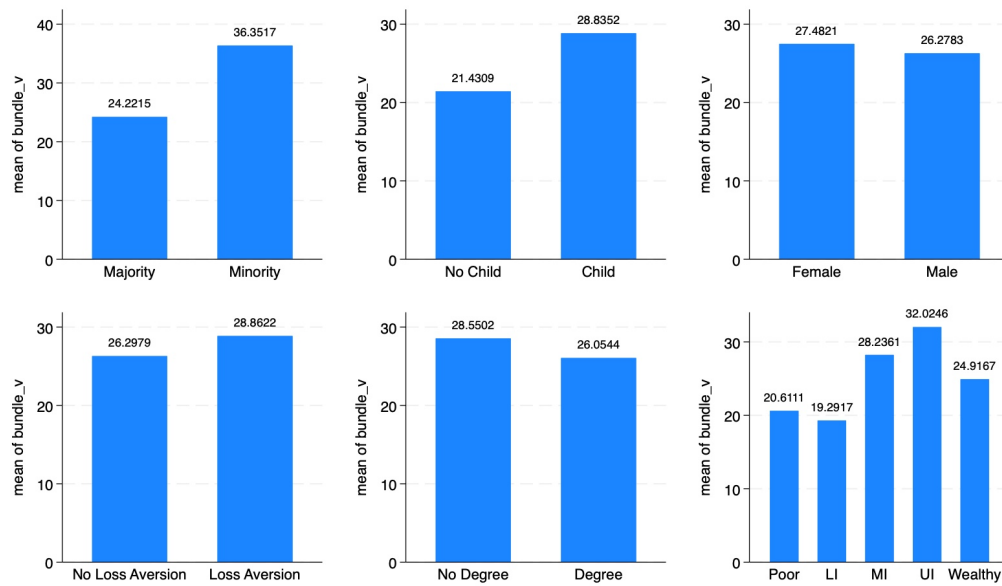


Figure A.1: Bundle A Valuation

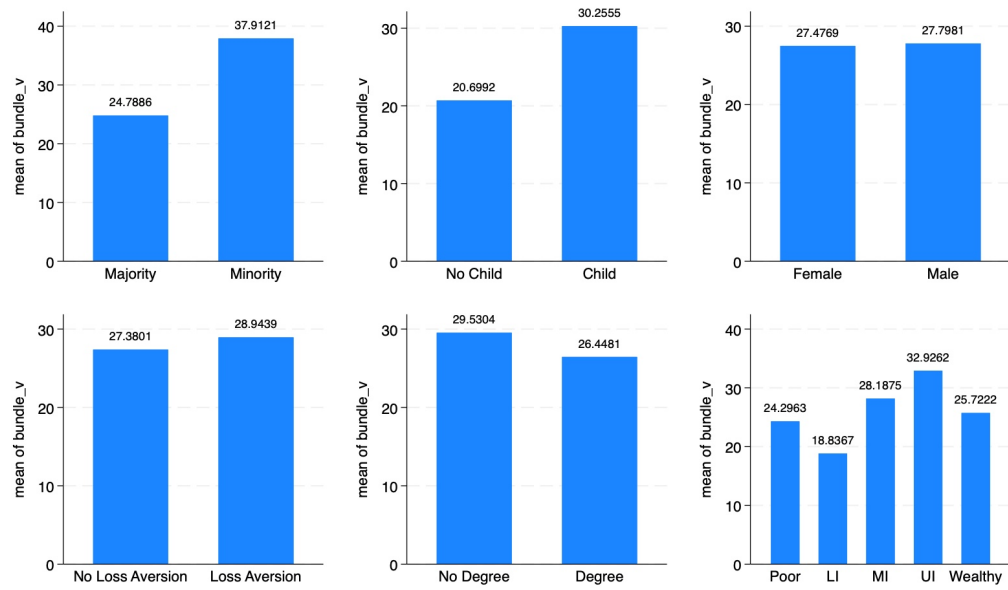


Figure A.2: Bundle B Valuation

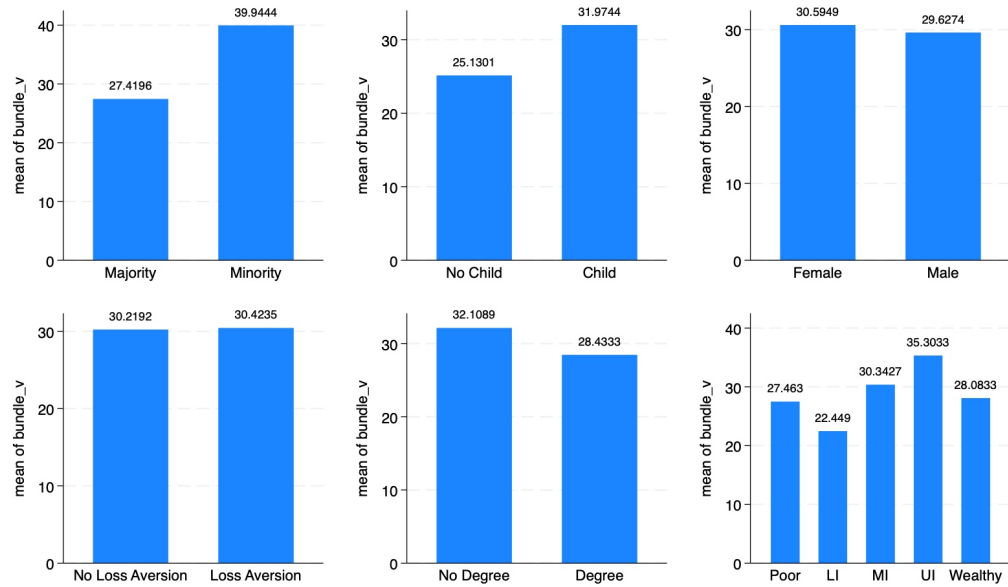


Figure A.3: Bundle C Valuation

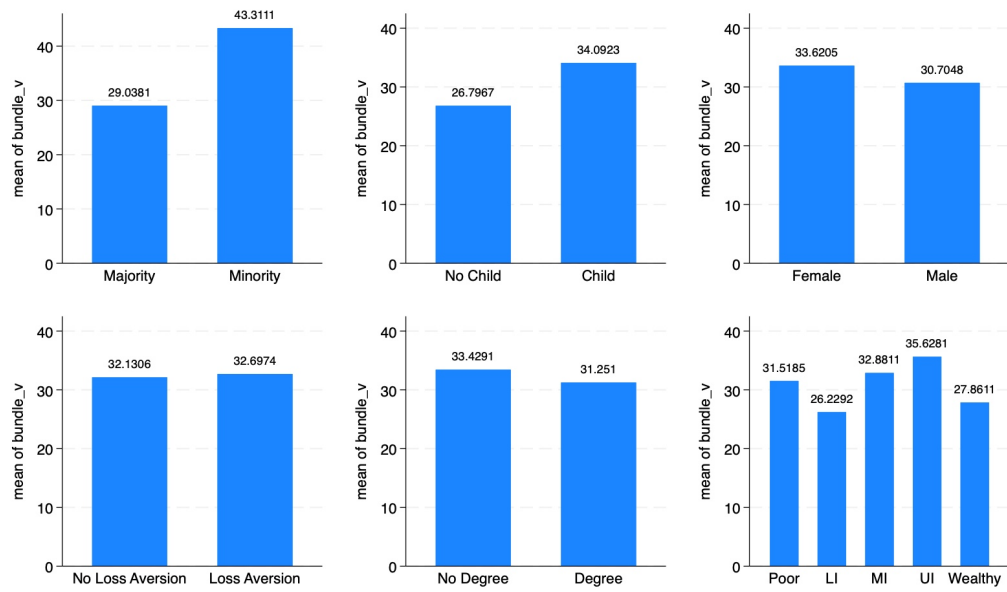


Figure A.4: Bundle D Valuation

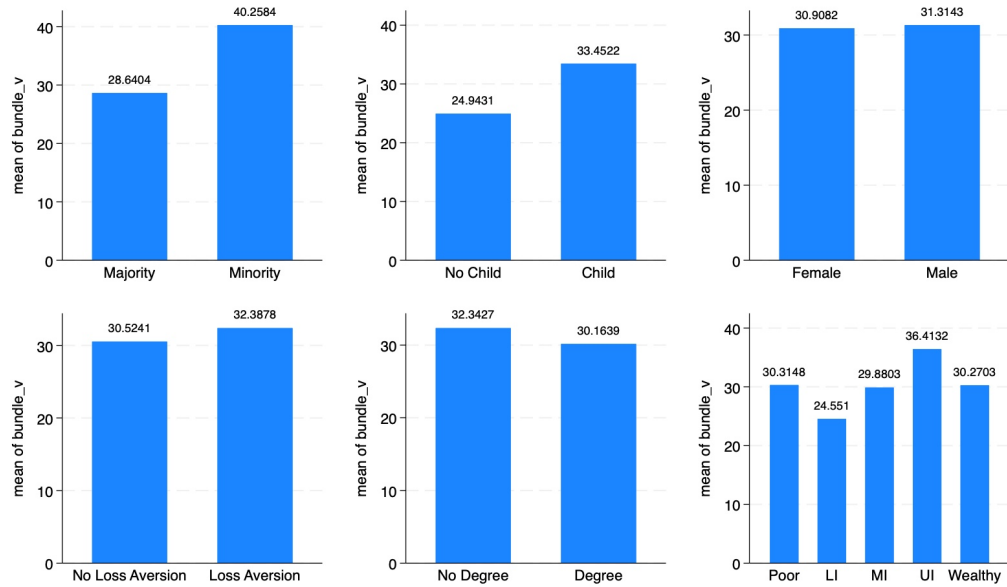


Figure A.5: Bundle E Valuation

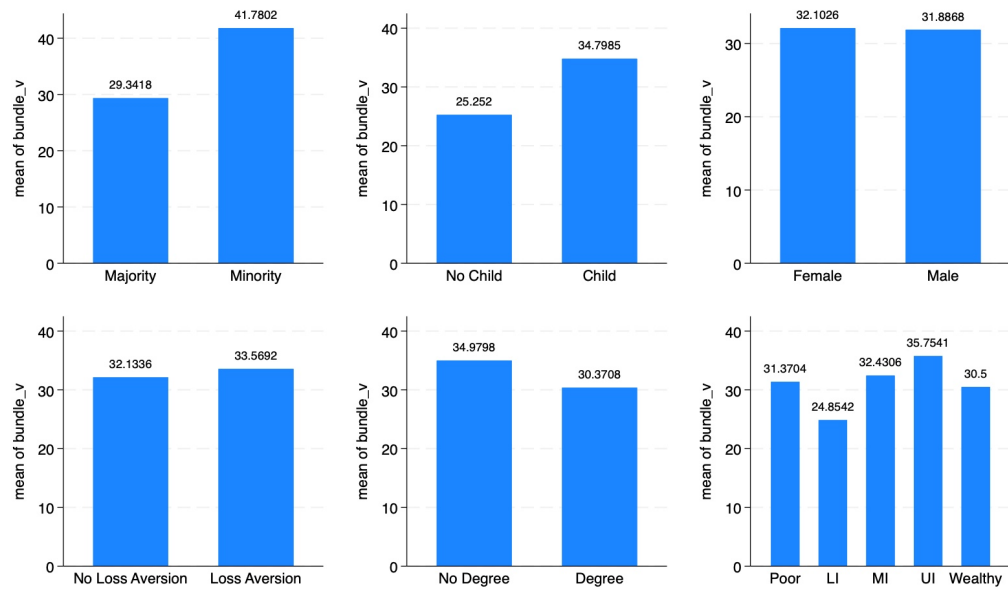


Figure A.6: Bundle F Valuation

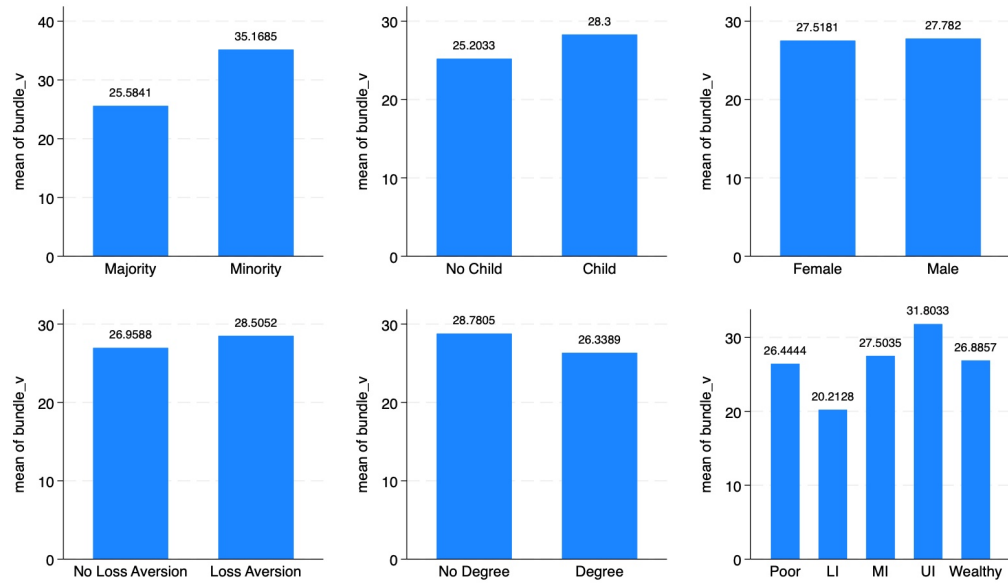


Figure A.7: Bundle G Valuation

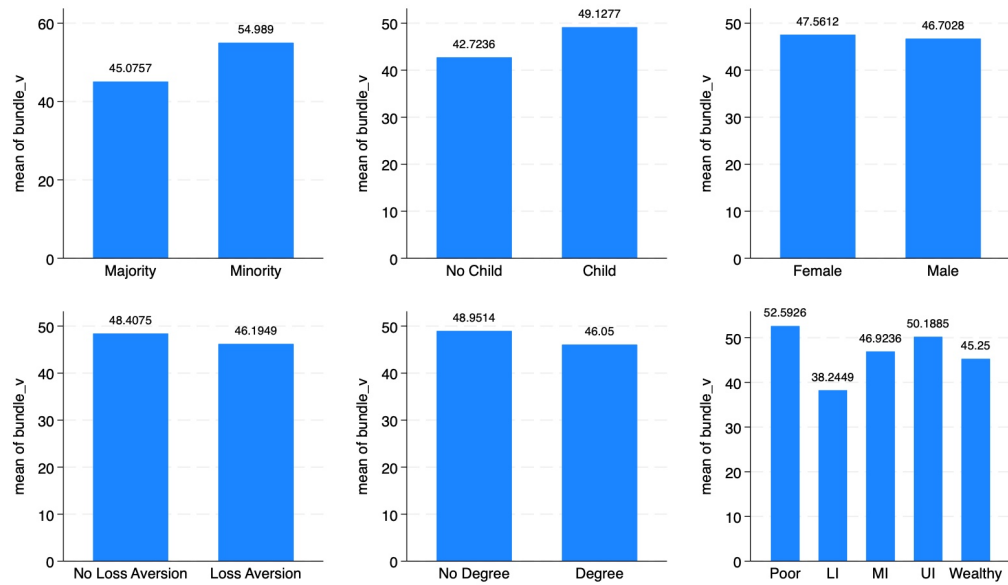


Figure A.8: Bundle H Valuation

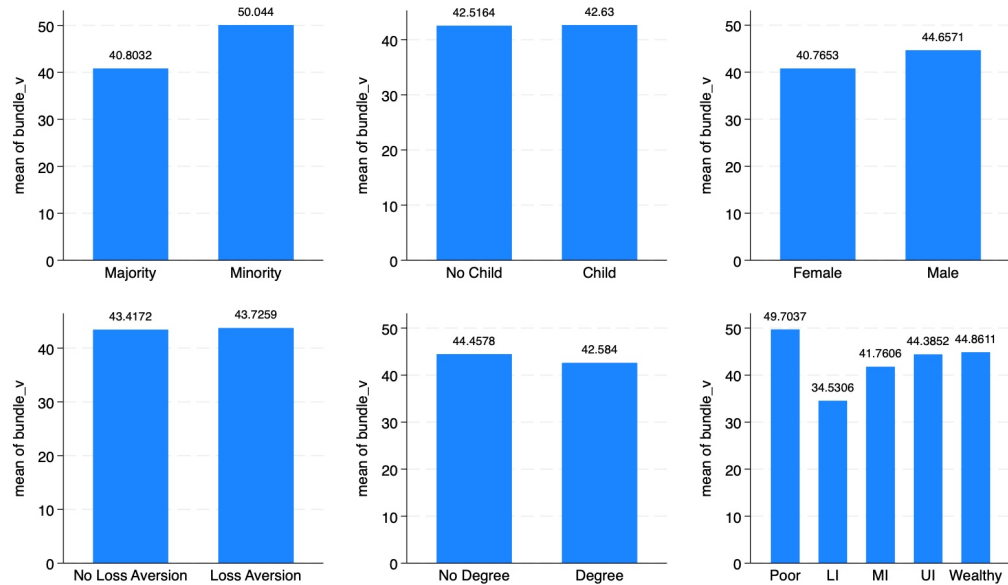


Figure A.9: Bundle I Valuation

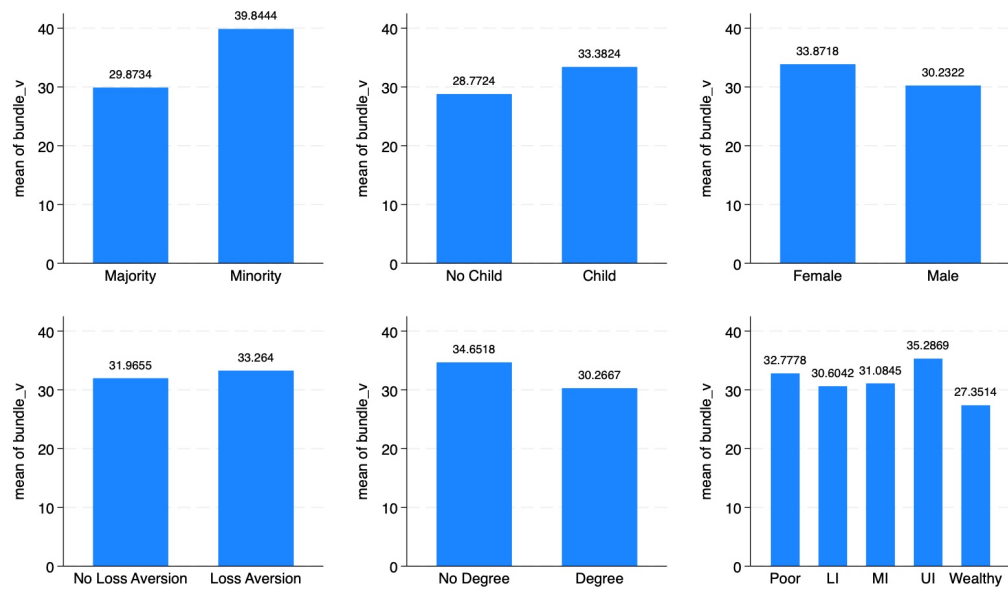


Figure A.10: Bundle J Valuation

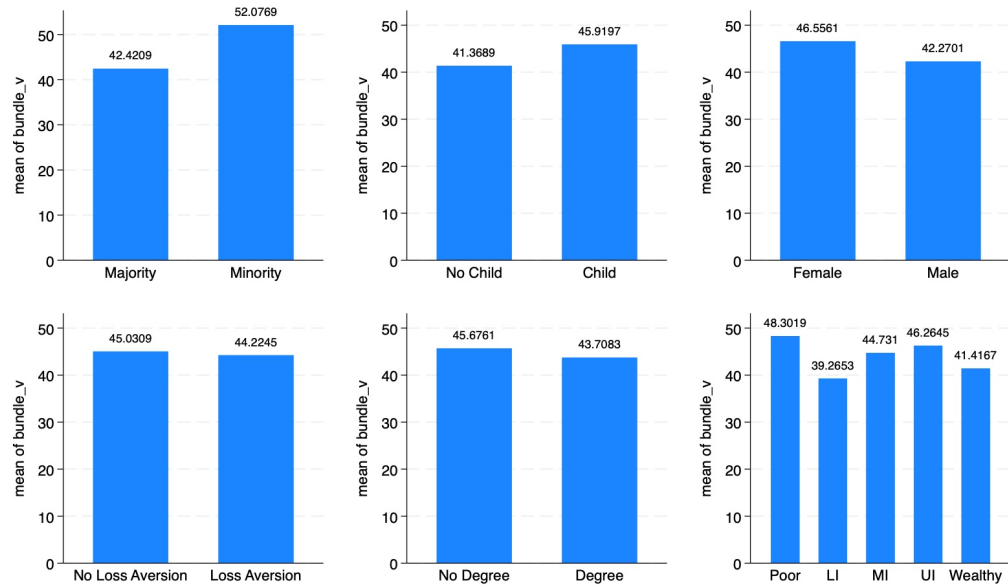


Figure A.11: Bundle K Valuation

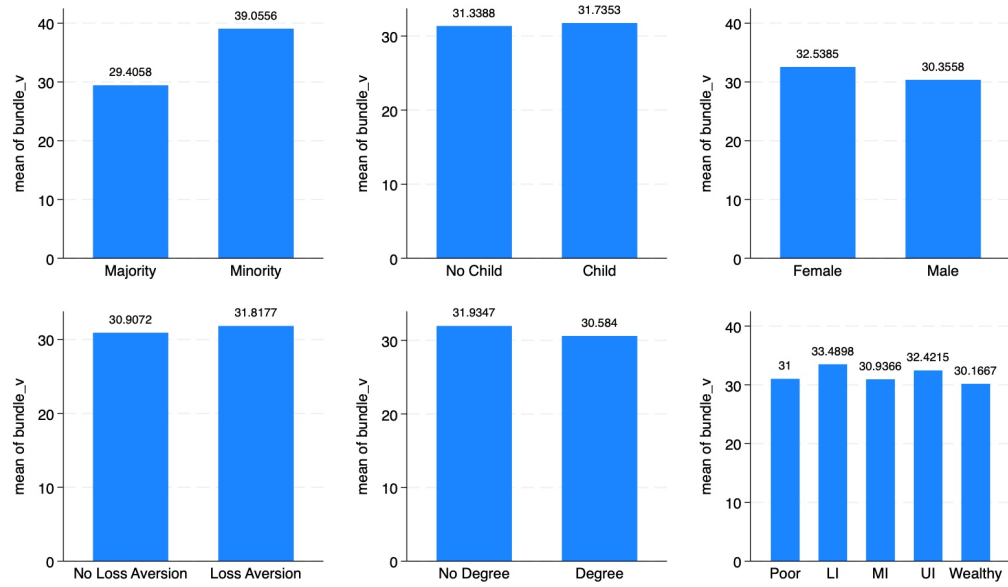


Figure A.12: Bundle L Valuation

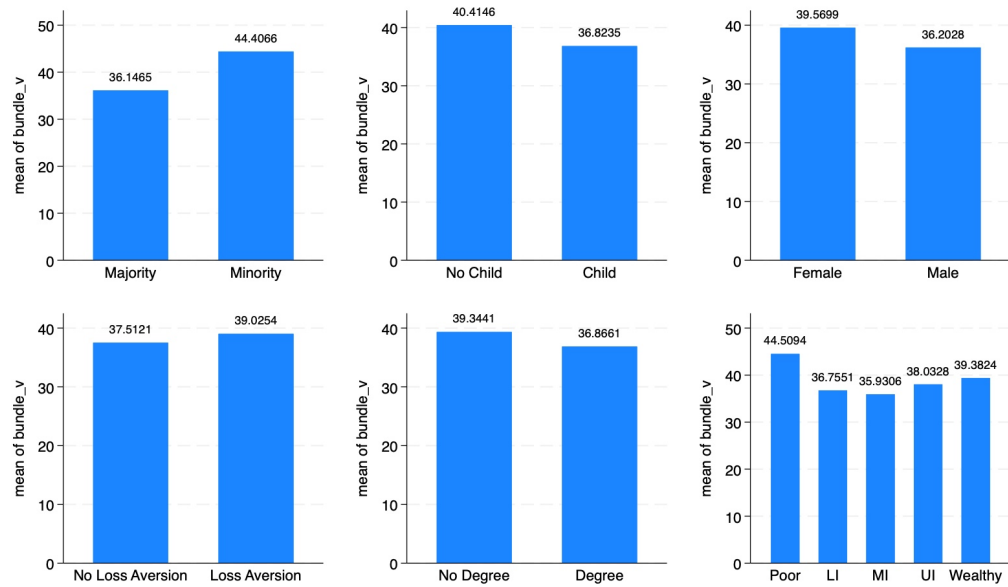


Figure A.13: Bundle M Valuation

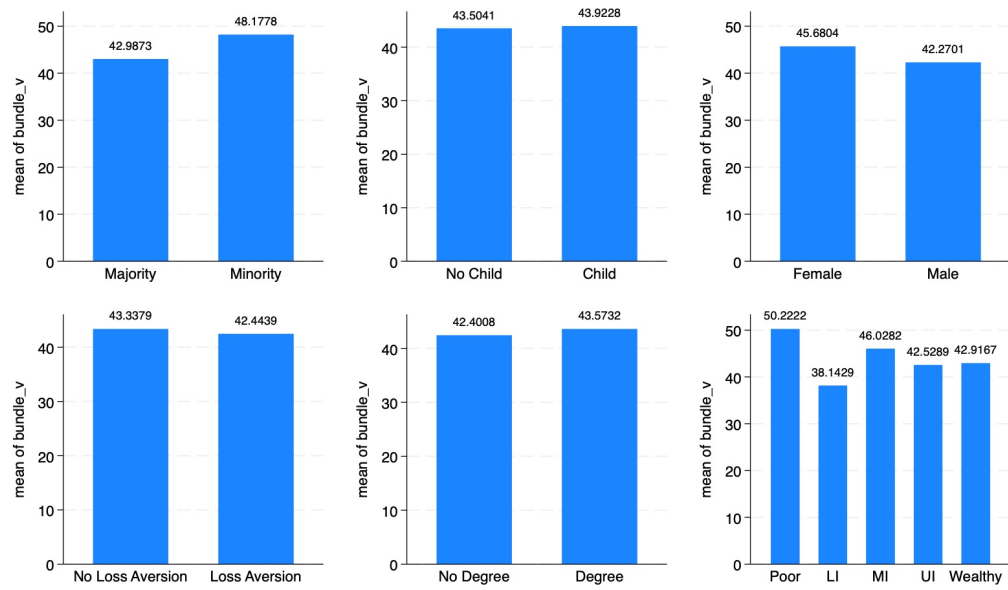


Figure A.14: Bundle N Valuation

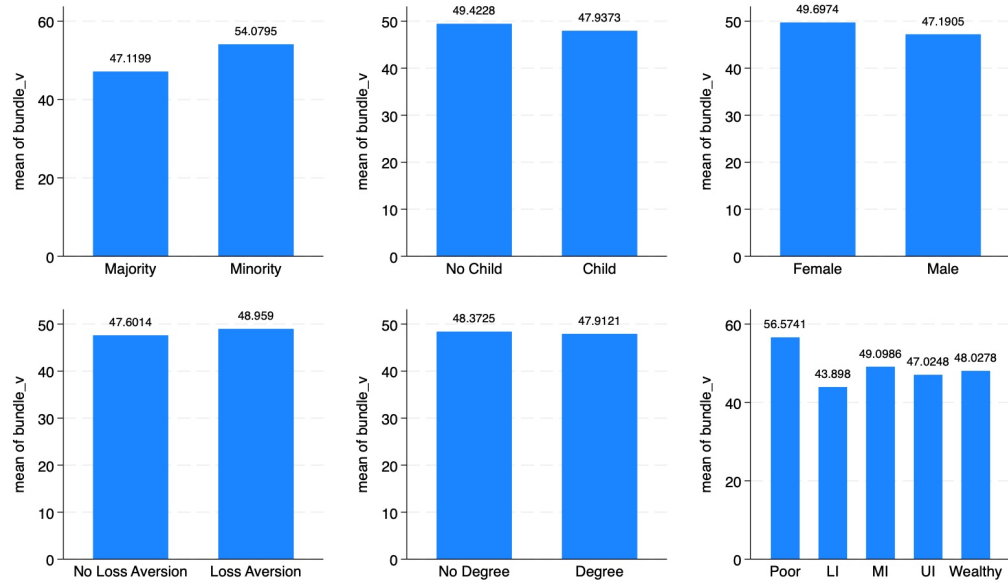


Figure A.15: Bundle O Valuation

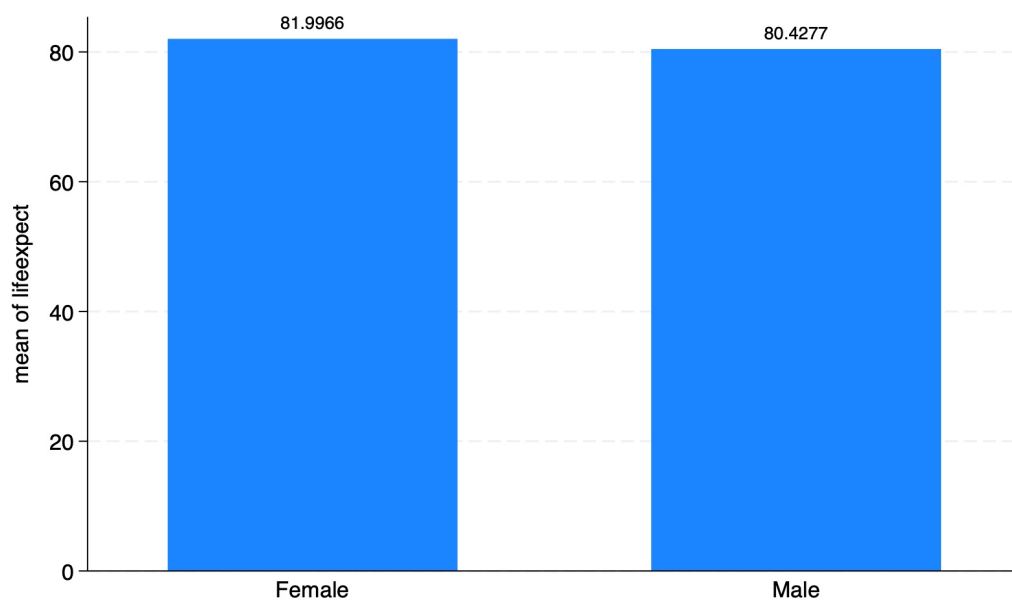


Figure A.16: Life Expectancy by Gender

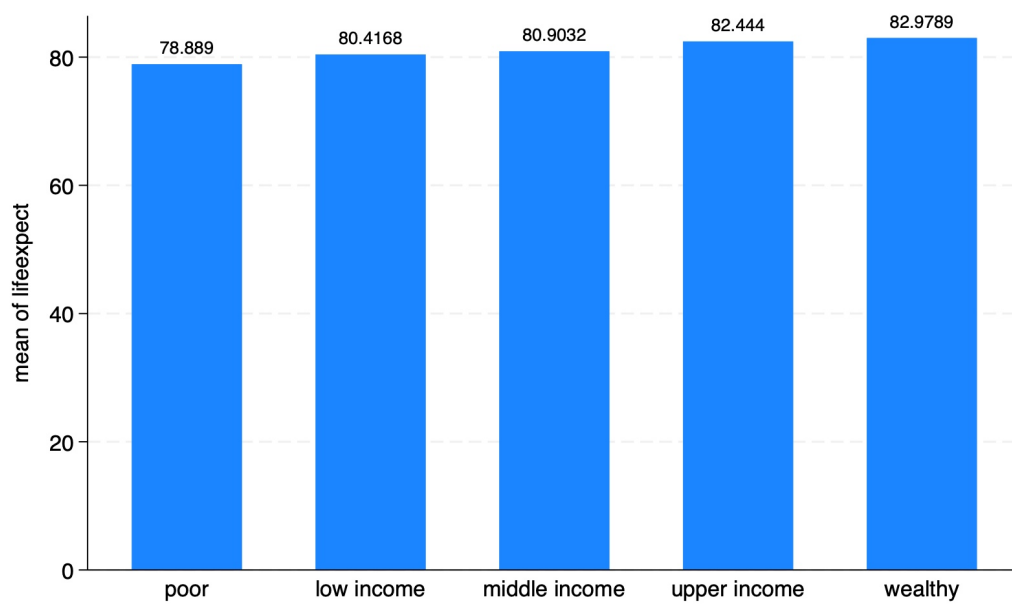


Figure A.17: Life Expectancy by Income

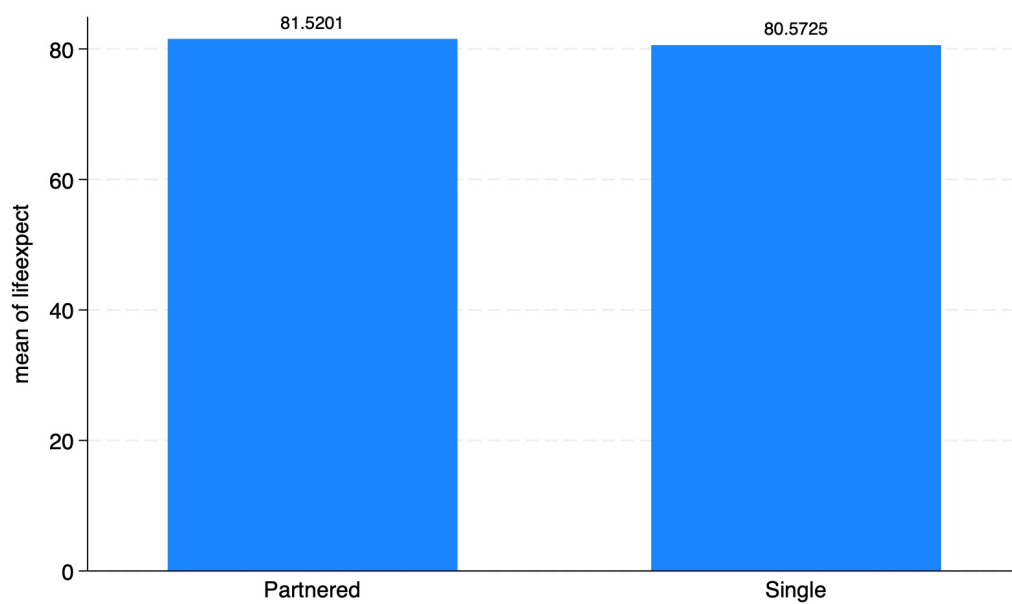


Figure A.18: Life Expectancy by Partner

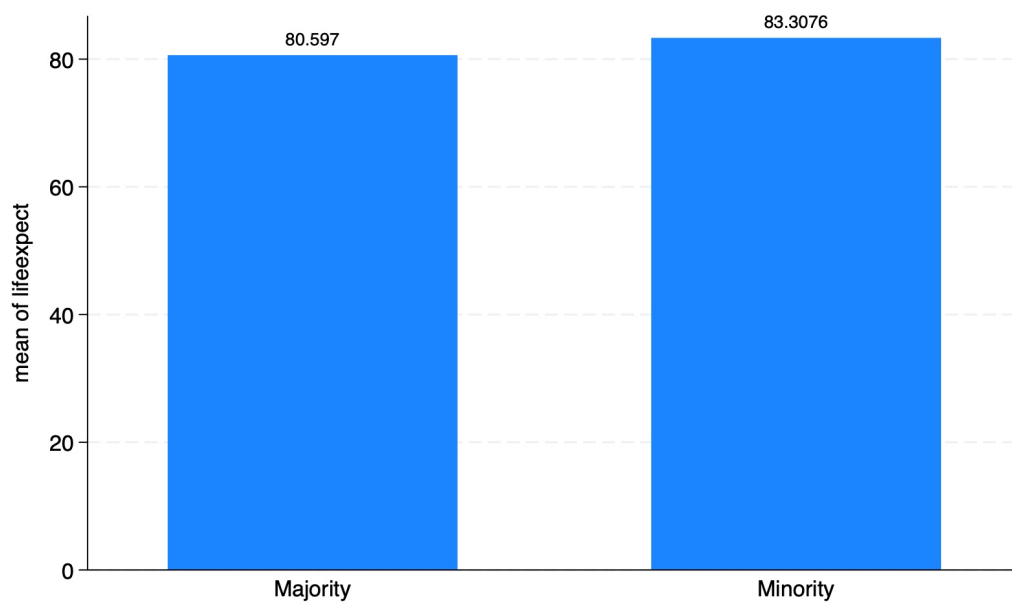


Figure A.19: Life Expectancy by Race

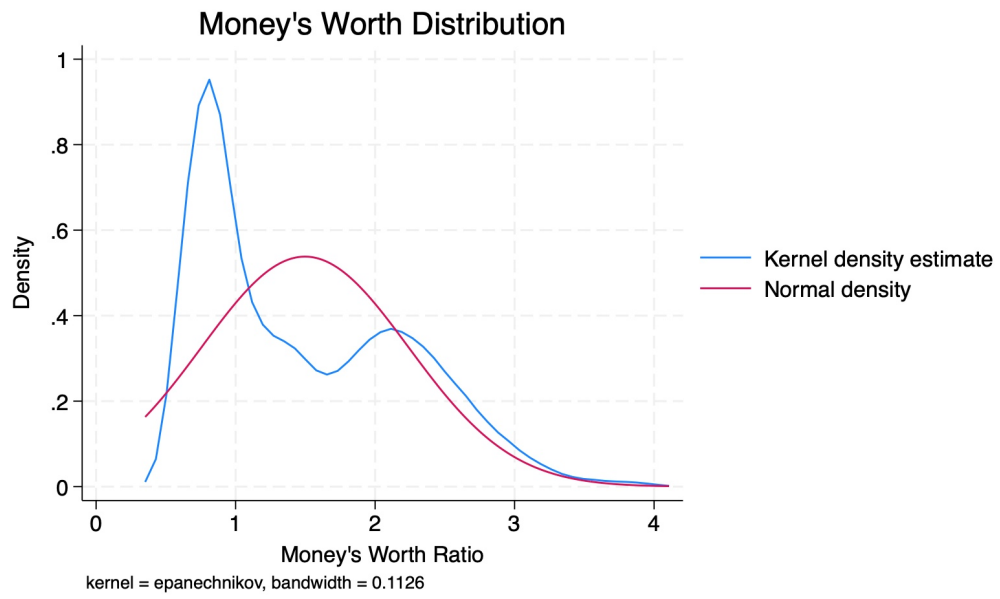


Figure A.20: Money's Worth Ratio by Total Sample

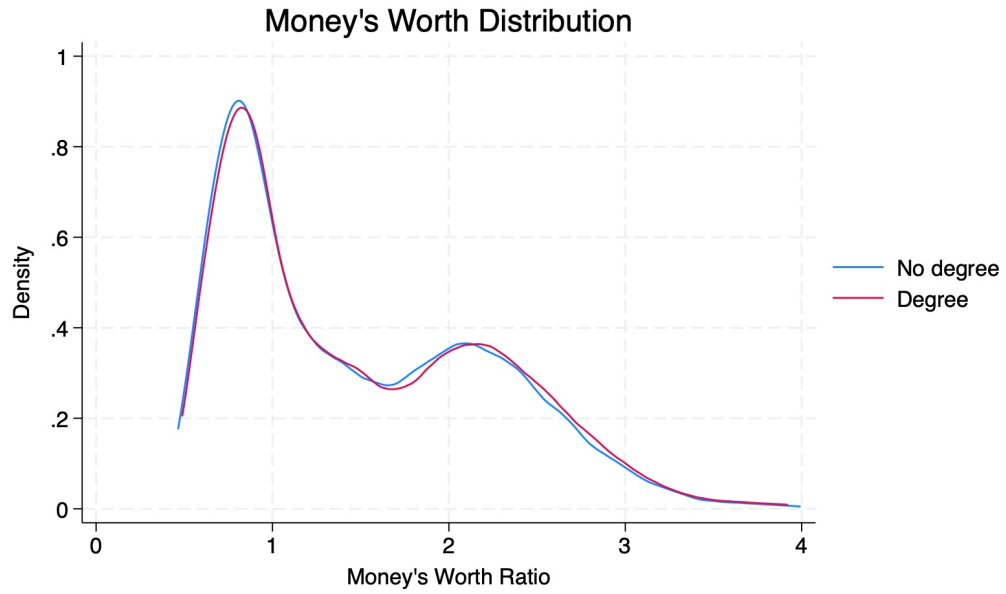


Figure A.21: Money's Worth Ratio by Degree

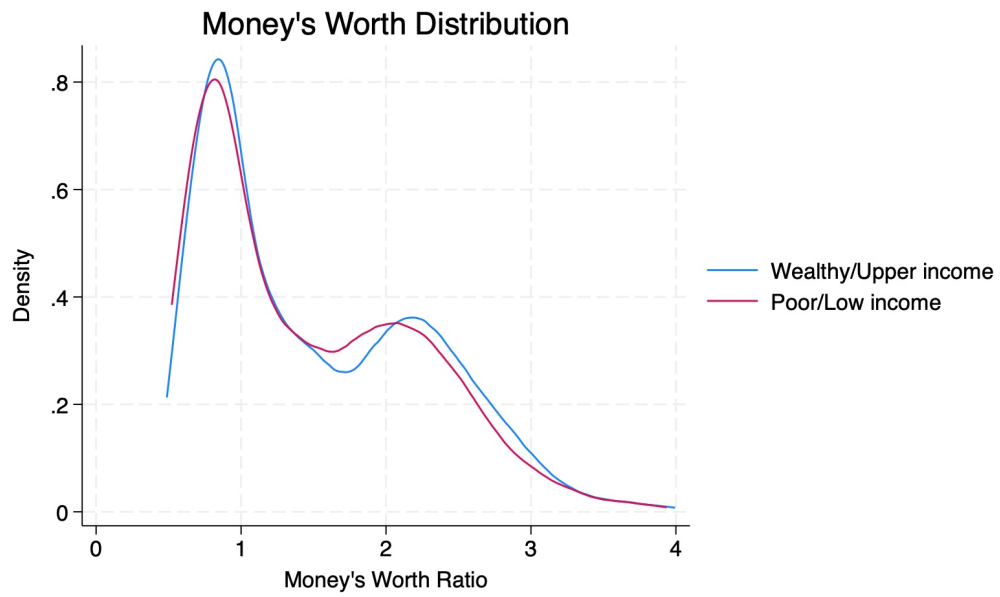


Figure A.22: Money's Worth Ratio by Income

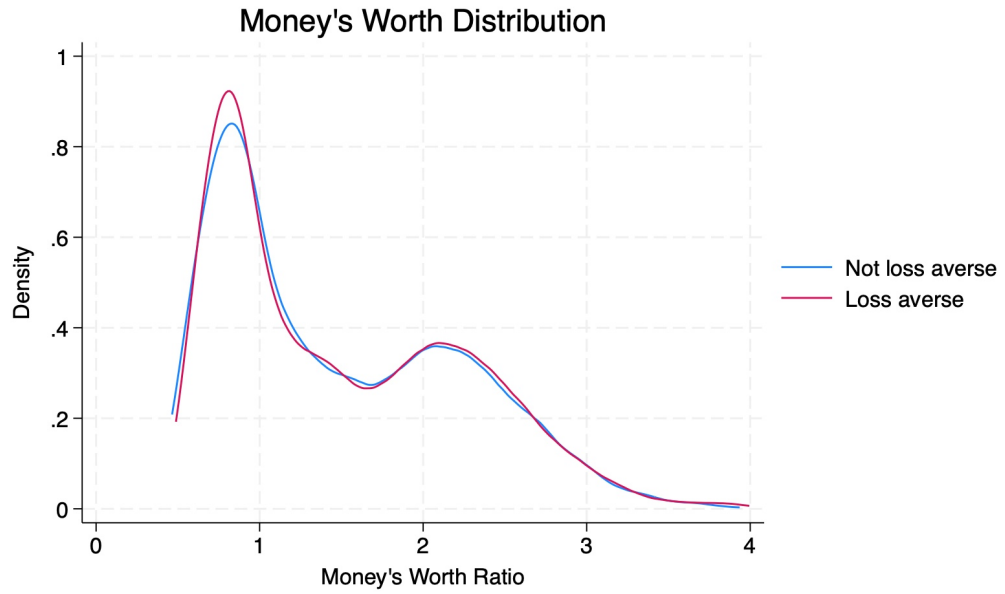


Figure A.23: Money's Worth Ratio by Loss Aversion

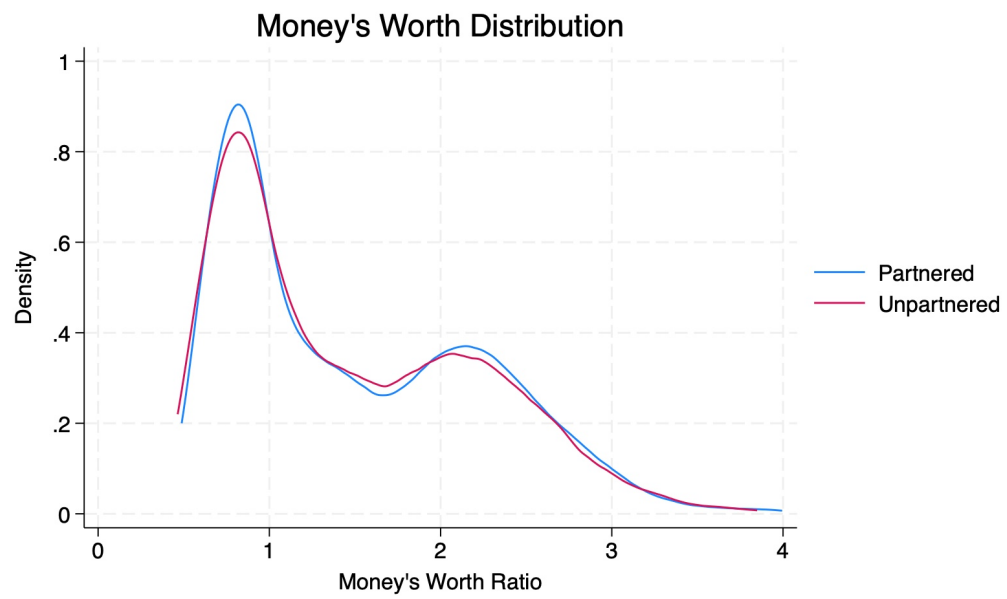


Figure A.24: Money's Worth Ratio by Partner Status

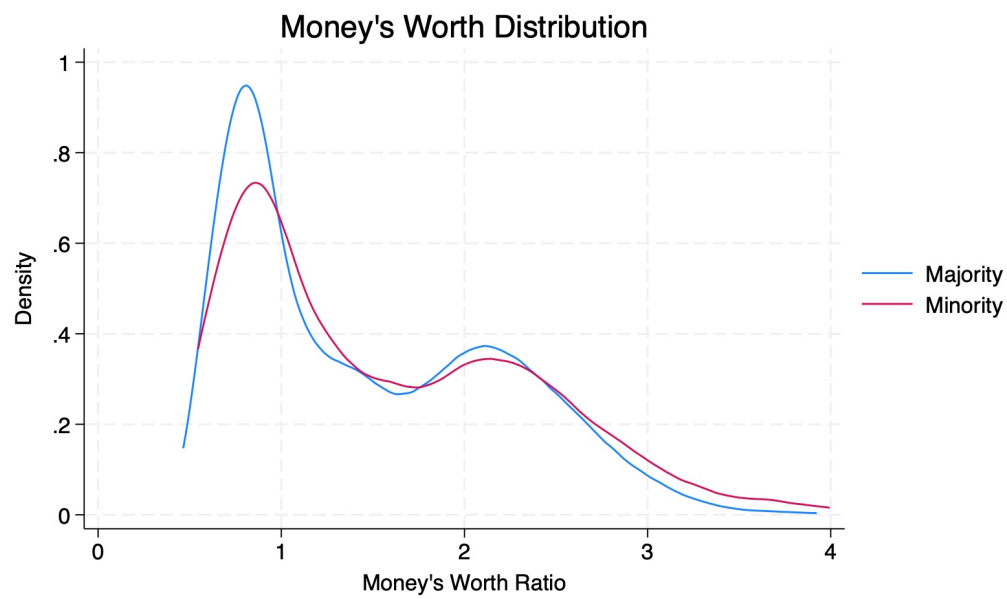


Figure A.25: Money's Worth Ratio by Race

Bundle A, NPV = \$73,219.65 (-\$26,780.35)

Start Age 72

Monthly Payments Start at \$300 (\$3600 Per Year)

No Annual Increase in Payments

10-Year Period Guarantee

Figure A.26: Bundle A Traits and NPV

Bundle B, NPV = \$71,252.18 (+\$28,747.82)

Start Age 72

Monthly Payments Start at \$300 (\$3600 Per Year)

No Annual Increase in Payments

Survivor Guarantee

Figure A.27: Bundle B Traits and NPV

Bundle C, NPV = \$78,000.24 (-\$21,999.76)

Start Age 68

Monthly Payments Start at \$300 (\$3600 Per Year)

No Annual Increase in Payments

10-Year Period Guarantee

Figure A.28: Bundle C Traits and NPV

Bundle D, NPV = \$76,988.21 (+\$23,011.79)

Start Age 68

Monthly Payments Start at \$300 (\$3600 Per Year)

No Annual Increase in Payments

Survivor Guarantee

Figure A.29: Bundle D Traits and NPV

Bundle E, NPV = \$97,626.20 (-\$2,373.80)

Start Age 72

Monthly Payments Start at \$400 (\$4800 Per Year)

No Annual Increase in Payments

10-Year Period Guarantee

Figure A.30: Bundle E Traits and NPV

Bundle F, NPV = \$84,695.58 (+15,304.42)

Start Age 72

Monthly Payments Start at \$400 (\$4800 Per Year)

No Annual Increase in Payments

Survivor Guarantee

Figure A.31: Bundle F Traits and NPV

Bundle G, NPV = \$102,650.95

Start Age 68

Monthly Payments Start at \$400 (\$4800 Per Year)

No Annual Increase in Payments

No Guarantee

Figure A.32: Bundle G Traits and NPV

Bundle H, NPV = \$137,633.80

Start Age 65

Monthly Payments Start at \$500 (\$6000 Per Year)

No Annual Increase in Payments

Survivor Guarantee

Figure A.33: Bundle H Traits and NPV

Bundle I, NPV = \$138,493.70

Start Age 65

Monthly Payments Start at \$500 (\$6000 Per Year)

No Annual Increase in Payments

10-Year Period Guarantee

Figure A.34: Bundle I Traits and NPV

Bundle J, NPV = \$159,227.53

Start Age 72

Monthly Payments Start at \$300 (\$3600 Per Year)

\$300 Annual Increase in Payments

10-Year Period Guarantee

Figure A.35: Bundle J Traits and NPV

Bundle K, NPV = \$181,398.67

Start Age 72

Monthly Payments Start at \$500 (\$6000 Per Year)

\$300 Annual Increase in Payments

Survivor Guarantee

Figure A.36: Bundle K Traits and NPV

Bundle L, NPV = \$201,173.24

Start Age 65

Monthly Payments Start at \$300 (\$3600 Per Year)

\$300 Annual Increase in Payments

No Guarantee

Figure A.37: Bundle L Traits and NPV

Bundle M, NPV = \$222,664.80

Start Age 65

Monthly Payments Start at \$400 (\$4800 Per Year)

\$300 Annual Increase in Payments

No Guarantee

Figure A.38: Bundle M Traits and NPV

Bundle N, NPV = \$252,317.89

Start Age 68

Monthly Payments Start at \$600 (\$7200 Per Year)

\$300 Annual Increase in Payments

No Guarantee

Figure A.39: Bundle N Traits and NPV

Bundle O, NPV = \$277,718.32

Start Age 65

Monthly Payments Start at \$600 (\$7200 Per Year)

\$300 Annual Increase in Payments

No Guarantee

Figure A.40: Money's Worth Ratio by Race