Unintended Consequences of Minimum Annuity Laws: An Experimental Study

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Abstract

The need to ensure that people have adequate savings for retirement has prompted debate among regulators and academics. Certain countries have implemented or are considering implementing mandatory minimum annuity laws (e.g., Singapore and Israel), whereas others have repealed or are considering repealing such legislation (e.g., the U.K.). We investigate the introduction as well as the repeal of a regulatory change; "mandatory minimum annuity rules" using a laboratory experiment and two surveys. Demand for annuities vs. a lump sum is sensitive to the mandatory-minimum mechanism and consistent with anchoring to the signal reflected in the requirement. Our results indicate that imposing a mandatory minimum may have unintended consequences: such laws may fail to provide an increase in the demand for annuities and may even reduce it. The outcome is sensitive to the relation between the level of the mandatory minimum and anticipated consumption (i.e., future financial need). Furthermore, the repeal of mandatory minimum annuity laws may not restore the demand for annuities to the pre-law level.

Keywords: Mandatory Annuity, Anchoring, Household Finance

1. Introduction

The combined trends of lengthening life expectancy, occupational instability, and the steady erosion of government support for retirement plans raise many research questions related to ensuring adequate retirement resources. An important decision that individuals make upon retirement and may affect their resources during their retirement phase is whether to annuitize some of their long term savings. An annuity is a product, designed to insure against longevity risk, paying monthly (or yearly) pension for the rest of the retiree's life. Even though annuities provide insurance against longevity risk, the academic empirical evidence document a very limited use of them to the extent that this limited use is named in the academic literature the "Annuity Puzzle" (for further discussion of the puzzle see Benartzi, Previtero, and Thaler, (2011)) and others.) [1] A potential market failure may call for a regulatory intervention, such as imposing a minimum annuity law.

Regulators around the globe disagree regarding the need for mandatory minimum annuity laws. The United Kingdom had a minimum annuity law that was repealed in 2014. In contrast, Israel adopted a mandatory minimum annuity in 2008. Other countries have a range of policies regarding the decumulation phase; for instance, in Singapore, a combination of a lump sum and a deferred annuity (provided by the government) is mandatory (Fong et al. (2011)). India mandates

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[1] Starting with Yaari's (1965) theoretical work, a vast literature suggests that annuities have substantial value, and under some assumptions, retirees would use annuities on retirement, in contrast to empirical findings that many retirees prefer the lump sum in practice (e.g., Benartzi et al., 2011).Several reasons for not choosing an annuity versus a lump sum have been identified, such as the complexity of the decision (Brown, 2007; Brown, Kapteyn, Luttmer, Mitchell and Samek 2017), acquiescence and default biases (Bütler and Teppa, 2005; Agnew, Anderson, Gerlach, and Szykman, 2008), difficulty in making irreversible decisions (Brown and Warshawsky, 2001), framing (Benartzi, Previtero, and Thaler, 2011; Beshears, Choi, Laibson, Madrian, and Zeldes, 2014; Brown, Kling, Mullainathan, and Wrobel, 2008; Goldstein, Hershfield, and Benartzi, 2016), difficulty parting with accumulated money (Benartzi et al., 2011), mental accounting (Benartzi et al., 2011; Brown, 2007), ambiguity regarding one's own life expectancy (d'Albis and Thibault, 2012; V.K. Smith, Taylor, Sloan, Johnson, and Desvousges, 2001; Payne, Sagara, Shu, Appelt, and Johnson, 2013), and heuristics such as "insurance is only for bad events" (Brown, 2007).

annuitization of at least 40 percent of pension accumulations. The Netherlands mandates full annuitization at retirement, Sweden requires an annuity for a minimum period, and Chile offers only annuities or phased withdrawals. Other countries such as the United States and Denmark have no restrictions on retirees' lump-sum withdrawals, allowing a full lump-sum cash-out at retirement[2]. This variety of approaches prompted us to investigate the demand for annuities as a result of regulatory changes in minimum annuity laws. Whereas substantial attention has been devoted to studying the direct connection between behavioral biases and the choice of an annuity, our focus is on behavioral biases that may result from regulatory intervention.

Our goal in this paper is to investigate both the initiation and repeal of a mandatory minimal annuity law in a comparable way. Specifically, we use two comprehensive surveys (both with students and representative populations) and a laboratory experiments with performance – dependent incentives, to study both individuals' response to an initiation (repeal) of minimum mandatory law and the factors affecting their response as well as the possibility that an initiation and a repeal of such law may lead to unintended consequences.

We find that the initiation of mandatory annuitization laws shifts the distribution of chosen annuities towards higher levels. Regardless of whether the participants were students or retirement-age adults, our results suggest that the mandatory minimum annuity was used as a signal, leading to an anchor that on average increases the annuity amounts chosen, given the parameters we use. We also provide evidence of unintended consequences in the form of decrease in annuitization rates among high income (consumption perception) individuals[3]. We next assess the results of a

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[2] A review of annuitization policies world-wide is available at Mitchell et al. (2011).
[3] Previous literature such as Fuster et al. (2008), Brown (2003)) examine mandatory annuitization and suggest that it benefits most households.

repeal in mandatory annuity laws, showing that the distribution of annuities does not shift back to its original levels.

Our paper contributes to the literature that investigates the effect of regulatory changes, the literature that investigates long-term savings decisions and annuity choices, and the literature that discusses behavioral biases and individuals' long-term savings decisions, specifically anchoring.[4]

Our findings here link to a broader literature on regulations' unintended consequences related to different regulatory interventions. (e.g., Sharkey (2005) study the consequences of malpractice damage caps, Murphy (2013) discusses unintended consequences of regulating banking bonuses, Jensen et al. (2013) examine climate policies, Kennedy et al. (1998) discuss disclosure of contingent environmental liabilities, Robbennolt (2002) studies punitive damage caps and Mugerman and Ofir (2018) Provides evidence for anchoring towards regulatory limits in the mortgage market). The relevant literature suggests that regulators are either unaware or underestimate the effect of behavioral biases on the effectiveness of regulation. In the context of pension regulation such consequences can have detrimental effects on retirees' welfare.

To the best of our knowledge it is the first research to study both the effect of implementing regulation and the effect of its repeal. Regulations may be repealed for a variety of reasons ranging from political pressure to a change in the economic fundamentals. Often regulations are repealed because their implementation was meant to be temporary in the first place, and they were merely used as pilots. Typically, regulators view a regulatory policy as perfectly reversible, i.e., repealing

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[4] The anchoring effect (Tversky and Kahneman, 1974) refers to an estimation heuristic in which a person's final estimation of some value is biased by starting from an initial salient value (the "anchor"), possibly derived from the formulation of the problem or from a partial calculation, and then not adjusting sufficiently away from that anchor. The economics literature contains many illustrations of the anchoring effect. E.g negotiation, in stock prices, acquisition activities (Baker, Pan, and Wurgler, 2012), savings schemes (Benartzi and Thaler, 2007), and 401(k) pension investment choices (Choi, Laibson, Mardrian, and Metrick, 2004).

it would restores the economy to the same state that prevailed before its implementation. Such a view would make regulators rather at ease with the experimentation of policies that can be repealed if found ineffective or counter-effective. Our finding suggests that this view is rather optimistic. Because of the anchoring effect a repeal of a policy may not be memoryless and the effect of the policy may persist.

This paper continues as follows: In Section 2 we describe our methodology and design, in Section 3 we present our survey, in Section 4 we describe our laboratory experiment and its results, and in Section 5 we discuss our results.

2. Methodology and Design

To investigate a regulatory change such as mandatory annuity under various conditions there are more than a single potential methodology: (1) data analysis, (2) field experiment, (3) survey, and (4) laboratory experiment. Yet, due to a lack of satisfactory set of data that covers the entire individual portfolios of a sample of retirees during a period covering initiation and repeal of a law, we were compelled to use alternative methodologies. Our study therefore builds on a controlled laboratory experiment and two surveys. Surveys offer several advantages that other methodologies don't: (1) they facilitated gathering information regarding perceptions; (2) they allow for the recruiting of a substantial number of participants; (3) a verified representative sample of the population who were close to retirement could be used, an important point given the complexity of the annuitization decision; and (4) two populations could be compared.

The laboratory experiment was aimed at better understanding the cognitive determinants of the decision to annuitize. Its advantages, beyond those of surveys, are that (1) we could better control the information conditions and the exogenous stochastic processes. Specifically we could

capture the effect of anticipated consumption (i.e., future financial need) on the choices; (2) it enabled us to validate some of the previous survey results using a different research method and reveal the driving force behind some of the decisions that participants express in the survey; (3) It allows us to repeat the decision dilemma, for the same individual, to test for a possible learning effect; and (4) Monetary rewards related to the performance can be paid to create a more authentic decision environment.[5] For both research methods (survey and laboratory experiment), we used a between-subjects design, in which each subject was exposed to only one of six conditions. In both methods, causal estimates were obtained by comparing the behavior of participants across the conditions.

We now discuss the tasks that participants were presented with in each of the two methodologies we used. The survey respondents (362 students in the first survey and 886 participants in an age representative survey) were asked to divide a total sum of money that was saved for retirement and could be paid either as a monthly annuity or a lump sum (an amount of money paid immediately upon retirement). Participants were assigned to one of three conditions. In the first condition, respondents were asked to split their (virtual) accumulated funds (of NIS[6] 2 million) between an annuity and a lump sum with no limitations (control condition). In the second and third conditions, we added information regarding a regulatory requirement: either a mandatory minimum annuity law that was in force (Condition 2) or repealed (Condition 3).

In the laboratory experiment, 277 participants were also asked in two rounds, to allocate a sum of money saved for retirement between an annuity and a lump sum, under different regulatory requirements. We controlled the information that was given to the participants about expected

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[5] For a discussion about the use of financial incentives in the laboratory, see Camerer, Hogarth, Budescu, and Eckel (1999).
[6] New Israeli shekels. As of December 2017, USD worth NIS 3.5.

consumption during their lifetimes (low vs. high consumption) and their life expectancy, which allowed us to draw a richer set of conclusions with respect to the mandatory minimum annuity law. In particular, we created two expected consumption groups for each condition.[7]

3. Surveys

3.1 Detailed Design

The questionnaire was administered twice—once with a student sample and once with a representative sample of 50- to 70-year-olds, a group close to retirement.[8] All respondents were asked to divide a (virtual) sum of money that was saved for retirement between a monthly annuity and a lump sum to be paid immediately on retirement. Participants were randomly assigned to one of three conditions. In Condition 1, the control condition, respondents were asked to split their (virtual) funds between an annuity and a lump sum with no restriction. In Conditions 2 and 3 we added information regarding a regulatory requirement: a mandatory minimum annuity law that was in force (Condition 2) or had been repealed (Condition 3). All participants were asked to allocate their retirement savings, which they were told amounted to NIS 2 million.[9] We also specified a monthly conversion factor of 200 (a conversion factor is the value that determines how much annuity a retiree is able to purchase from a certain lump sum; it is generally specified in terms of either years or months).[10]

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[7] Conditions were the same as in the surveys. The consumption groups were basically an evenly distributed lottery of future consumption. The high-consumption group had expected consumption distributed from the values ZUZ 8,000, ZUZ 9,000, and ZUZ 10,000. The low-consumption group had expected consumption distributed from the values ZUZ 3,000, ZUZ 4,000, and ZUZ 5,000 (ZUZ was an experimental currency).

[8] Previous studies such as Heimer, Myrseth, and Schoenle (2015) demonstrated differences in perception of life expectancy in different age groups, hence motivating us to examine perceptions separately for students and an older population.

[9] Equal to approximately U.S. $500,000; we chose the amount according to an analysis of the average household wage and reasonable long-term rates of return.

[10] In Israel conversion factors are specified in terms of months. A 200 monthly conversion factor equals a 16.67 yearly conversion factor.

We asked participants the following question:

*At retirement, a retiree can generally choose between an **annuity** and **a lump-sum** withdrawal from his or her pension savings, with respect to each retiree's conversion factor. Assume that you have saved NIS 2 million and your conversion factor is 200. What does 200 mean? It means that if you choose an annuity of NIS 1,000[11] a month, the accumulation required for the annuity is $1,000 * 200 = 200,000$ and the remainder can be withdrawn as a lump-sum amount of NIS 1.8 million (2,000,000−200,000). In these terms, what is the __monthly__ annuity you would choose if you were to retire today (you would receive the remaining amount as a lump sum today) _____"*

In Condition 2 we added the following statement: "*According to State of Israel laws, there is a mandatory minimum annuity of NIS 4,000 a month.*" The rest of the wording was the same as in Condition 1. In Condition 3 we added the sentence "*In the past, State of Israel laws stated a mandatory minimum annuity of NIS 4,000 a month; these laws were recently repealed.*" Again, the rest of the wording remained the same as in Condition 1.

In addition, we asked participants about their own life expectancy estimations and collected demographic and self-assessed health information (including smoking). Most of the questions were multiple choice but some were open ended (e.g., occupation), and some included a scale of responses (i.e., probabilities).

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[11] One can argue that the specific example we provided in the instructions may influence choices. If that indeed the case, we expect that it will influence all 3 manipulations. Relatively few subjects, 3.27% of the representative sample and 3.31% of the students, chose exactly 1,000. Further, in the lab experiment we offered a range of different examples.

3.2 Participants

The student sample consisted of 362 students ($n = 109$ in Condition 1; $n = 118$ in Condition 2; $n = 135$ in Condition 3; $M_{age} = 26.14$ years, $SD = 3.46$, range 19–54 years; 51% male, 49% female) who were recruited from the Hebrew University of Jerusalem and the College of Management Academic Studies in Israel.[12] To assess how seriously the respondents treated the questionnaire, they were asked to answer questions regarding life expectancy in Israel. The mean estimated life expectancy (for both males and females) was 79.6 years ($SD = 6.9$) and the median answer was 80 years. The proximity of the estimated values to the real-life expectancy at birth in Israel according to the Central Bureau of Statistics (men: 80.3 years, women: 83.9 years) can be an indicator that the survey respondents took the survey seriously and paid attention to the questions.

The age-representative sample was drawn from respondents to an online survey conducted by a research company of 886 Israeli residents aged 50–70 years ($n = 324$ in Condition 1; $n = 258$ in Condition 2; $n = 304$ in Condition 3; 56% aged 50–60 years; 43% male, 57% female) in November 2016.[13] With regard to income, 30% reported that they earned more than the average income of the population, 32% earned the same as the average, and 38% earn less than the average.

This sample was also asked to estimate the mean life expectancy in Israel. Respondents' mean estimates were 76.9 years for women and 76 years for men ($Mdn = 84.5$ and 81 years, respectively), very close to the actual life expectancy at age 60 reported by the Central Bureau of Statistics of 83 years for men and 85.5 years for women.

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[12] A paper-and-pencil survey, administered during class time.
[13] The survey was administered by Geocartography using an online panel of voluntarily registered potential participants with a wide residential age distribution.

Table 1 displays the characteristics of the student sample and Table 2 the characteristics of the representative sample, by condition. The subgroups were very similar, both in demographic parameters and health perception.

[TABLE 1]

[TABLE 2]

3.3 Results

3.3.1 The Anchoring Effect

Fig. 1 shows the distribution of chosen annuities in the different conditions for the student sample and the representative sample. Participants chose higher annuities in Condition 2 (mandatory minimum annuity) and Condition 3 (mandatory minimum annuity repealed) than in Condition 1 (control group). Tables 3 and 4 show the proportion of participants in each sample who chose an annuity of NIS 0, NIS 4,000 (the mandatory minimum annuity), NIS 10,000 (the maximum possible annuity), and the adjusted NIS 4,000 in which all the annuities that were between 1 and 4,000 were set to 4,000. This was done because one could argue that the difference is not surprising and may have resulted from the technical fact that those who wanted initially to choose a value below the constraint, once the minimum annuity law was introduced, had to choose a higher value, the constraint. To test whether this drove results, we conducted an additional test. If there is no other effect, one would expect that the only observed change would be that those who initially wanted an annuity with a value below the constraint would have to change their choice to the constraint value. Hence, for the comparison, in the unconstrained condition, we assigned the constraint value for each observation that had a value below the constraint ("adjusted treatment"). If, for example, the choice was a value of NIS 2,000, we assigned it the value of NIS 4,000, the

minimum annuity law constraint. We called this value "adjusted 4,000." We compared the adjusted treatment to the treatment with the actual constraint introduced by the minimum annuity law.

[FIGURE 1]

[TABLE 3]

[TABLE 4]

As seen in Table 3, the proportion of student participants who chose an annuity of NIS 4,000 was significantly higher in Condition 2 (mandatory minimum annuity) than in the other conditions. Again, note that in Condition 2, choices were lower bounded at the value of 4,000, and hence all choices between NIS 0 and 4,000 were taken into account (adjusted 4,000 in Table 3) and that Condition 1 (control group) had a higher proportion of participants choosing that amount than Conditions 2 and 3. The mean annuity was highest in Condition 2. The median annuity was equal in Conditions 2 and 3 and higher than in Condition 1. The proportion who chose the maximum allowed annuity (in this questionnaire, NIS 10,000) was also highest in Condition 2, followed by Condition 3 and then Condition 1. The difference between Conditions 1 and 2 is statistically significant.

The mean results presented in Table 4 are similar. The proportion of the representative sample who chose an annuity between NIS 0 and 4,000 (adjusted 4,000 in Table 4) was highest in Condition 1, followed by Condition 3 and then Condition 2. The mean annuity was highest in Condition 2, followed by Condition 3 and then Condition 1. The difference between Conditions 1 and 3 is not statistically significant.

These results suggest that there was a shift of both students and retirement-age adults in Conditions 2 and 3, as the mandatory minimum annuity created an anchoring and adjustment process, with the anchor being the regulatory signal that led to higher annuities. To better

understand the determinants of the decision to annuitize and to test the hypothesis that a mandatory minimum annuity law may become an anchor that will shift the distribution of annuities, we further investigated the effects found in the questionnaire, using various specifications (including logit, probit, and ordinary least squares regression analyses and different dependent variables; since there was no significant difference, we present only the logit specifications) and controlling for both demographic and socioeconomic variables (e.g., age, gender,[14] marital status,[15] and income) and for relevant health conditions (such as smoking in the present or past and health perceptions[16]).

Equation 1 describes the potential main characteristics that might affect the decision of individual i to choose an annuity that is less than or equal to NIS 4,000 (the mandatory minimum):

$$\text{annuity}_{\leq 4,000_i} = \alpha + \beta_1 \text{Condition2} + \beta_2 \text{Condition3} + \beta_4 \text{age}_{61-70_i} + \beta_5 \text{male}_i +$$

$$\beta_6 \text{single}_i + \beta_7 \text{married}_i + \beta_8 \text{divorced}_i + \beta_9 \text{widowed}_i + \beta_{10} \text{smoker}_i +$$

$$\beta_{10} \text{past smoker}_i + \beta_{11} \text{chance85}_i + \beta_{12} \text{chance95}_i + \beta_{13} \text{income}_i +$$

$$\beta_{14} \text{very good health}_i + \beta_{15} \text{good health}_i + \epsilon_i \qquad (1)$$

where $\text{annuity}_{\leq 4,000_i}$ is a dummy variable for a chosen annuity that is less than or equal to NIS 4,000 ($\text{annuity}_{\leq 4,000} = 1$ if chosen annuity is lower than or equals 4,000); Condition 2 is the mandatory minimum annuity manipulation and Condition 3 is the repealed mandatory minimum annuity manipulation (Condition 1, the control group, is the reference category); age_{61-70_i} is a dummy variable that equals 1 if the respondent's age was between 61 and 70 years; single_i, married_i, divorced_i, and widowed_i are dummy variables for marital status; smoker_i and

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[14]For example, Bütler and Teppa (2005) found a relation between gender and annuity choice.
[15]Previous research provided evidence of a relation between marital status and the annuitization decision (e.g., Poterba and Warshawsky, 2000; Kotlikoff and Spivak,(1981; Cappelletti, Guazzarott, and Tommasino, 2013).
[16]Hurwitz and Sade (2017) presented evidence that medical condition affects annuitization decisions while smoking status does not.

past smoker$_i$ indicate smoking activity; β_{11}chance85$_i$ and chance95$_i$ are the subjective probabilities of reaching age 85 and 95, respectively; and good health$_i$ and very good health$_i$ are respondents' self-reported health status.

Equation 2 describes the potential characteristics that might affect the decision to choose an annuity of exactly NIS 4,000 (the mandatory minimum):

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\begin{aligned}
\text{annuity}_{4,000_i} = {}& \alpha + \beta_1 \text{Condition2} + \beta_2 \text{Condition3} + \beta_4 \text{age}_{61-70_i} + \beta_5 \text{male}_i + \\
& \beta_6 \text{single}_i + \beta_7 \text{married}_i + \beta_8 \text{divorced}_i + \beta_9 \text{widowed}_i + \beta_{10} \text{smoker}_i + \\
& \beta_{10} \text{past smoker}_i + \beta_{11} \text{chance85}_i + \beta_{12} \text{chance95}_i + \beta_{13} \text{income}_i + \\
& \beta_{14} \text{very good health}_i + \beta_{15} \text{good health}_i + \epsilon_i
\end{aligned}
\tag{2}
$$

where annuity$_{4,000_i}$ is a dummy variable for selecting an annuity that equals NIS 4,000.

The version of the questionnaire used in Condition 2 indicating the mandatory minimum annuity significantly affected the propensity to annuitize. As shown in Table 5, personal characteristics are not significantly related to the annuitization decisions for the representative sample. Gender, income, and health condition were significantly related to the decision in only one of the specifications presented above; male participants had a tendency to choose higher annuities, and higher income increased the propensity to annuitize, as did good and very good health.

[TABLE 5]

Moreover, the results presented in Table 5 (regression analysis) illustrate that the mandatory minimum annuity affected participants' decisions in the representative sample. Specifically, as expected, the tendency to choose an annuity at the level of NIS 4,000 was higher

when this level was the mandatory minimum (Condition 2) than when there were no restrictions (Condition 1). Furthermore, we wanted to check whether the difference resulted from the mandatory-minimum constraint, that is, if participants who initially might have wanted to choose an annuity of less than NIS 4,000 chose NIS 4,000. We found that the likelihood of choosing an annuity of strictly more than NIS 4,000 was significantly higher in the constrained conditions (Conditions 2 and 3) than in the unconstrained (control) condition. Participants who were informed about a mandatory minimum annuity requirement that was repealed (Condition 3) were less likely to choose an annuity of less than or equal to NIS 4,000 compared to participants who had not been informed of the mandatory minimum annuity (Condition 1; see Table 5, columns 2 and 3). The effect of the mandatory minimum annuity (Condition 2) was much stronger for participants who were less educated (less than a high school diploma).

As in the representative sample, personal characteristics did not affect the tendency to annuitize in the student sample. When we tested for the influence of the mandatory minimum annuity law (both its enforcement and its repeal) on the tendency to choose an annuity less than or equal to NIS 4,000 (Table 6, columns 2 and 3), the effect of both manipulations was statistically significant, meaning that the entire distribution of chosen annuities changed as a result of the regulation. Whether participants were told that the mandatory minimum annuity law was in effect (Condition 2) or repealed (Condition 3), their demand for annuities was higher compared to the control group (Condition 1). As these results are similar to those presented in Table 5, the manipulation appears to have affected students and older participants in similar directions.

[TABLE 6]

3.3.2 Repeal of the Regulatory Requirement

We were interested in studying the effect of the repeal of the mandatory minimum annuity law. As shown in Table 3, for the student participants in Condition 3 where the law was repealed, the chosen annuities were still higher than when there was no anchor at all (Condition 1). In particularly, the median annuity in both the mandatory minimum annuity and the repealed mandatory minimum annuity conditions (Conditions 2 and 3) was higher than the median annuity in the control condition (Condition 1). Moreover, the average annuity in Condition 3 was higher than in Condition 1. Interestingly, similar results were obtained in the representative sample. Table 6 reports the analysis of the factors affecting their annuitization decisions.

The effect of repealing the mandatory minimum annuity (Condition 3) was negative and significant in the specifications above (tables 5 and 6), reflecting a tendency to choose annuities less than or equal to NIS 4,000. This result suggests that, in our framework, a regulation that was repealed still had an impact on individuals' decisions. Specifically, the annuity amounts were still higher in the repeal condition (Condition 3) than in the control condition in which the participants were not informed about the regulation at all (Condition 1).

3.3.3 Income and Effects of a Mandatory Minimum Annuity Law

Our survey results indicate that the initiation of a mandatory minimum annuity law was not significantly diminished by the law's repeal. One might ask whether this effect is differed for people with different demographics. For instance, one might expect smaller effects for people with lower expectations regarding their future consumption (i.e., financial need).

To explore this question, we compared annuity choices between participants in the representative sample who reported having a very high income and those who reported a very low

income.[17] Fig. 2 reveals that for low income participants, the mandatory minimum annuity indeed increased the mean chosen annuity, whereas for high income participants, the "anchor" of a mandatory minimum annuity had little effect. Furthermore, in the low-income group, both educated and uneducated individuals were affected by the anchor, whereas in the high-income group, the anchor did not affect the educated participants as much as the uneducated participants.

It should be noted that in the students' survey, 80.61% of the participants declared that their income was much lower than or equal to the average of the population; hence it is not surprising that on average they behaved similarly to the low-income representative survey participants. This finding led us to investigate the relation between consumption perceptions and annuity choice in a laboratory experiment setting.

[FIGURE 2]

4. Laboratory Experiment

4.1 Detailed Design

The experiment consisted of two rounds of a computerized task that involved the distribution of money between an annuity and a lump sum (where the conversion factor was 200). Participants, students of the Hebrew University of Jerusalem and the College of Management Academic Studies, Israel,[18] first were given verbal instructions and then read a scenario in which they learned they were at the stage of life just before retirement and had saved an amount of ZUZ[19] 2,000,000. Furthermore, participants were told that a computer would draw their life expectancy from a set ranging from 0 to 360 months with an average of 200 months. They were informed that

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[17] In the survey we used reported income as a parameter for economic status. Recent research has claimed that during the process of predicting financial slack, people are driven by expected changes in income and tend to ignore changes in expected consumption (Berman, Tran, Lynch, and Zauberman, 2016). We approached future consumption more directly in our laboratory experiment.

[18] Participants were recruited using ads at the University and emails from the academic staff.

[19] ZUZ was a virtual currency that was converted (for payment) into new Israeli shekels at a ratio of ZUZ 50,000 to NIS 1.

the outcome of the draw would be revealed only after they chose their annuity. Thus, they did not know the exact amount they would need before choosing the annuity. Participants were given two examples of the task to ensure that they understood the instructions. They provided demographic details before proceeding with the task.

Participants ($N = 277$) were randomly assigned to one of two consumption groups in one of three conditions ($n = 99$ in Condition 1; $n = 89$ in Condition 2; $n = 89$ in Condition 3). Condition 1 was a control condition; participants received no additional information beyond what we described above. In Condition 2, participants were told that regulators in the State of Israel had stipulated a mandatory minimum annuity in the amount of ZUZ 4,000 monthly. In Condition 3, we aimed to reflect the situation of a recent repeal of a mandatory minimum annuity law. Hence the participants were given additional information stating that a previous mandatory minimum annuity of ZUZ 4,000 had recently been repealed. Participants in the high-consumption groups were told that their monthly consumption would be ZUZ 8,000, 9,000, or 10,000 (evenly distributed); participants in the low-consumption group were told that their monthly consumption would be ZUZ 3,000, 4,000, or 5,000 (also evenly distributed). The participants' task was to decide how to split their (virtual) accumulated funds between an annuity that would pay every period according to the realized longevity and a lump sum. During the experiment, we computed the monthly balance in the participants' account according to their choices and the realization of the variables. In the case of a surplus, it was accumulated each month and in the case of a deficit the shortfall was taken from the lump sum, if possible.

The participants were paid for their participation receiving a show-up fee of NIS 27 (equivalent to the hourly minimum wage in Israel) and NIS 20 in addition if they had no deficit in their account. This was meant to simulate the real-life situation in which retirees who perceive

annuities as a consumption tool are more likely to purchase annuities (Brown et al., 2008).

Moreover, if there was a monthly surplus or a lump sum not needed for consumption, it was added

to the participants' payment (explained to participants in detail at the beginning of the experiment).

The aim of this part of the compensation scheme was to take into consideration bequest motives

known to influence annuity choices (Friedman and Warshawksy, 1990; Inkmann, Lopes, &

Michaelides, 2010). Given that being an elderly person with no income or savings is a very

undesirable outcome, participants were told that if they consumed all of the lump sum and the

annuity was insufficient for living expenses, they would receive the show-up fee only. Each

participant took part in the experiment twice (same manipulation), to test for potential learning

effects.

4.2 Results

We compared the chosen annuity in each of the conditions and in the two rounds. The

general trend is presented in Fig. 3.[20]

[**FIGURE 3**]

The results show a clear treatment effect in the high-consumption groups and a less

substantial effect in the low-consumption groups. In the low-consumption groups, the mandatory

minimum annuity increased the mean chosen annuity as expected (above the level in the control

group), but in the high-consumption groups, the mandatory minimum annuity led to a decrease.

Similar to the simulation we performed in the surveys, we computed again the adjusted 4,000

annuity (in which we assigned each participant who chose an annuity value that was lower than

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[20] We should first note that since all participants were given ZUZ 2 million, participants in the low-consumption group are expected on average to choose lower annuities than the high-consumption group. In fact, we find that the mean chosen annuity in the control group is higher in the high-consumption group compared to the low-consumption group, which implies that on average participants understood the task. Hence, our focus is on a comparison of the choices and the effect of the mandatory annuity law within each consumption group and not on the comparison of the level of the chosen annuitization between the two consumption groups.

4,000 in Conditions 1 and 3 the level of 4,000). In the high-consumption group, the proportion of participants who chose an annuity equal to 4,000 or less was 2.17% in the control group, increased to 7.5% in Condition 2 (mandatory annuity), and to 11.11% in the repeal treatment. In the low-consumption group, the proportion was 22.64% in the control group, 8.16% in Condition 2, and 15.91% in the repeal treatment. Table 7 displays detailed statistics regarding the mean annuity choices for each condition for each group in each round.

[TABLE 7]

Results show that the consumption group mattered for the mean chosen annuity in both rounds. Moreover, in both low- and high-consumption groups and in both the first and second round, we found a difference between Conditions 1 and 2. Interestingly, the direction of the difference between the conditions was different for participants with low versus high consumption. For low-consumption groups, participants in Condition 2 had a higher mean chosen annuity (in both rounds) than participants in Condition 1; for high-consumption groups, participants in Condition 1 had a higher mean chosen annuity (in both rounds) than participants in Condition 2.

Additionally, there was a smaller difference between Conditions 2 and 3. In both rounds, participants in the low-consumption group in Condition 2 had a higher mean chosen annuity than participants in the low-consumption group in Condition 3. For the high-consumption groups, the mean chosen annuity in Condition 3 was higher than the mean chosen annuity in Condition 2 in Round 1 but lower in Round 2.

To determine the significance of the differences between the mean chosen annuity in Conditions 1 and 3 (in both the low- and high-consumption groups), we conducted a *t* test and for robustness also a nonparametric test (Kruskal–Wallis). For the *t* test, the difference between the means of Conditions 1 and 2 for the low-consumption groups was statistically significant at the

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6% level in Round 1 and at the 5% level in Round 2. In the high-consumption groups the difference in the means was statistically significant at the 5% level in Round 1 but not statistically significant in Round 2.

We used a Kruskal–Wallis test because of different variances between the groups.[21] The test results indicated that for the of low consumption groups, there was a statistically significant difference in chosen annuities between the mandatory minimum annuity condition (Condition 2) and the control condition (Condition 1) in Round 2 but not in Round 1, ($\chi^2(1) = 4.579, p = 0.0324, \chi^2(1) = 0.724, p = 0.395$, respectively). In the high-consumption group, the test results indicate a statistically significant difference between the groups in Round 1 but not in Round 2, ($\chi^2(1) = 9.608, p = 0.0019$ and $\chi^2(1) = 0.474, p = 0.4913$, respectively).

These results highlight the difference between high and low income individuals in the representative sample. For low-consumption participants, the results indicate that the mandatory minimum annuity increased the mean chosen annuity (consistent with the survey results for respondents with low income). For high-consumption participants, the opposite occurred.

Our results suggest that repealing a mandatory minimum annuity law does not immediately convert the distribution of annuities back to its original shape. This result is consistent across all of the measurements in this project, including a student survey, an online representative survey, and a laboratory experiment.

The result is consistent with an anchoring effect. We conjecture that in this complex situation, participants used the regulatory constraint as a signal. In particular, under the veil of ignorance (no information), participants had to choose their annuity merely based on their beliefs regarding future consumption and life expectancy. Since the decision of how much to annuitize is

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[21] Instead of the more common Wilcoxon test used in experimental economics (Siegel and Castellan, 1988). The obtained results remain when using a Wilcoxon test.

complex, the regulatory message served as a signal informing participants anchored when making their decisions. Hence, for participants in the high-consumption group the new signal pushed beliefs about the amount of annuity downward, whereas in the low-consumption group, the signal pushed the beliefs upward. In the repeal condition, the signal was weaker, but apparently, still influenced the decision to annuitize. Hence, the distribution of annuities did not immediately revert to its original shape. One might ask whether the effect was caused by having a constraint per se, or if it was due to the constraint being imposed by a regulator (government). In other words, would a similar constraint imposed by nature have a similar effect? We cannot rule this out, but in the pension domain, governments and regulators set the constraints in the markets and hence imposing a national-level constraint implies imposing a constraint by a regulator with the related reputation.

5. Discussion

We have demonstrated, using a laboratory experiment and two surveys, that mandatory minimum annuity laws influence individual decisions and choices. Our results suggest that the introduction of a mandatory minimum annuity shifted the entire distribution of chosen annuities, presumably due to a process of anchoring and adjustment with the anchor being the regulatory signal (minimum annuity). By contrast, information about repeal of such a regulation did not entirely shift the distribution back again. Interestingly, the effect differed between people with different income and consumption levels, suggesting that careful investigation is needed before regulators use this mechanism to increase annuity choices to any given minimum level.

In particular, a mandatory minimum annuity will not necessarily increase the annuity amount people choose. Specifically, in some conditions (e.g., when income and consumption are high), mandatory minimum annuities may result in a decrease in the annuity amount chosen. In our experimental framework, high-consumption individuals naturally believed that they would

need to withdraw a major part of their assets as an annuity. For these people the constraint of a NIS 4,000 minimum annuity sent a signal that pushed beliefs about the funds needed for living downward, in contrast to individuals in the low-consumption group, for whom there was an opposite effect. Furthermore, our results suggest that a repeal of the constraint can be expected to weaken the effect but not necessarily to cancel it.

Our study is the first to explore the behavioral effects of both initiation and repeal of the mandatory annuity laws in the same research in a comparable manner. It contributes to the literature that investigates the effect of regulatory changes, the literature that investigates unintended consequences of regulatory changes and caps, the literature that investigates long-term savings decisions and annuity choices, and the literature that discusses behavioral biases (specifically anchoring) and individuals' long-term savings decisions. Our findings are also relevant for policy discussions, in particular for cases in which regulators impose constraints that limit individuals' choices for the purpose of protecting them. Such regulations vary widely. For instance, regulators impose speed limits that may in reality be a signal of the maximal speed allowed. A similar mechanism may be related to health recommendations, alcohol consumption limits, and others.

We conjecture that merely mentioning a minimum annuity level as a recommended level for withdrawal, rather than imposing it as a regulation, might be sufficient to create behavioral change. We leave testing this for future research. We also leave for future research and additional investigation the following questions: what is the appropriate level of mandatory annuity for a given population with specific characteristics? Is it socially acceptable to mandate an increase in annuities of some individuals while understanding that this regulation may cause other individuals to choose smaller annuities?

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Table 1. Summary Statistics by Condition: Student Sample

Condition	N	Gender (% male)	Mean age (years)	Mean education (years)	% single	% very good health
1	109	50	25.87	14.10	86	76
2	118	56	27.03	14.98	76	74
3	135	49	25.59	13.71	90	82

Note. Condition 1 had no specific manipulation. In Condition 2 participants were informed about a mandatory minimum annuity required by law, and in Condition 3 participants were informed about a mandatory minimum annuity regulation that was repealed recently. Gender represents the proportion of male participants out of the sample. Single is the proportion of participants who defined themselves as single. The proportion of very good health was derived from a question in our survey in which participants were asked to assess their health conditions in terms of very good, good, not so well or not well at all.

Table 2. Summary Statistics by Condition: Representative Sample

Condition	N	Gender (% male)	% age 50–60 years	% age 61–70 years	% with academic education	% married	% with good or very good health
1	324	41	54	46	47	76	89
2	258	46	57	43	50	72	87
3	304	42	58	42	51	70	88

Note. Condition 1 had no specific manipulation. In Condition 2 participants were informed about a mandatory minimum annuity required by law, and in Condition 3 participants were informed about a mandatory minimum annuity regulation that was repealed recently. Gender represents the proportion of male participants out of the sample. Age 50-60 represents the proportion of participants who are in this age range, while age 61-80 are the proportion of participants aged 61-70. % with academic education was derived from a question in which participants were asked to assess their education level (out of the categories: high school education, post-secondary or academic education. Married is the proportion of participants who defined themselves as married. The proportion of good and very good health was derived from a question in our survey in which participants were asked to assess their health conditions in terms of very good, good, not so well or not well at all.

Table 3. Percentage of Student Sample Choosing Annuities of Different Values

Condition	N	Monthly annuity value (new Israeli shekels)					
		0	4,000	Adjusted 4,000[a]	10,000	Mean	Median
1	109	18.35%	8.26%	52.29%	10.09%	4116.97	4,000
2	118	0%	21.19%	21.19%	19.49%	6,572.03	6,000
3	135	11.11%	8.15%	34.07%	12.59%	5,346.22	6,000

Note. Condition 1 had no specific manipulation. In Condition 2 participants were informed about a mandatory minimum annuity required by law, and in Condition 3 participants were informed about a mandatory minimum annuity regulation that was repealed recently. As expected, the mean annuity was highest in the condition that introduced an anchor (Condition 2), while the medians in Conditions 2 and 3 were equal. Choosing the exact amount of 4,000 that was introduced as the minimum annuity (the anchor) was highest in Condition 2. Nevertheless, small annuities that were lower than or equal to 4,000 (i.e., adjusted 4,000) were lowest in Condition 2, implying a shift in the entire distribution toward higher annuities. Moreover, the proportion of participants who chose an annuity lower than or equal to 4,000 was higher in Condition 3 than in Condition 2 but not as high as in Condition 1.

[a]Any value between NIS 1 and 4,000 was adjusted to 4,000.

Table 4. Percentage of Representative Sample Choosing Annuities of Different Values

Condition	N	Monthly annuity value (new Israeli shekels)					
		0	4,000	Adjusted 4,000[a]	10,000	Mean	Median
1	324	7%	6.79%	47.5%	12.3%	4,479.9	5,000
2	258	0%	28.3%	28.3%	10.8%	5,922.5	5,000
3	304	7.5%	9.86%	39.8%	9.54%	4,871.2	5,000

Note. Condition 1 had no specific manipulation. In Condition 2 participants were informed about a mandatory minimum annuity required by law, and in Condition 3 participants were informed about a mandatory minimum annuity regulation that was repealed recently. As expected, the mean annuity was highest in the condition that introduced an anchor (Condition 2) while the median was the same in all conditions. Nevertheless, small annuities that were lower than or equal to 4,000 (i.e., adjusted 4,000) were lowest in Condition 2, implying a shift in the entire distribution toward higher annuities. Moreover, the proportion of participants who chose an annuity lower than or equal to 4,000 was higher in Condition 3 compared to Condition 2 but not as high as in Condition 1.

[a]*Any value between NIS 1 and 4,000 was adjusted to 4,000.*

Table 5. Representative Sample: Logit Models of the Factors Affecting the Choice of an Annuity Less Than or Equal to NIS 4,000 and Exactly NIS 4,000

Variable	Less than or equal to NIS 4,000				Exactly NIS 4,000	
	Total sample (N = 886)		Uneducated sample[a] (N = 216)		Total sample (N = 886)	
	Estimate	Odds ratio	Estimate	Odds ratio	Estimate	Odds ratio
Condition 2	-0.818***	0.441***	-1.444***	0.236***	1.754***	5.777***
	(0.182)	(0.0801)	(0.388)	(0.0917)	(0.266)	(1.535)
Condition 3	-0.317*	0.729*	-0.906**	0.404**	0.432	1.540
	(0.166)	(0.121)	(0.356)	(0.144)	(0.296)	(0.456)
Age 61–70 years	0.159	1.172	0.0114	1.012	-0.0898	0.914
	(0.146)	(0.172)	(0.316)	(0.320)	(0.211)	(0.192)
Male	-0.368**	0.692**	-0.0707	0.932	-0.282	0.754
	(0.154)	(0.107)	(0.341)	(0.318)	(0.222)	(0.168)
Single	0.268	1.308	-0.338	0.713	-0.126	0.881
	(0.657)	(0.859)	(1.289)	(0.919)	(0.801)	(0.706)
Married	0.457	1.580	-0.445	0.641	-0.751	0.472
	(0.578)	(0.913)	(1.053)	(0.675)	(0.715)	(0.337)
Divorced	0.505	1.656	-0.417	0.659	-0.972	0.378
	(0.596)	(0.988)	(1.104)	(0.727)	(0.746)	(0.282)
Widowed	0.236	1.266	-0.753	0.471	-0.609	0.544
	(0.667)	(0.845)	(1.369)	(0.645)	(0.825)	(0.449)
Smoker	0.285	1.329	-0.0927	0.911	0.501	1.651
	(0.251)	(0.333)	(0.476)	(0.434)	(0.338)	(0.558)
Past smoker	-0.0796	0.923	0.00909	1.009	-0.153	0.858
	(0.167)	(0.155)	(0.364)	(0.367)	(0.242)	(0.208)
Subjective chance of reaching age 85	0.0120	1.012	0.0200	1.020	0.0681	1.070
	(0.0444)	(0.0449)	(0.0893)	(0.0911)	(0.0641)	(0.0686)
Subjective chance of reaching age 95	-0.00473	0.995	-0.0644	0.938	-0.0611	0.941
	(0.0346)	(0.0345)	(0.0744)	(0.0697)	(0.0488)	(0.0459)
Income	-0.112*	0.894*	-0.134	0.875	-0.00414	0.996
	(0.0670)	(0.0599)	(0.158)	(0.138)	(0.0952)	(0.0948)
Very good health	-0.775***	0.461***	-0.456	0.634	-0.358	0.699
	(0.259)	(0.119)	(0.543)	(0.345)	(0.361)	(0.252)
Good health	-0.534**	0.587**	-0.735	0.480	-0.117	0.889
	(0.237)	(0.139)	(0.471)	(0.226)	(0.330)	(0.293)
Constant	0.347	1.415	1.807	6.091	-1.797**	0.166**
	(0.649)	(0.919)	(1.232)	(7.502)	(0.834)	(0.138)

| Variable | Less than or equal to NIS 4,000 | | | | Exactly NIS 4,000 | |
| | Total sample (N = 886) | | Uneducated sample[a] (N = 216) | | Total sample (N = 886) | |
	Estimate	Odds ratio	Estimate	Odds ratio	Estimate	Odds ratio
Pseudo R^2	0.0426		0.075		0.094	

Note. N = Number of observations in the models. Standard errors in parentheses. Dependent variables are either choosing an annuity that is less than or equal to NIS 4,000 (columns (2)-(4)) or choosing

an annuity that equals exactly 4,000 (columns (5)-(6)). Main explanatory variables are gender, marital status, smoking decisions, subjective survival probability, income, and health.

*$p < 0.1$. **$p < 0.05$. ***$p < 0.01$.

[a]*Participants with less than a high school diploma.*

Table 6. Student Sample: Logit Models of the Factors Affecting the Choice of an Annuity of Less Than or Equal to NIS 4,000 and Exactly NIS 4,000

Variable	Less than or equal to NIS 4,000 (N = 338)		Exactly NIS 4,000 (N = 338)	
	Estimate	Odds ratio	Estimate	Odds ratio
Condition 2	-1.505***	0.222***	1.262***	3.533***
	(0.343)	(0.0760)	(0.483)	(1.705)
Condition 3	-0.834***	0.434***	-0.00621	0.994
	(0.289)	(0.125)	(0.490)	(0.487)
Age	-0.0559	0.946	-0.122	0.885
	(0.0447)	(0.0423)	(0.0798)	(0.0706)
Male	0.114	1.121	0.192	1.211
	(0.252)	(0.283)	(0.361)	(0.437)
Single	0.176	1.193	0.411	1.509
	(0.392)	(0.468)	(0.581)	(0.877)
Smoker	0.594	1.811	0.431	1.539
	(0.442)	(0.800)	(0.622)	(0.958)
Past smoker	-0.173	0.841	0.275	1.316
	(0.371)	(0.313)	(0.551)	(0.725)
Subjective chance of reaching age 85	-0.0691	0.933	0.172	1.187
	(0.0776)	(0.0724)	(0.112)	(0.133)
Subjective chance of reaching age 95	0.0695	1.072	-0.110	0.896
	(0.0648)	(0.0695)	(0.0897)	(0.0804)
Income	0.112	1.119	0.0378	1.039
	(0.113)	(0.127)	(0.155)	(0.161)
Very good health	-0.851	0.427	-1.074	0.342
	(1.304)	(0.556)	(1.344)	(0.459)

Variable	Less than or equal to NIS 4,000 (N = 338)		Exactly NIS 4,000 (N = 338)	
	Estimate	Odds ratio	Estimate	Odds ratio
Good health	-1.585	0.205	-2.327	0.0976
	(1.329)	(0.273)	(1.433)	(0.140)
Constant	2.262	9.603	0.510	1.665
	(1.841)	(17.68)	(2.627)	(4.373)
Pseudo R^2	0.0862		0.0889	

Note. N = Number of observations in the models. Standard errors in parentheses. Dependent variables are either choosing an annuity that is less than or equal to NIS 4,000 (columns (2)-(3) or choosing an annuity that equals exactly 4,000 (columns (4)-(5). Main explanatory variables are gender, marital status, smoking decision, subjective survival probability, income, and health.

$*p < 0.1$. $**p < 0.05$. $***p < 0.01$.

Table 7. Mean Chosen Annuity in Each Condition and in Each Round of the Laboratory Experiment

Condition	High-consumption group			Low-consumption group		
	Mean	*SD*	*N*	Mean	*SD*	*N*
Round 1						
1. No manipulation (control)	8,275.54	1,847.77	46	5,739.28	2,772.02	53
2. Mandatory minimum annuity	7,120.35	1,691.81	40	6,421.86	1,372.48	49
3. Mandatory minimum annuity repealed	7,543.53	2,782.83	45	6,097.73	1,724.58	44
Round 2						
1. No manipulation (control)	7,791.30	2,364.72	46	5,215.79	2,819.58	53
2. Mandatory minimum annuity	7,700.25	1,830.90	40	6,500.00	1,555.63	49
3. Mandatory minimum annuity repealed	7,351.11	3,120.83	45	6,176.14	2,164.18	44

Note. All amounts are in the experimental currency, ZUZ. Shown is mean chosen annuity in each condition and in each round (participants were required to perform the same task twice). High-consumption groups consisted of participants who were told that their future consumption would be ZUZ 8,000, 9,000, or 10,000. Low-consumption groups consisted of participants who were told that their future consumption would be ZUZ 3,000, 4,000, or 5,000.
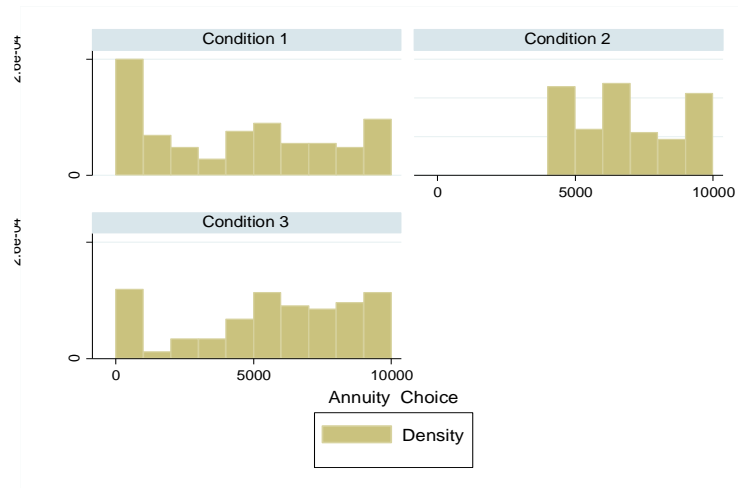
Figure captions

Figure 1. Annuity distributions by conditions for (a) the student sample and (b) the representative sample and the proportion of participants who chose either an annuity of NIS 4,000, adjusted 4,000 (i.e. lower or equal to 4,000) or higher than adjusted 4,000 for (c) the student sample and (d) the representative sample

Figure 2. Mean annuity amount chosen by the representative sample for different incomes and annuity requirements. NIS = New Israeli shekels.
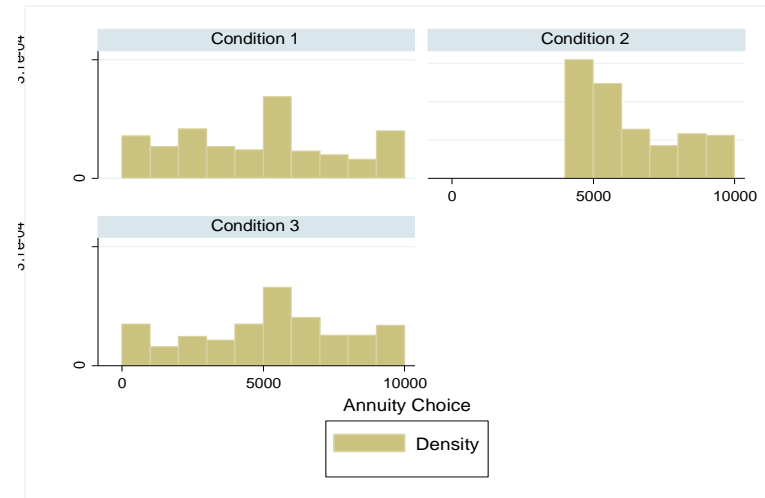
Figure 3. Mean annuity amount chosen by participants in the high- and low-consumption groups in (a) Round 1 and (b) Round 2 of the experiment. ZUZ = experimental currency.
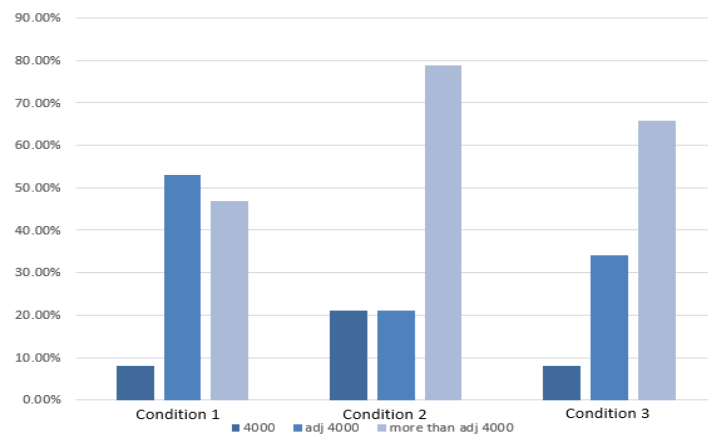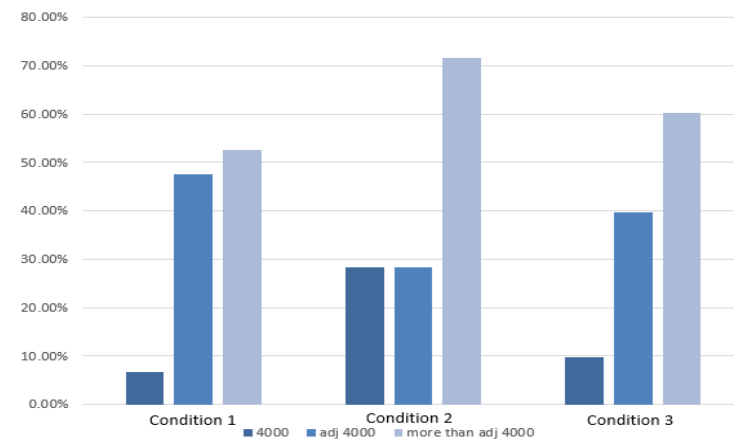
Figure 1

(a)

(b)

(c)

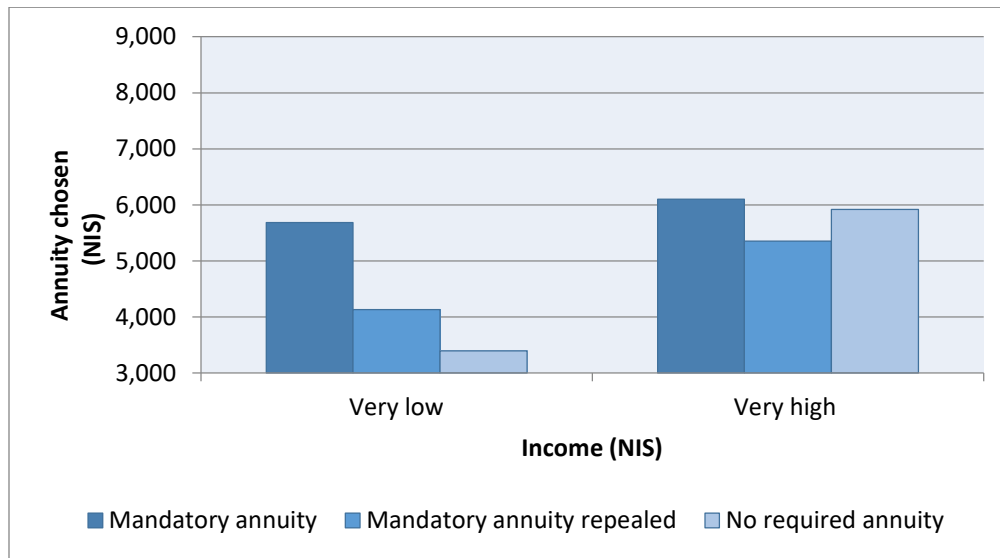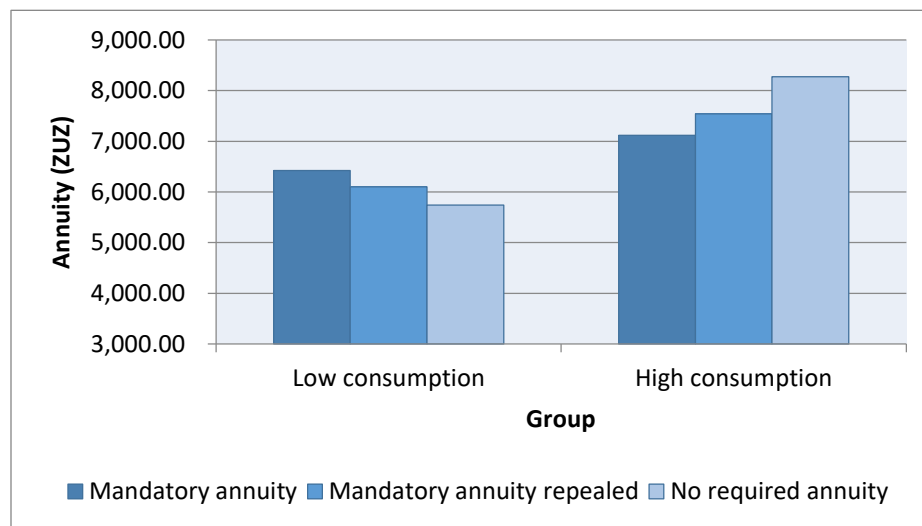

(d)

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Figure 2

Figure 3

(a)

(b)