An investigation of time preferences, life expectancy, and annuity versus lump sum choices: Can smoking harm long-term saving decisions?

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ABSTRACT

We exploit the fact that Israeli pension insurance policies do not take health conditions or smoking status into account in annuity pricing to investigate the potential effect of being a smoker on retirement payout choices. Contrary to the idea that smokers have higher discount rates (and thus should prefer the lump sum option), and even though the insurance pricing mechanism means that smokers would be offered the same annuity as nonsmokers (all else equal), we find that smokers do not prefer the lump sum option. We offer and test several potential explanations for our findings: illusions regarding life expectancy, self-control, and advantageous selection.

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Significance statement: We investigate the results of financial decisions made by 1556 individuals upon retirement using data from an Israeli insurance corporation. To optimize the results of such decisions, one should consider one's own expected longevity. In our sample, smokers do not behave as expected, in contrast to people with a major disease, when we control for other related variables. We relate our findings to several potential explanations: illusions regarding life expectancy, self-control, and advantageous selection.

1. Introduction

Cigarette smoking is a popular behavior but also the leading preventable cause of death in the Western world (Wang, 2014): For example it is responsible for roughly 20% of total U.S. mortality since the 1990s (Mokdad et al., 2004). Yet, if smoking is a clearly unhealthy behavior and a significant determinant of early mortality, why do people smoke? The economics literature suggests that differences in personal attitudes such as time preferences, self-control, and risk preferences are involved.

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Cigarette smokers are predictably reluctant to give up the present pleasure of smoking in exchange for better health and longevity in the future. In the language of time preference theory, smokers are viewed as having higher discount rates, meaning that they would demand higher compensation than nonsmokers to postpone present consumption to the future.[1] Accordingly, some empirical papers use smoking as a proxy for present preferences in a variety of contexts (e.g., Lusardi et al., 2010; Munasinghe and Sicherman, 2006; Scharff and Viscusi, 2011). Yet, there is an ongoing debate regarding the exact relationship between smoking and time preferences (e.g., Adams and Nettle, 2009; Fuchs, 1982; Harrison et al., 2010). Empirical studies, mostly based on surveys, document a low correlation between smoking and different measures of time preference (some find a relation for male participants only) or find the opposite relation, showing that smokers actually have lower discount rates than nonsmokers (e.g., Chabris et al., 2008; Reynolds et al., 2003).[2]

Concerns related to time preference and individual choice are also involved in long-term saving decisions. Yaari's (1965) theoretical work suggests that annuities have substantial value, and that under a certain set of assumptions (von Neumann-Morgenstern expected utility with intertemporally separable utility, no uncertainty other than longevity, no bequest motives, and a market with actually fair annuities), retirees would use annuities on retirement, in contrast to empirical findings that many retirees prefer the lump sum, for behavioral reasons, among others (e.g., Benartzi et al., 2011).

In this paper, we focus on the annuitization decisions of smokers in Israel who are insured by pension insurance policies. We exploit a special feature of these products—their pricing—that takes into account only gender, actuarial life expectancy, and the expected rate of return. Pension insurance policy pricing in Israel does not take into account any health conditions (including smoking status).This means that all other factors being equal, smoking and nonsmoking retirees are offered the exact same annuity payment per month, despite smokers being expected to live fewer years and as a result to receive fewer payments overall. This makes an interesting test case for smokers' financial decisions. If the decision to smoke can be explained by time preference, then smokers should be more likely than nonsmokers to prefer a lump sum payout. Moreover, the significantly lower life expectancy for smokers compared to nonsmokers, combined with being offered the exact same annuity payment per month as nonsmokers, reinforces the hypothesis that smokers should have a lower preference for annuities than nonsmokers.

Our investigation relies on unique proprietary data from an Israeli insurance corporation that provides us with detailed information regarding retirees' decisions as well as a rich set of variables relating to these retirees, including information on smoking behavior. This dataset allows us to investigate real annuitization decisions. Our sample consists of 1556 retirees observed from 2009 to 2013 who had cumulative savings exceeding NIS 500,000.[3] Each client in our sample could elect to withdraw a lump sum, an annuity, or both, subject to a minimal mandatory annuity law[4] (applying only to funds accumulated after 2008). Surprisingly, in our sample, smokers do not have a stronger preference for the lump sum option than nonsmokers. Yet those with other health problems such as diabetes do prefer the lump sum option, as expected. This finding challenges the smokers' time preference theory, discussed above. It is also puzzling to find that smokers' behavior differs from that of people with impaired health, since both conditions are correlated with a shorter life expectancy, on average.

We suggest three possible explanations for the findings. First, it could be that even though research has shown a close relationship between smoking and medical problems, smokers do not perceive themselves as having a shorter life span and experience certain illusions regarding their own life expectancy. This conjecture is supported by evidence presented by Hurwitz and Sade (2018) showing that Israeli smokers have optimistic self-perceptions regarding health and life expectancy.

A second possible explanation is related to self-control awareness. O'Donoghue and Rabin (1999a) define sophisticated people as those who are fully aware of their self-control problems. In our context, if smokers are at least partially aware of self-control problems, they may use different mechanisms, including annuities, to pace their spending. We test whether people using annuities to overcome self-control problems (a costly mechanism) are also observed using other mechanisms, such as purchasing permanent health insurance (PHI). We find no support for this conjecture.

A third explanation relates to the advantageous selection puzzle (De Meza and Webb, 2001): Low-risk individuals are also those who buy more insurance. In the annuities markets, a smoker (with a lower life expectancy) is considered to be a low-risk individual (from a longevity risk perspective); hence, our results are consistent with the advantageous selection prediction. Our results contribute to the work of Cutler et al. (2008) and Corea (2017), who use longitudinal studies (HRS and SHARE,[5] respectively) to investigate the relationship of risk and the demand for several insurance products.

In what follows, we first review the setting in which our investigation took place and describe the annuity choices. Next, we present the data and report the empirical results. Finally, we present the possible explanations for our findings and conclude.

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[1] The economics literature also relates smoking to addictive behavior. The theory of rational addiction assumes that delayed rewards are discounted exponentially (Becker and Murphy, 1988; Bickel et al., 1999).

[2] Time preference is not the only explanation suggested in the literature for smoking behavior. Lipkus et al. (1994) demonstrate that smokers differ from the general population in traits such as impulsiveness, rebelliousness, sensation seeking, gregariousness, self-presentational concerns, and hostility. Keough et al. (1999) also review many previous explanations for substance use such as anxiety, neuroticism, lower impulse control, and novelty seeking, among others, concluding that time preference is an important variable to be considered in relation to health-related behaviors, including cigarette smoking. Ert et al. (2013) relate smoking behavior to a tendency to take risks. Others such as Chaloupka (1991) account for the addictive nature of smoking behavior.

[3] Israeli new shekels, close to USD 142,000 as of 2017. Further explanation of our choice of sample is provided in Section 4.

[4] The minimal annuity set by law in Israel is approximately NIS 4405 monthly in 2017 monetary values.

[5] The Health and Retirement Study and the Survey of Health, Ageing and Retirement in Europe.

2. Smoking in Israel and around the globe

There is a vast body of research that indicates that smoking is an unhealthy behavior (e.g., Newcomb and Carbone, 1992; Terzikhan et al., 2016). Thus, many countries around the world require tobacco companies to warn consumers about the harmful effects of smoking.[6] Data from the Israeli Ministry of Health[7] reveal the mortality differences between smokers and nonsmokers in selected countries. Overall there is a gap of more than 9 years in life expectancy between the two groups, and that gap is even wider in the United States (12 years for men and 11 years for women).[8] As further evidence, the price gap for life insurance policies for smokers versus nonsmokers in Israel widens with age.[9]

According to the Ministry of Health report on smoking in Israel in 2014 (published May 2015), the percentage of Israeli adults age 21 years or over who were "current cigarette smokers" (i.e., those who smoked every day or some days) was 19.8%, with the percentage being higher for men (27.3%) than for women (12.6%). The U.S. Centers for Disease Control and Prevention found in 2014 that 16.8% of American adults aged 18 years or over were "current cigarette smokers" (i.e., those who had smoked more than 100 cigarettes in their lifetime and now smoked every day or some days; Jamal et al., 2015). The percentage was higher for men (18.9%) than for women (14.8%).[10]

Khwaja et al. (2007) and Scharff and Viscusi (2011) find that smokers differ on attitudes such as time preferences, risk preferences, and impulsivity. Lipkus et al. (1994) conclude that indicators of impulsiveness, rebelliousness, sensation seeking, gregariousness, self-presentational concerns, and hostility measured in college-age students best predicted people who were likely to begin smoking. People who continued smoking were more hostile and engaged in more sensation-seeking behaviors.

Other papers argue that self-control is at the heart of time preference theory (Lahav et al., 2015; O'Donoghue and Rabin, 1999b; Thaler and Shefrin, 1981). The theoretical literature suggests that smoking and time preference are closely linked (e.g., Becker and Murphy, 1988) and that self-control problems can be modeled as present-biased preferences (O'Donoghue and Rabin, 1999b).

Nevertheless the empirical results regarding smoking and time preference are inconsistent. Some empirical and experimental studies find a positive relationship between smoking and time preference (e.g., Bickel et al., 1999; Fuchs, 1982; Harrison et al., 2018; Munasinghe and Sicherman, 2006; Scharff and Viscusi, 2011). Others mention only partial support for this relationship. For instance, Khwaja et al. (2007) find no significant difference between smokers and nonsmokers in discount rates but do find a difference in other measures of time preference, such as impulsivity and financial planning. Adams and Nettle (2009) find only one of the time preference measures they discuss is associated with smoking, while Harrison et al. (2010) find a significant correlation between individual discount rates and smoking only among men.

In the economics literature, smoking is associated with risky behavior (e.g., Anderson and Mellor, 2008), and it is argued that smoking status contains precise information about individuals not captured by economic and psychological data alone (e.g., Viscusi, 1991). It is also suggested that there may be some personal characteristic as yet unrevealed that can be expressed in smoking and ultimately affect financial behavior (Adams et al., 2014).

3. Annuity versus lump sum choices

3.1. Literature review

The theoretical literature, starting with Yaari (1965), claims that annuities have substantial value, and that retirees should generally use annuities for retirement. Yet more recent empirical studies find little evidence that retirees follow this advice (e.g., Beshears et al., 2014; Ganegoda and Bateman, 2008). The different explanations of retirees' choices generally follow one of three trends: supply side, demand side, or market imperfections. In our literature review, we focus on individual characteristics.[11]

Variables such as gender, marital status, children, and attitudes such as risk aversion and time preferences are discussed with no definitive conclusions (Agnew et al., 2008; Bütler and Teppa, 2007; Cappelletti et al., 2013; Chalmers and Reuter, 2012). Some papers highlight other personal characteristics in an attempt to explain the puzzle, such as medical conditions (Sinclair and Smetters, 2004; Turra and Mitchell, 2008), prior existence of a social security annuity (Benartzi et al., 2011; Chalmers and Reuter, 2012), and the subjective discount rate (Bütler and Teppa, 2007; Warner and Pleeter, 2001). Other

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[6] Health warnings are common in many countries (e.g., Canada, the United States, Australia, and others). These warnings differ in size and design according to the requirements in each country. For a review see Hammond (2011).

[7] Ministry of Health report on smoking in Israel 2013, published May 2014.

[8] Similar results are reported by, among others, Jha et al. (2013), who note on the basis of U.S. data that "life expectancy was increased 4 to 10 years among smokers who quit, depending on their age at the time of smoking cessation" (p. 348); Taylor et al. (2002), who conclude based on a study of U.S. adults that "life expectancy among smokers who quit at the age of 35 exceeded that of continuing smokers by 6.9 to 8.5 years for men and 6.1 to 7.7 years for women" (p. 990); and Streppel et al. (2007), who conclude on the basis of Dutch data that "average cigarette smoking reduced the total life expectancy by 6.8 years, whereas heavy cigarette smoking reduced the total life expectancy by 8.8 years" (p. 107).

[9] For instance, according to data reported to the Israeli Ministry of Finance, in one of the biggest insurance companies in Israel, the average price gap for a 5-year life insurance contract for a male smoker vs. nonsmoker increased from 58% at the age of 40 to 89% at the age of 60.

[10] Based on data from the National Health Interview Survey, 2014, sample adult core component.

[11] For an extensive review see Benartzi et al. (2011).

papers reveal several psychological and irrational behavioral barriers to annuitization, such as complexity of the decision (Brown et al., 2013, 2017), default biases (Agnew et al., 2008; Bütler and Teppa, 2007), difficulty in making irreversible decisions (Brown and Warshawsky, 2004), different biases that arise from framing (Benartzi et al., 2011; Beshears et al., 2014; Goldstein et al., 2016), difficulty parting with accumulated money (Benartzi et al., 2011), mental accounting (Benartzi et al., 2011), availability errors (Hu and Scott, 2007), ambiguity regarding self-rated life expectancy (Smith et al., 2001), and the belief that annuities have a "smell of death" (Statman, 2017).

3.2. Annuity versus lump sum savings products in Israel

The Israeli pension system consists of two layers, one public and the other private. The private layer is a complex pension scheme that consists of five types of pensions/long-term savings products: (a) "old" pension funds,[12] (b) "new" pension funds,[13] (c) "new" general pension funds, (d) provident funds, and (e) pension insurance policies.[14] In this paper we focus on choices in the private layer related to the pension insurance policies. These policies, some of which provide the saver with tax benefits, are managed by insurance companies that provide both operational management and investment of the funds.

The extensive process of reforming the Israeli pension system created a diverse market for annuities. Unlike in many other countries, all savings products in Israel are linked to inflation. Upon retirement each retiree can choose a withdrawal of a lump sum, an annuity, or both, subject to the minimal mandatory annuity law (which applies only to funds accumulated after 2008).[15]

Our paper focuses on pension insurance policies. It is important to emphasize that these insurance policies differ in form from similar products worldwide. In Israel, savers with a pension insurance policy that was bought prior to 2013 received a contractual guarantee of the conversion factor used to convert a lump sum to an annuity, according to the terms that existed in the market at the time the policy was issued.[16] Twenty-three percent of the funds under management in Israel in 2013 were in pension insurance policies.[17]

4. Data

The proprietary data we use are from an insurance corporation in Israel regarding retirees with pension insurance policies. The dataset contains information on 18,860 retirees' withdrawal schemes between the years 2009 and 2013. Each client could choose a withdrawal of a lump sum, an annuity, or both, subject to the minimal mandatory annuity law (which applied only to funds accumulated after 2008, as explained above). Individuals in Israel can invest their long-term savings in several plans, simultaneously or over time, to reflect, for example, changes that occur in the workplace over the course of a lifetime. The initial dataset we received shows very large differences in the amounts accumulated, possibly indicating that the dataset did not necessarily reflect people's main long-term savings plans. To avoid the potential mental accounting effects related to small amounts on our analysis,[18] we focus on individuals' choices concerning meaningful sums of money.[19] However, since we lack information regarding the income level of the retirees in this dataset, we analyze 1556 individuals with accumulated funds of at least NIS 500,000. We base our threshold on an investigation of long-term savers in Israel.[20]

The administrative dataset contains socioeconomic and demographic data for each retiree, such as date of birth, date of purchase of the policy, date of disbursement, gender, marital status, and smoking status. In addition it reports the annuity factor (i.e., the value that determines how much annuity a retiree will receive from a certain lump sum, generally specified

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[12] "Old" applies to defined benefit pension funds that were closed to new clients as of January 1, 1995.

[13] "New" describes defined contribution pension funds that were first established on January 1, 1995 and must preserve actuarial balance.

[14] Also known in Israel as management insurance, the trade name of pension insurance policies. These policies include both a saving component and an insurance component (for different kinds of risks such as death and disability).

[15] Since 2008, lump sum payments have been allowed only for retirees with a minimal annuity as set by the new law.

[16] For example, the insured could purchase this guarantee at the age of, say, 25 years. No such guarantee is given in the United States. In Germany, a client can buy a guaranteed annuity before retirement but the insurance company is allowed to change the guaranteed conversion factor up to 30%.

[17] Source of data: Israeli Ministry of Finance, annual report, 2013.

[18] Mental accounting theory (Thaler, 1985) suggests that individuals have a tendency to categorize and treat money differently depending on the source of the income, the amount of money concerned, where it is kept, and how it will be spent. Specifically, our concern is that due to mental accounting, retirees would treat a small amount of funds differently from a larger amount. Hence, small savings accounts may be treated differently from large accounts with respect to the annuitization choices. Brown et al. (2008b) suggest that annuitization choices are influenced by a mental separation of investment choices from consumption choices. Hu and Scott (2007) illustrate that an annuity may be segregated into its own mental account rather than integrated with all retirement consumption funds. Hurwitz and Sade (2019) provide evidence that relates annuity choices to mental accounting bias using Israeli data.

[19] For accumulations lower than NIS 500,000, almost 80% of the population chose the full lump sum option, in contrast to 15.87% for the higher amounts.

[20] This threshold was chosen because we aim to address decisions of retirees whose savings in this insurance corporation were relatively substantial (some retirees might have several insurance policies in different insurance companies, started by different employers). We compare our data to public information published by Old Mivtachim, the largest Israeli "old pension fund" (historically, members of these funds usually did not have other pension accounts). We can see that in our data the average accumulated fund designated for an annuity (rather than a lump sum) is NIS 794,000 with a standard deviation of NIS 533,000 (whereas in the public data published by Old Mivtachim, the average accumulation for clients between the ages of 60 and 64 years is NIS 728,000). The average annuity of clients in our data is NIS 3816 monthly (also similar to the average annuity reported by Old Mivtachim, NIS 4177). Moreover, the average (client-level) accumulation in a lump sum product in our data is NIS 449,000, with a standard deviation of NIS 583,000, and the maximum lump sum accumulation is NIS 8 million. We provide robustness test for that threshold in Section 6.

Table 1

Distribution of annuity choices by gender, marital status, and smoking status for individuals who had accumulated at least NIS 500,000.

Characteristic	Annuity included[a]	Lump sum[b]
Gender		
Female ($n = 405$)	373	32
	92.10%	7.90%
Male ($n = 1151$)	936	215
	81.32%	18.68%
Total ($N = 1556$)	1309	247
	84.13%	15.87%
Marital status		
Divorced ($n = 150$)	136	14
	90.67%	9.33%
Married ($n = 1175$)	1029	146
	87.57%	12.43%
Widowed ($n = 75$)	66	9
	88.00%	12.00%
Single ($n = 42$)	41	1
	97.62%	2.38%
Unknown ($n = 114$)	37	77
	32.46%	67.54%
Total ($N = 1556$)	1309	247
	84.13%	15.87%
Smoking status		
Smoker ($n = 150$)	135	15
	90.00%	10.00%
Nonsmoker	1012	197
($n = 1209$)	83.71%	16.29%
Unknown ($n = 197$)	162	35
	82.23%	17.77%
Total ($N = 1556$)	1309	247
	84.13%	15.87%

Note. Clients with unknown smoking status were excluded from analysis. NIS = New Israeli shekels.

[a] Clients who chose some portion of disbursement as annuity.

[b] Clients who chose the full lump sum option (no annuity at all).

in terms of either years or months), investment management method, medical and professional supplements to the policies, residence, last occupation, and other insurance additions to the policy (risk, work disability, long-term care insurance, and health insurance).

The sample mean age is 67.2 years (74% men, 26% women; 75.5% married, 9.64% divorced, and 4.82% widowed) and the average seniority of the accounts is 18.8 years. The insurance corporation classified 9.64% of these participants as cigarette smokers.[21]

The majority of retirees in the sample chose to receive at least some portion of their money via an annuity. This can be explained by the Israeli legislation described earlier and by the fact that in the past, owners of pension insurance policies received preferred conversion factors, making annuities very attractive. Nevertheless, our aim is not to focus on patterns in annuity withdrawal in general in Israel, or to solve the "annuity puzzle." Rather, we seek to focus on retirement payout choices of smokers versus nonsmokers, and of savers with documented impaired health. Table 1 presents the distribution of annuity choices by gender, marital status, and smoking status.

Women were significantly more likely to choose a full annuity than men (92.1% vs. 81.3%), although in Israeli pension insurance policies, gender is taken into account in the pricing of the policies (hence from the perspective of pricing we do not expect any gender differences). Single people were most likely to choose an annuity, consistent with the literature (e.g., Bütler and Teppa, 2007). The average accumulation is NIS 770,000 for smokers in our sample and NIS 945,000 for nonsmokers. Seventy-six percent of smokers are male.

5. Smokers' time preferences and retirement payout choices

The calculation of a specific retiree's monthly payment uses an annuity factor that takes into account variables that affect life expectancy, such as gender. In Israel, health conditions are not part of the annuity pricing mechanism. As a result, two people with exactly the same traits other than their health status will be offered the same monthly annuity payment

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[21] "Smokers" could be current or recent former cigarette smokers because we do not know how frequently the insurance companies updated the socioeconomic data. We do acknowledge that individuals have the incentive to report changes in their health and smoking status, since otherwise they may not be covered by the disability part of these policies or might have to pay a premium on other products.
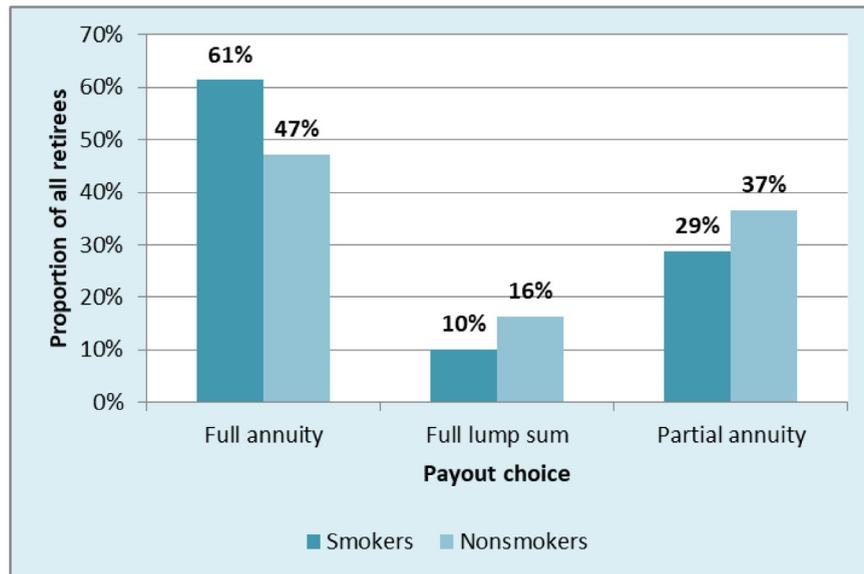
Fig. 1. Proportion of 1556 retirees with savings accumulations $\geq$ NIS 500,000 who made each disbursement choice, separately for smokers and nonsmokers. NIS = New Israeli shekels.

from an insurance company. Thus, we expect that smokers (and other less healthy people, either actually or in expectation) realize that their life expectancy is somewhat lower than that of (healthy) nonsmokers, and that this realization ultimately affects their annuity versus lump sum choice.

The conjecture is based on Cappelletti et al. (2013) and other papers that demonstrate that impaired health reduces the preference for an annuity. This result is consistent with two different explanations. First, retirees wish to avoid financial shocks, which are often caused by unexpected medical expenses (Sinclair and Smetters, 2004), and therefore retirees with impaired health will prefer the lump sum. Alternatively, retirees who are ill should anticipate a lower life expectancy, and as a result they might be more sensitive to bequest motives. Based on the literature that suggests that smoking status is a good proxy for impaired health, and that smokers may have higher discount rates, our hypothesis is that smokers would choose fewer annuities than nonsmokers, all else being equal.[22]

5.1. Smoking and annuity choices—the empirical investigation

We divide our sample into three groups based on disbursement choice. An individual is categorized as *full annuity* if all accumulations were converted into an annuity (regardless of the annuity value); as *partial annuity* if some of the accumulated savings were converted into an annuity; and as *full lump sum* if none of the accumulated savings were converted into an annuity. In our dataset, smokers significantly preferred annuities. As shown in Fig. 1, 61% of smokers chose full annuities, whereas only 47% of nonsmokers chose this option. This decision was not due to a difference in conversion factors between smokers and nonsmokers, since our comparison of the conversion factors reveals no significant difference.

Next, we conduct a series of descriptive regressions to examine the characteristics of retirees who chose to annuitize. These are clustered in three main groups: (a) personal, (b) pension policy, and (c) macroeconomic fixed effects (FEs).

5.1.1. Choosing an annuity

In our first examination, Eq. (1) ignores smoking and impaired health to investigate the potential main characteristics that can affect the decision to choose an annuity:

$$Y_{ann\,it} = \alpha + \beta O_i' + \delta \, P_i' + \gamma \, GDP_t + \theta RF_t + \varepsilon_{it} \tag{1}$$

where "$Y_{ann\,it}$" is a dummy variable for annuitization ($Y_{ann\,it} = 1$ if the retiree chose any portion of the whole as an annuity; as a robustness check we also look at the propensity to annuitize and the choice of full annuity, described below); "O_i'" is a vector of individual i's characteristics, including "*retirement age$_i$*", which is the retiree's age at the time of decision; "*total amount$_i$*" is the total accumulation at retirement; "*divorced*", "*widowed*", "*married*", and "*unknown marital status*" are dummy variables for marital status (the category "single" was omitted)[23]; "P_i'" is a vector of policy of individual i's char-

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[22] Unless they use an annuity as a mechanism for self-control issues, which we discuss later.

[23] In addition to controlling for marital status, we check the policies themselves and find that the default option in these policies was a "single life annuity." For robustness, we also investigate the choices of single individuals separately. Admittedly, there were very few singles in our sample (only 35: 8 smokers and 27 nonsmokers). In this sample, 75% of the smokers and 74% of the nonsmokers chose to annuitize.

Table 2
Annuity-decision regression. Dependent variable: choosing any part as annuity (rather than the full lump sum choice).

Variable	Basic regression with macroeconomic fixed effects				Basic regression with year fixed effects			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Probit coefficient	Marginal effects at mean	Logit coefficient	Marginal effects at mean	Probit coefficient	Marginal effects at mean	Logit coefficient	Marginal effects at mean
Gender	−0.199	−0.0380	−0.377	−0.0358	−0.203*	−0.0386*	−0.386	−0.0365
	(0.122)	(0.0232)	(0.238)	(0.0224)	(0.123)	(0.0232)	(0.239)	(0.0224)
Retirement age	0.00567	0.00108	0.0130	0.00123	0.00524	0.000997	0.0128	0.00121
	(0.0163)	(0.00310)	(0.0294)	(0.00278)	(0.0163)	(0.00310)	(0.0294)	(0.00277)
Total amount	1.69e−08	3.22e−09	1.20e−08	1.14e−09	−1.97e−08	−3.74e−09	−1.86e−08	−1.76e−09
	(6.32e−08)	(1.20e−08)	(1.09e−07)	(1.03e−08)	(6.32e−08)	(1.20e−08)	(1.09e−07)	(1.03e−08)
Marital status								
Divorced	−0.547	−0.104	−1.275	−0.121	−0.523	−0.0995	−1.264	−0.119
	(0.476)	(0.0902)	(1.092)	(0.102)	(0.474)	(0.0896)	(1.094)	(0.102)
Widowed	−0.508	−0.0968	−1.250	−0.118	−0.487	−0.0927	−1.243	−0.118
	(0.497)	(0.0942)	(1.121)	(0.105)	(0.495)	(0.0937)	(1.123)	(0.105)
Married	−0.543	−0.103	−1.300	−0.123	−0.528	−0.101	−1.304	−0.123
	(0.456)	(0.0863)	(1.057)	(0.0986)	(0.453)	(0.0856)	(1.059)	(0.0985)
Unknown	−2.104***	−0.401***	−3.965***	−0.376***	−2.080***	−0.396***	−3.956***	−0.374***
	(0.471)	(0.0887)	(1.075)	(0.0987)	(0.468)	(0.0881)	(1.076)	(0.0985)
Purchase age	−0.0848***	−0.0162***	−0.154***	−0.0146***	−0.0836***	−0.0159***	−0.152***	−0.0144***
	(0.0114)	(0.00213)	(0.0214)	(0.00197)	(0.0115)	(0.00214)	(0.0215)	(0.00197)
No. of policies	0.0146	0.00279	0.0434	0.00411	0.0146	0.00277	0.0425	0.00402
	(0.0131)	(0.00249)	(0.0272)	(0.00257)	(0.0131)	(0.00250)	(0.0273)	(0.00257)
Percent post-2008	2.613***	0.498***	4.747***	0.450***	2.597***	0.494***	4.722***	0.446***
	(0.438)	(0.0817)	(0.823)	(0.0758)	(0.440)	(0.0817)	(0.826)	(0.0758)
GDP	−2.48e−06**	−4.74e−07**	−4.85e−06**	−4.59e−07**				
	(1.18e−06)	(2.25e−07)	(2.17e−06)	(2.05e−07)				
RF	−5.905	−1.126	−7.340	−0.696				
	(6.248)	(1.189)	(11.57)	(1.097)				
Year 2009					0.460***	0.0875***	0.871***	0.0823***
					(0.173)	(0.0329)	(0.320)	(0.0301)
Year 2010					0.180	0.0343	0.354	0.0335
					(0.148)	(0.0282)	(0.271)	(0.0256)
Year 2011					0.0438	0.00833	0.155	0.0146
					(0.131)	(0.0250)	(0.243)	(0.0229)
Year 2012					0.137	0.0261	0.288	0.0272
					(0.134)	(0.0255)	(0.251)	(0.0237)
Constant	7.679***		14.17***		5.129***		9.275***	
	(1.375)		(2.610)		(0.944)		(1.820)	
Observations	1556	1556	1556	1556	1556	1556	1556	1556
Pseudo R^2	0.2425	0.2425	0.2423	0.2423	0.2438	0.2438	0.2436	0.2436

Note. Standard errors in parentheses. The dependent variable, y_{ann}, is an indicator variable for choosing any part of disbursement as annuity (rather than the full lump sum choice). Main explanatory variables are gender, retirement age, gross domestic product (GDP), and risk-free rate of return (RF) in specifications 1 and 2, or year dummies in specifications 3 and 4, total accumulation amount (total amount), marital status, purchase age, number of policies, and the percentage of accumulation saved after 2008. Specifications are for retirees with accumulated funds of at least NIS 500,000 in this insurance corporation ($N = 1556$). NIS = New Israeli shekels.

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

acteristics, including "*purchase age$_i$*" which is the retirees' average age (averaged over all of the retiree's policies) when the policies were purchased (this variable is correlated with the client conversion factor and hence can serve as a proxy for it; we do not have information about the conversion factor for clients who chose the full lump sum option); "*no. of policies$_i$*" is the number of different policies each client has with this particular insurance provider; and "*percent post* 2008$_i$" is the proportion of money accumulated after 2008 that therefore must be withdrawn as an annuity to satisfy the mandatory monthly annuity requirement; "*GDP$_t$*" is the Israeli gross domestic product in the retirement year in fixed prices[24]; and "*RF$_t$*" is the risk-free rate in the retirement year.[25]

The results for probit and logit models appear in specifications 1–4 in Table 2. Overall, all models are significant with pseudo R^2 equal to around 25%.

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[24] Data from the Israeli Central Bureau of Statistics.
[25] The Bank of Israel's declared effective rate of return.

We find that purchase age and macroeconomic status are related to the annuity choice, but most of the individual socioeconomic characteristics do not significantly affect the outcome. This is consistent with previous literature (e.g., Bütler and Teppa, 2007).

To understand both the impact of seniority in the fund and conversion factors, we include "*purchase age$_i$*" in the regression. Its coefficient is negative and significant in all the specifications, meaning that a 1-year delay in the purchase of a pension plan reduces the likelihood of choosing an annuity (this could result from the increase in the conversion factor). With respect to the specification of the year dummies (column 6 in Table 2), holding all other variables at their mean, an increase of 1 year in the purchase age reduces the probability of purchasing an annuity by 1.6%.

In contrast to previous literature such as Bütler and Teppa (2007), the stock of capital at retirement does not play an important role in any of the specifications. Nevertheless, all regressions refer to accumulations of at least NIS 500,000. Age at retirement and number of policies are not significant.

Some may argue that using GDP and rate of return to capture macroeconomic FEs is problematic because we investigate only a short period of time. Hence we use a year FE method as a robustness test, as indicated in Eq. (2):

$$Y_{annit} = \alpha + \beta O_i' + \delta P_i' + Year_t + \varepsilon_{it} \tag{2}$$

where "*Year$_t$*" is a year FE of the years 2009–2012, when the retiree made the choice between an annuity and a lump sum as defined above (2013 is omitted).

For most variables, the modification from Eq. (1) does not make a difference. The 2009 dummy (the year in which the annuitization decisions were made) is positive and significant, implying that a year after the global financial crisis, the likelihood of annuitizing increased.[26]

5.1.2. Smoking and medical condition

We now examine the impact of smoking and medical condition on the decision to annuitize, while controlling for the other variables previously discussed. Three variables serve as proxies for impaired health: whether the individual was a smoker; whether the individual had a surcharge required by the insurance company for impaired health; and whether the individual had a surcharge required by the insurance company for a risky profession. The variables are added to our previous specifications and results of this estimation are reported in Table 3. [27]

For robustness, to investigate the relationship between smoking and the other health proxies that can affect the estimation, we estimate the same regression without the insurance tariff add-ons. Table 3 presents the estimated effect of medical conditions on the annuity decision. Our results are qualitatively similar when using either logit or probit models. In particular, our main coefficients of interest, capturing the effect of medical condition, have the same sign and similar levels of statistical significance under either model type. The precise magnitudes of the estimated marginal effects from probit or logit models are sensitive to the point in the distribution at which marginal effects are evaluated and are calculated and reported at the mean. Overall, all models are significant with pseudo R^2 around 25%.

When examining both mortality and professional surcharges, both coefficients are negative in the logit and the probit models, but only the mortality surcharge is statistically significant. Retirees required to pay more for their life insurance (meaning that they were considered less healthy or at higher risk of being so) are less likely to purchase annuities at retirement. For instance, we can see that in the probit specification (Table 4, columns 1 and 2), holding all other variables at their mean, being in the group required to pay extra for risk insurance reduces the probability (marginal effect at means) of annuitizing by 13.6% (logit results are very similar). This result implies that ill people are indeed less likely to purchase annuities.

Surprisingly, cigarette smokers are not statistically less likely to demand an annuity. Rather, the coefficient is positive (statistically nonsignificant), in contrast to the prediction of the theory described above.[28] This fits neither our predictions regarding smokers' time preferences, as presented above,[29] nor the assumption that because health condition is not a part of the pricing mechanism in these pension insurance policies, smokers would prefer the lump sum option. Our results hold whether we include or exclude other controls for health condition as described above. In particular, columns 13–16 in Table 3 show that whether we use smoking status alone as a representation of medical condition or add mortality surcharges, smoking does not significantly affect annuitization.

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[26] For robustness, we also check the impact of including the yield on market portfolio (TA-100 Index) and the results are similar. Next we omit the GDP, rate of return, and TA-100 variables and use the year dummies.

[27] Mortality surcharge is a dummy variable for having a surcharge required by an insurance company for impaired health (=1; note that the increased premium is for the risk insurance and not for the annuity because health factors are not taken into account when pricing annuities. We expect that retirees with a mortality surcharge are less likely to annuitize because of lower life expectancy). Professional surcharge is a dummy variable for a surcharge required by an insurance company for having a risky profession (=1; the increased premium is for the risk insurance and not for the annuity. We expect that retirees with a professional surcharge are less likely to annuitize because of lower life expectancy, because of damaged health caused by the risky profession).

[28] We expect smoking status to affect the decision to annuitize, above and beyond the information regarding medical surcharges, since some smoking-related illnesses occur after retirement and hence are not embedded in the preretirement life and health insurance tariff. For example, chronic obstructive pulmonary disease (COPD) is one of the leading causes of smokers' mortality. The incidence of COPD among smokers (but not among nonsmokers) increases after the age of 60 (Terzikhan et al., 2016).

[29] Regarding the entire population in our dataset, 11.46% were smokers. Only 9.64% of individuals in the dataset had a high accumulation (over NIS 500,000).

Table 3
Medical condition: Probit and logit specifications. Dependent variable: choosing any part of disbursement as an annuity (rather than the full lump sum).

Variable	Medical status regression with year fixed effect (including smoking)				Smoking status regression with year fixed effect			
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Probit coefficient	Marginal effects at mean	Logit coefficient	Marginal effects at mean	Probit coefficient	Marginal effects at mean	Logit coefficient	Marginal effects at mean
Gender	−0.179	−0.0297	−0.321	−0.0227	−0.203	−0.0340	−0.351	−0.0251
	(0.136)	(0.124)	(0.262)	(0.337)	(0.135)	(0.141)	(0.261)	(0.373)
Retirement age	−0.00181	−0.000301	−0.00235	−0.000166	0.00253	0.000424	0.00590	0.000421
	(0.0179)	(0.00323)	(0.0324)	(0.00336)	(0.0177)	(0.00343)	(0.0319)	(0.00665)
Total amount	7.68e−08	1.28 e−08	1.11 e−07	7.86 e−09	7.28 e−08	1.22 e−08	1.02 e−07	7.27 e−09
	(7.21 e−08)	(5.38 e−08)	(1.23 e−07)	(1.17 e−07)	(7.41 e−08)	(5.14 e−08)	(1.26 e−07)	(1.08 e−07)
Marital status								
Divorced	−3.956	−0.658	−13.88	−0.979	−3.975	−0.667	−13.89	−0.992
	(120.5)	(17.35)	(680.5)	(33.47)	(120.5)	(17.48)	(681.9)	(33.97)
Widowed	−3.969	−0.661	−13.95	−0.984	−3.977	−0.667	−13.96	−0.997
	(120.5)	(17.34)	(680.5)	(33.40)	(120.5)	(17.48)	(681.9)	(33.90)
Married	−3.917	−0.652	−13.84	−0.977	−3.941	−0.661	−13.89	−0.992
	(120.5)	(17.38)	(680.5)	(33.51)	(120.5)	(17.51)	(681.9)	(33.97)
Unknown	−5.494	−0.914	−16.54	−1.167	−5.515	−0.925	−16.58	−1.184
	(120.5)	(16.30)	(680.5)	(30.68)	(120.5)	(16.43)	(681.9)	(31.12)
Purchase age	−0.0776***	−0.0129	−0.140***	−0.00985	−0.0792***	−0.0133	−0.143***	−0.0102
	(0.0128)	(0.0530)	(0.0237)	(0.146)	(0.0127)	(0.0543)	(0.0235)	(0.152)
No. of policies	0.00754	0.00126	0.0295	0.00208	0.00761	0.00128	0.0285	0.00204
	(0.0140)	(0.00566)	(0.0293)	(0.0310)	(0.0140)	(0.00572)	(0.0291)	(0.0303)
Percent post-2008	2.515***	0.418	4.514***	0.318	2.395***	0.402	4.312***	0.308
	(0.469)	(1.719)	(0.873)	(4.729)	(0.466)	(1.643)	(0.867)	(4.570)
Year 2009	0.716***	0.119	1.378***	0.0972	0.724***	0.121	1.391***	0.0993
	(0.199)	(0.490)	(0.381)	(1.444)	(0.199)	(0.497)	(0.380)	(1.475)
Year 2010	0.131	0.0219	0.247	0.0174	0.131	0.0220	0.248	0.0177
	(0.160)	(0.0936)	(0.290)	(0.259)	(0.159)	(0.0936)	(0.290)	(0.264)
Year 2011	−0.00360	−0.000599	0.0440	0.00311	−0.0164	−0.00275	0.0244	0.00174
	(0.143)	(0.0239)	(0.261)	(0.0497)	(0.142)	(0.0264)	(0.261)	(0.0318)
Year 2012	0.0975	0.0162	0.202	0.0142	0.0996	0.0167	0.196	0.0140
	(0.144)	(0.0707)	(0.267)	(0.212)	(0.143)	(0.0723)	(0.265)	(0.208)
Medical condition								
Smoker	0.173	0.0288	0.306	0.0216	0.152	0.0254	0.296	0.0211
	(0.172)	(0.122)	(0.329)	(0.321)	(0.169)	(0.108)	(0.329)	(0.315)
Mortality surcharge	−0.835**	−0.139	−1.450**	−0.102				
	(0.338)	(0.573)	(0.577)	(1.520)				
Professional surcharge	−0.254	−0.0422	−0.517	−0.0364				
	(0.248)	(0.178)	(0.434)	(0.542)				
Constant	9.780		24.19		8.517		21.88	
	(120.5)		(680.5)		(120.5)		(681.9)	
Observations	1359	1359	1359	1359	1359	1359	1359	1359
Pseudo R^2	0.2569	0.2569	0.2563	0.2563	0.2512	0.2512	0.2506	0.2506

Note. Standard errors in parentheses. The dependent variable, y_{ann}, is an indicator variable for choosing any part of disbursement as annuity (rather than the full lump sum). Main explanatory variables are gender, retirement age, year dummies, total accumulation amount (total amount), marital status, purchase age, number of policies, the percentage of accumulation saved after 2008, and medical status (defined by either smoking status or medical surcharge implying the need to pay a premium for medical problems on insurance policies). Specifications are for retirees with accumulated funds of at least NIS 500,000 in this insurance corporation and information about smoking status ($N = 1339$). NIS = New Israeli shekels.

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

We explore these finding further: Fig. 2 shows both smoking and mortality surcharge coefficients from Table 3 along with 75% and 95% confidence intervals. It is clear that the range for the mortality surcharge variable is negative, and the smoking coefficient and a substantial part of the confidence intervals are in the positive range, implying a clear positive effect of being a smoker on the demand for annuitization.

5.2. Robustness tests

To verify that our results are not driven by sample selection related to investigating only clients who accumulated over NIS 500,000, we repeat the analysis reported in Table 3 with all clients with accumulated funds of at least NIS 300,000

Table 4
Robustness. Dependent variables: choosing full lump sum, choosing partial annuity, and choosing full annuity.

Variable	Choosing full lump sum		Choosing partial annuity		Choosing full annuity		Medical status regression with year fixed effect (including smoking) — accumulations over NIS 300,000
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Probit coefficient	Marginal effects at mean	OLS coefficient	Tobit coefficient	Probit coefficient	Marginal effects at mean	Probit coefficient
Gender	0.178	0.0296	−0.00332	−0.000968	−0.0376	−0.0149	−0.0646
	(0.136)	(0.124)	(0.0226)	(0.0264)	(0.0988)	(0.0393)	(0.0786)
Retirement age	0.00258	0.000429	−0.00229	−0.00458	0.0268*	0.0107*	0.0151
	(0.0180)	(0.00347)	(0.00355)	(0.00425)	(0.0158)	(0.00628)	(0.0119)
Total amount	−7.61 e−08	−1.27 e−08	4.20 e−09	6.05 e−09	−3.93 e−08	−1.56 e−08	2.85 e−07***
	(7.21 e−08)	(5.33 e−08)	(1.34 e−08)	(1.56 e−08)	(6.00 e−08)	(2.39 e−08)	(8.01 e−08)
Marital status							
Divorced	3.957	0.658	−0.0941	−0.0980	−0.269	−0.107	−0.266
	(120.5)	(17.34)	(0.0607)	(0.0701)	(0.273)	(0.108)	(0.247)
Widowed	3.969	0.660	−0.131*	−0.136*	−0.173	−0.0688	−0.222
	(120.5)	(17.33)	(0.0673)	(0.0779)	(0.302)	(0.120)	(0.267)
Married	3.915	0.651	−0.101*	−0.105	−0.245	−0.0975	−0.281
	(120.5)	(17.37)	(0.0559)	(0.0645)	(0.254)	(0.101)	(0.228)
Unknown	5.492	0.913	−0.558***	−0.721***	−1.350***	−0.537***	−1.848***
	(120.5)	(16.29)	(0.0638)	(0.0762)	(0.297)	(0.118)	(0.242)
Purchase age	0.0771***	0.0128	−0.0188***	−0.0215***	−0.0836***	−0.0332***	- 0.0707***
	(0.0128)	(0.0527)	(0.00229)	(0.00269)	(0.0101)	(0.00402)	(0.00816)
No. of policies	−0.00775	−0.00129	−0.0108***	−0.0108***	−0.147***	−0.0584***	0.00815
	(0.0140)	(0.00578)	(0.00262)	(0.00308)	(0.0142)	(0.00564)	(0.0111)
Percent post-2008	−2.525***	−0.420	0.213***	0.293***	−1.029***	−0.409***	1.583***
	(0.470)	(1.726)	(0.0749)	(0.0876)	(0.326)	(0.130)	(0.269)
Year 2009	−0.715***	−0.119	0.112***	0.142***	−0.130	−0.0519	0.590***
	(0.199)	(0.490)	(0.0339)	(0.0395)	(0.147)	(0.0586)	(0.124)
Year 2010	−0.130	−0.0217	−0.000921	0.00405	−0.256**	−0.102**	0.205*
	(0.160)	(0.0929)	(0.0295)	(0.0346)	(0.128)	(0.0511)	(0.105)
Year 2011	0.00178	0.000296	−0.0368	−0.0366	−0.295**	−0.117**	0.0391
	(0.143)	(0.0238)	(0.0266)	(0.0312)	(0.115)	(0.0456)	(0.0964)
Year 2012	−0.0975	−0.0162	0.00689	0.0108	−0.177*	−0.0706*	0.0620
	(0.144)	(0.0707)	(0.0242)	(0.0283)	(0.104)	(0.0415)	(0.0939)
Medical condition							
Smoker	−0.175	−0.0291	0.0370	0.0424	0.160	0.0637	0.343***
	(0.172)	(0.123)	(0.0279)	(0.0324)	(0.124)	(0.0494)	(0.107)
Mortality surcharge	0.816**	0.136	−0.188**	−0.242***	−0.202	−0.0804	−0.488*
	(0.340)	(0.560)	(0.0756)	(0.0922)	(0.333)	(0.133)	(0.268)
Professional surcharge	0.305	0.0507	−0.0511	−0.0623	−0.500**	−0.199**	−0.213
	(0.242)	(0.212)	(0.0487)	(0.0576)	(0.245)	(0.0976)	(0.159)
Constant	−9.843		2.203***	0.364***	3.598***		3.227***
	(120.5)		(0.217)	(0.00798)	(0.853)		(0.644)
Observations	1359	1359	1359	1359	1359	1359	2533
R^2			0.2628				
Pseudo R^2	0.2573	0.2573	0.2535	0.2358	0.1998	0.1998	0.2095

Note. OLS = Ordinary least squares. NIS = New Israeli shekels. Standard errors in parentheses. Dependent variables, y_{lump}, y_{prop}, and y_{full}, are indicator variables for choosing the full lump sum (rather than any part as annuity), choosing a partial annuity, and choosing the full annuity. Main explanatory variables are gender, retirement age, year dummies, total accumulation amount (total amount), marital status, purchase age, number of policies, the percentage of accumulation saved after 2008, and medical condition (either defined by smoking status or medical surcharge, implying the need to pay a premium for medical problems on insurance policies). Specifications 1–6 are for retirees with accumulated funds of at least NIS 500,000 in this insurance corporation and information about smoking status ($N = 1359$); smoking effect is nonsignificant in all specifications and consistent with our main results. Specification 7 is for retirees with accumulated funds of at least NIS 300,000 in this insurance corporation and information about smoking status ($N = 2533$); smoking effect is positive and significant.

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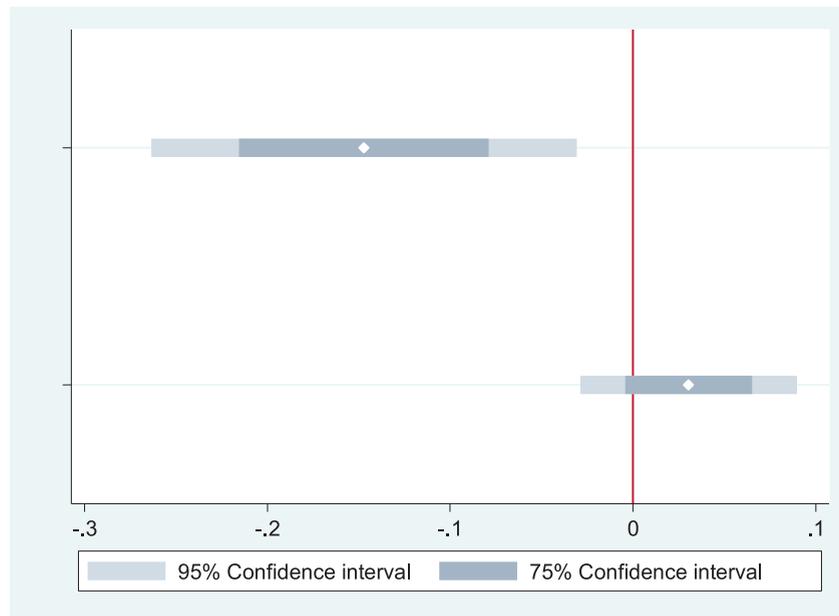 ** $p < 0.05$.
  *** $p < 0.01$.

Fig. 2. Smoking and mortality surcharge coefficients and 75% and 95% confidence intervals.

(approximately USD 85,000). Our main results are even stronger: The smoking coefficient is now positive and significant, whereas the impaired health coefficients remain negative, implying that being a smoker significantly increases the propensity to annuitize, in contrast to our prior conjectures. We repeat the analysis for various thresholds (NIS 100,000 and NIS 50,000) and the results hold.[30]

Table 4 presents additional robustness tests. It could be that the requirement to purchase a minimal mandatory annuity legislated in Israel as of 2008 (applying only to savings accumulated after this period) would affect the results. To address this concern, we added a probit specification in which the dependent variable was choosing the full-annuity option, and two specifications (linear regression and tobit) in which the dependent variable was the percentage of accumulation designated for annuity. We show that our results hold in these different specifications.[31]

One possible reason for our results might be related to differences in the annuity factors (annuity pricing) between smokers and nonsmokers, as the lower the factor, the more attractive an annuity is in relative terms. In particular, it could be that smokers who chose to purchase an annuity at retirement did so because of the better annuity factors they had in their policies (the annuity factor determines the payment per period), compensating them for their shorter life expectancies (the number of periods). To test this potential concern, we examine whether the annuity factor for smokers, conditional on the fact that they chose the annuity option, was significantly lower (i.e., better) than the annuity factor for nonsmokers. We find no significant difference between the mean annuity factors of smokers and nonsmokers (161.62 and 160.78, respectively). Further, when we regress the annuity factor (for policies in which the retiree had chosen any portion as annuity) over smoking status, we find that the relation is not statistically significant even when we add the control variables previously used, such as gender, total accumulated amount, marital status, percentage of money accumulated after the Israeli minimal mandatory annuity law, choosing full annuity, and the insurance company requirement to pay a premium for impaired health (mortality surcharge, described above). We do not find evidence in our sample that smokers chose annuities because of better terms.

A final aspect is related to the fact that our results about smokers' behavior are derived from the comparison to non-smokers. Yet, one might ask if rather than the annuitization levels among smokers being relatively high, the annuitization levels among nonsmokers are relatively low. First, our sample (and the Israeli pension market in general) shows a relatively high level of annuitization compared with the academic literature about annuitization worldwide; hence, assuming that this level represents under-annuitization for nonsmokers is less intuitive, though still plausible. Second, to address this more directly, we compare the decisions of nonsmokers (smokers) who indicated they had received professional advice from an

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[30] We do not analyse amounts smaller than NIS 50,000 since these are trivial amounts and in this dataset only 2.3% of participants with amounts below this threshold annuitize.

[31] We also added to our analysis GLM specifications for both the binary variable (y_{ann}, indicating choosing any portion of annuity) and the continuous variable (y_{prop}, percentage of accumulation designated for annuity). We used several link functions (identity, log, and logistic functions) as well as two different maximization methods (maximum likelihood and iterated, reweighted least-squares optimization). The results with regard to health conditions do not change. Smoking behavior is nonsignificant positive while the mortality surcharge is negative and statistically significant.

insurance agency with decisions of nonsmokers (smokers) who did not have a registered adviser.[32] We assume that advised clients received advice that benefitted them. If indeed nonsmokers optimally should have chosen more annuities than they did, we should expect those who were advised by professionals to annuitize more. However, in our sample, 47% of advised nonsmokers chose to fully annuitize, compared to 49% of those who did not have a registered adviser, implying that professional advice did not increase full annuitization among nonsmokers.

Regarding smokers, 50% of smokers who received the assistance of an adviser chose to fully annuitize, compared with 61% of the smokers without a registered adviser, suggesting that professional advisers directed smokers to reduce their full annuitization rates. Admittedly, we have relatively few smokers and nonsmokers who were advised by an insurance agency, yet the comparison suggests that receiving professional advice reduced smokers' full annuitization rates and did not increase nonsmokers' full annuitization rates, which is in line with our analysis.

6. Potential explanations

We offer three potential explanations for smokers' choices of annuities. The first is that smokers may not perceive themselves as having shorter life spans, meaning that smokers experience a delusion regarding life expectancy, which is one of the factors affecting the demand for annuities (e.g., Pashchenko, 2013).

Optimism among smokers is reported in the literature. Hurwitz and Sade (2018) investigate life expectancy perceptions of Israelis with an online survey. Their main findings are that smokers experience optimism about their life expectancies, as 57% of smokers thought that they would live as long as the average person, and 22% expected they would have a longer life expectancy.

Several studies provide further evidence regarding smokers' health perceptions. For instance, using the U.S. Health and Retirement Study, Schoenbaum (1997) shows that heavy smokers are overoptimistic regarding their life expectancy. Brock and Balloun (1967) provide evidence that smokers are more receptive to supportive information about smoking (denial of the smoking-cancer link) than to nonsupportive information (affirmation of the smoking-cancer link). Ayanian and Clearly (1999) report that only 29% of American smokers thought that their own risk of heart attack was higher than average and only 40% thought that their risk of cancer was higher than average. Masiero et al. (2015) confirm the presence of optimistic bias among Italian smokers.

A second explanation of our results is related to self-control. O'Donoghue and Rabin (1999a) define sophisticated people as those who are fully aware of their self-control problems and, in contrast, naïve people as those who are fully unaware of their future self-control issues. Lack of self-control is a common explanation for smoking and other addictive behaviors. If smokers are at least partially aware of their self-control problems, they might choose an annuity to fight the potential temptation to spend too much of their cash on hand from a lump sum payment, and hence they might somewhat prefer annuities. We test this using an indirect approach. One would expect that smokers who are at least aware of their self-control problem would use not just one (choosing an annuity) but several mechanisms of self-protection. We look for evidence that smokers employed self-protection mechanisms to a greater extent than nonsmokers.

To protect oneself from trouble caused by a lack of self-control, one possible option is to purchase PHI, which provides an income in the case of disability that prevents the insured from being able to work. Given (a) that smoking is associated with many illnesses linked to disability, (b) that PHI, paid on a schedule, can prevent impulsive spending of a lump sum, and (c) that smoking is not a factor in the pricing, PHI is a good self-protection option for sophisticated smokers. However, our data reveal that nonsmokers insured themselves against disability with PHI from the investigated insurance company at a higher rate (75.77%) than smokers (52.67%).

Our results are also consistent with Hurwitz and Sade (2018), who find in a survey of the Israeli population that there was neither a significant difference between Israeli smokers and nonsmokers regarding the use of external advisers when facing a financial decision (a mechanism that could also help people cope with self-control problems) nor a willingness to postpone social security claims in favor of future higher social security benefits. In summary, we find no supporting evidence in our data or in previous findings regarding smokers for the self-control explanation.

The third explanation is that smokers' behaviors result from advantageous selection in the annuities markets. Advantageous selection theory suggests that low-risk individuals (such as careful drivers) are also those who buy more insurance (De Meza and Webb, 2001). There is empirical evidence supporting this theory (Cutler et al., 2008).

Smokers are usually considered to be risk-tolerant individuals (Khwaja et al., 2006(. However, annuities are insurance against longevity risk. Hence, in the annuities markets, smokers are considered low-risk individuals (they are expected to have shorter lives) and therefore our results, based on real choices, that smokers choose relatively more annuities are consistent with the advantageous selection literature.

Our work contributes to the academic literature on advantageous selection regarding a variety of insurance products, including annuities (Brown et al., 2008a). Fang et al. (2008) provide evidence for advantageous selection in the Medigap insurance market, and Corea (2017) presents results that are consistent with ours, of smokers buying more annuities, using survey data from the SHARE study for 11 European countries and Israel.

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[32] An insurance agency in Israel is a broker that, although aligned with the insurance provider, has a primary responsibility to the buyer, set by the Control of Financial Services Act (2005).

7. Conclusion

This paper uses a rich dataset of Israeli insurance pension policies to explore smokers' versus nonsmokers' time preferences and retirement payout decisions. Since the pension policies consider only gender, actuarial life expectancy, and expected rate of return for pricing purposes, and not health or smoking, we postulated that lump sum options would be preferred by less healthy retirees. Surprisingly, we find that smokers are not less likely to annuitize.

Three possible explanations for our findings are further discussed: First, smokers might not perceive themselves as having a shorter lifespan, which is consistent with results of previous surveys in Israel. Second, if smokers are at least partially aware of their self-control problems, they might use several mechanisms, including annuities, to overcome their temptation to spend too much of their cash on hand. However, we find no evidence of smokers using other mechanisms in our data. A third explanation is related to the existence of advantageous selection in the annuities markets, in that in these markets smokers are considered low-risk individuals.

In addition to contributing to the insurance and annuity choice literature, our paper has implications for research related to smokers' behavior. We document a behavior of smokers in a financial domain and suggest several mechanism to explain it. Further research on how smokers perceive their life expectancies as well as on advantageous selection related to smokers' behavior in different insurance markets may help in designing products, policies, and related interdisciplinary research.

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