



Displaced, disliked and misunderstood: A systematic review of the reasons for low uptake of long-term care insurance and life annuities

Timo R. Lambregts*, Frederik T. Schut

Erasmus School of Health Policy & Management, Burgemeester Oudlaan 50, 3062 PA Rotterdam, the Netherlands

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ABSTRACT

With aging populations, the role of private insurance in financing late-in-life risks is likely to grow. Yet, demand for long-term care insurance (LTCI) and life annuities (hereafter *annuities*) is very limited and lags behind economic projections. This systematic literature review surveys the large number of theoretical and empirical studies analyzing this contradiction. We examine the LTCI and annuity puzzles separately and show which factors limit demand for insurance against both late-in-life risks. Our systematic search rendered 3,945 unique hits and findings of 187 studies were integrated in our analyses. Results hereof suggest that holding of both insurance products is systematically impeded by substitution by social security, adverse selection, nonstandard preferences and limited rationality due to low financial literacy and risk unawareness. Furthermore, insurance holding is concentrated among wealthier and subjectively healthier individuals. A comprehensive approach addressing all four reasons for low uptake may increase insurance holding most effectively and may particularly empower people with lower socio-economic status to make well-informed decisions.

Introduction

Facing aging populations, many developed countries strive to protect against late-in-life risks through policies that ensure adequate elderly care and retirement income. Yet fiscal affordability of such policies is simultaneously impeded by these demographics. Consequently, the role of public policy in protecting against long-term care (LTC) and longevity risks remains small in countries where government policies have traditionally been limited and is decreasing in countries where extensive public programs are being constricted. Hence, social benefits for LTC and longevity risks often provide a minimalist safety net for the worst-off, while others need to buy private insurance to cover those risks.

Limited coverage of public programs and the considerable individual uncertainty about late-in-life risks provide a strong rationale for buying private insurance. Indeed, a market with limited government intervention offers ample freedom to deploy resources and smooth consumption over one's life-cycle. Individuals can purchase a preferred amount of insurance coverage at a preferred point in time, e.g., when income and assets are high to protect against depleting assets due to late-in-life risks when income is lower. Yet in practice, private insurance against LTC and longevity risks lags behind economic projections. The uptake of long-term care insurance (LTCI) is much lower than

predicted by standard economic (expected utility) theory (Pestieau and Ponthière, 2012). Similarly, economic theory judges that life annuities (hereafter *annuities*) should play a larger role in insuring against longevity risks than is observed in the current market (Modigliani, 1986).

In response, for both distinct but related markets a broad literature has emerged to explain why such underinsurance exists. This research has analyzed both the supply side of the market, where existing insurance products may suffer from design flaws and the demand-side, where people may fail to adequately purchase these products. We focus on demand-side analyses and group this literature into four explanations. First, people could substitute for private insurance with public insurance or family help (e.g., Brown et al., 2007b). Second, people could have private information about their LTC and longevity risk that risk-rated insurance premiums do not control for. Then primarily the worst risks adversely select into LTCI and annuities, driving up premiums and lowering demand among better risks (e.g., Sloan and Norton, 1997). Third, people could have different preferences than those assumed in expected utility models (e.g., Brown et al., 2012). Fourth, behavior of limited rationality not reflected in expected utility evaluations could impact uptake. For example, when people are not perfectly rational, factors such as financial literacy may impact uptake (e.g., Brown, 2007).

To evaluate why uptake of LTCI and annuities is so low our paper

* Corresponding author.

E-mail address: lambregts@eshpm.eur.nl (T.R. Lambregts).

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provides an overview of all factors impacting LTCI and annuity purchase decisions. To date, the only extensive review in the fast growing field of literature on LTCI evaluates three major research areas (financing, demand, and insurability) by identifying the most significant paths in a citation network (Eling and Ghavibazoo, 2019). By contrast, our review provides a more in-depth analysis of the potential explanations for low uptake of LTCI – including more than twice as many empirical studies on LTCI uptake – while simultaneously providing a similar analysis for low uptake of annuities. Hence, our contribution to the literature is fourfold. First, we provide a systematic review of the literature on demand for LTCI and annuities with quality checks (rather than a structured review). Second, we provide overviews of the theoretical and empirical literature separately and for both fields of study. Third, we move beyond summarizing previous results by employing our descriptive results to unravel the underlying reasons for low uptake. Fourth, we compare the reasons for low uptake in both markets.

Our article continues as follows. Section “Background” gives an overview of the main LTCI and annuity markets and products. Section “Methods” describes the state-of-the-art methods of our systematic review. Section “Theoretical literature” integrates the findings of previous theoretical research. Section “Empirical literature” summarizes the findings of empirical research and uses these to explain why uptake of LTCI and annuities is so low. Section “Discussion” discusses to what extent the factors that lead to low uptake for LTCI and annuities overlap. Finally, our conclusion and recommendations follow in Section “Conclusion and recommendations”.

Background

The uptake of private LTCI differs greatly between countries, in part because there are large differences between social security schemes. Still, private LTCI markets do not necessarily thrive in countries with less generous social security schemes. In the US, for example, LTCI is the primary risk sharing mechanism for many individuals as Medicaid – the public insurance scheme – only provides a means-tested safety net for the lowest income groups. Nonetheless, the American LTCI market covers just a fraction of the total LTC expenditures (Brown and Finkelstein, 2007). In the UK, private LTCI is almost absent, notwithstanding the fact that LTC provided by local authorities is also stringently means-tested.

Private LTCI in France and Germany is generally seen to be more successful (Doty et al., 2015; Rothgang, 2010). In these countries, LTCI is marketed as a supplement to (income adjusted) social insurance policies. Supplemental LTCI policies are also available in Israel and Singapore (Swiss Re, 2014). The downside is that these are bare-bone policies do not nearly cover the costs of LTC and offer limited relief from pressure on public expenditures. Nonetheless, such meagre policies are viewed to be more marketable. With social security protecting against tail-risks, supplemental policies are both more affordable and less prone to uncertain developments of future LTC costs than more comprehensive insurance products.

Similarly, annuity markets are hardly ever substantial, even in case of more extensive social security settings (Rusconi, 2008). Generally, we can distinguish two types of annuity products. First there are immediate annuities, in which annuitants are almost immediately entitled to receive annuity income after paying a lump-sum. Such policies are the predominant form of longevity insurance in e.g., the UK, the US and Australia. Second, there are deferred annuities, in which annuitants pay periodic premiums in advance and will start receiving annuity payments at some point in the future. These policies are the conventional type of longevity insurance in countries such as Germany, Denmark and the Netherlands. The main difference between both types is that, in the purchase of immediate annuities, (pension) savings are converted at once to buy an annuity which starts paying out immediately, whereas deferred annuities are purchased through iterative premiums that are converted to future entitlements. Although they differ, neither annuity

product is particularly popular in a voluntary setting and when pension savings become available people seem inclined to opt for lump-sum payments rather than annuity payments (Brown et al., 2007a).

To some extent LTCI and annuity markets overlap, because of the availability of combined products. In the US, some products currently offer a LTC rider on top of an immediate annuity. LTC needs can be paid with this annuity and if not all annuity assets are depleted, the remainder will be paid out as death benefits (NAIC, 2016). Deferred annuity hybrids are also available, yet less popular. The uptake of these new products seems to outperform that of conventional annuities (NAIC, 2016). In Germany, similar products are available, yet their commercial success is unknown (Zhou-Richter and Gründl, 2011).

Methods

We performed a systematic literature review based on state-of-the-art methods (Higgins and Green, 2011). Thus, we (1) formulated a protocol with clear research questions and eligibility criteria beforehand; (2) approached an information specialist to develop a highly sensitive search string and search the relevant databases; (3) performed the study selection collaboratively; (4) searched relevant working paper databases manually, snowballed reference lists of all included publications and approached experts to ensure the integrality of the included studies; (5) used a data extraction form that was developed ex ante; (6) graded all included studies based on the strength of their methodology and study design in order to assess the risk of biased results; and (7) integrated the results. Below, we describe this process in-depth.

(1) In the protocol, we laid down the following research questions: (i) which factors impact the uptake of LTCI? and (ii) which factors impact the uptake of life annuities? To be included, publications should:

1. be explicitly about private LTCI, annuities and/or combined life care annuities;
2. focus on uptake and/or demand of these products;
3. identify factors that impact demand;
4. be either empirical or theoretical;
5. when empirical, be on high income countries as defined by the World Bank (2018)
6. when theoretical, be the most recent available applying the specific model;
7. be in English; and
8. be published in a peer-reviewed journal.

(2) A comprehensive search strategy was developed with the help of an information specialist of the Erasmus Medical Center Library. We defined keywords as well as Medical Subject Headings (MeSH) and Embase Subject Headings (Emtree terms) that captured the first two eligibility criteria: a focus on LTCI and/or annuity demand. In order to maximize the identification of potentially relevant publications, we designed the search string to be highly sensitive by including keywords with few (relevant) hits (see Appendix A).

This search string was then used to search a combination of general databases, namely: EMBASE, Medline Ovid, and Web of Science. A general search string was additionally entered in Google Scholar and the first 400 hits were recorded. This combination of database searches was suggested by Bramer et al. (2017b). Following their recommendations we also added the following subject specific databases: CINAHL EBSCOhost (nursing care), PsychINFO Ovid (psychology), ABI inform Proquest (general non-medical) and EconLit (economics). The search was performed on July 3rd 2018 and resulted in 3,945 records to be included in this literature review. A complete overview of the study selection process can be found in Figure B1.

(3) Titles and abstracts of the identified records were stored in EndNote and reviewed simultaneously by both authors following

Bramer et al. (2017a). We scanned the abstracts specifically to identify publications on factors impacting LTCI and annuity uptake decisions as defined in the eligibility criteria. This resulted in the inclusion of 341 publications for full text reading, in which the eligibility criteria from our protocol were applied.

(4) We employed three additional data collection sources to minimize the risk of overlooking potentially relevant publications. First, we manually searched the working-paper series of the NBER, Netspar, Cepar, the Pension Research Council and SHARE from 2006 onwards to identify papers that met eligibility criteria 1 to 7, but which had not yet been published in a peer-reviewed journal. Second, we similarly snowballed reference lists of all articles and working papers included. Third, five experts reflected on the list of included publications and indicated whether any relevant studies were still missing. In this way, we ultimately included a total of 187 studies of which 106 empirical and 81 theoretical.

(5) Relevant data were extracted from the included studies using the predefined data extraction form. This data extraction – which focused on either the most extensive analyses performed or the preferred specification identified by the authors – derived the outcome variable used, the independent variables analyzed, the corresponding associations and whether these were significant at a 5 percent significance level. As our goal is to gain an overview of the directional associations found across different studies – and not to perform a meta-analysis – we do not report strength of association. For empirical studies, we also retrieved the dataset used, the sample size, and the sampling restrictions.

(6) We performed additional quality checks, in order to safeguard the quality of the included studies and incorporate quality aspects in our review. Publications were scored on a scale from A (best) to D (worst) using the relevant measures from the GRADE method (Schünemann et al., 2013). Specifically, an initial grade was based on study design, with quasi-experiments (B) ranking above observational studies (C) and other means of data collection (D). Points were then deducted for study limitations and publication biases. Studies that scored minus points in excess of rank D, were excluded retrospectively. In total, 19 studies have been excluded because of quality issues (see Figure B1). The main reason for exclusion was that studies failed to (properly) apply multivariate analyses and hence reported monocausal results. As such, all studies included contained multivariate analyses.

(7) We combine findings of both theoretical and empirical literature as follows. For theoretical research, we integrate these by describing the main findings on LTCI (Section “Demand for LTCI”) and annuity uptake (Section “Demand for annuities”). This overview is not intended to compare theoretical predictions based on underlying assumptions, but rather to shed light on the different factors impacting insurance uptake that the theoretical literature provides. For empirical research, we employ a vote count to give an overview of the results of included studies (Section “Empirical literature”). We pay particular attention to the strongest level of evidence (B) that results from quasi-experimental studies evaluating causal relationships. For both theoretical and empirical papers we distinguish between individual level characteristics (e.g., age, gender and income) and contextual characteristics (e.g., social benefits and taxes) that could impact uptake. After presenting our integrated results, we discuss how the findings can explain low uptake through substitution, adverse selection, insurance preferences and limited rationality for LTCI (Section “Why is LTCI uptake so low?”) and annuities (Section “Why is annuity uptake so low?”). Finally, we show which factors impact uptake of both products in Section “Discussion”.

Theoretical literature

Demand for LTCI

Standard insurance theory in its simplest form posits that LTCI is valuable for those who are risk averse (i.e., with a concave utility function). Such a risk averse individual prefers the certainty provided

by insurance coverage over the uncertainty of facing an uninsured risk and is willing to pay a premium to attain such certainty. However, uptake of LTCI as predicted by standard insurance theory is much higher than as observed in practice. Hence, researchers have sought to expand and adjust the model to fit actual market conditions better. Here we provide an overview of the main demand-side adaptations of the basic model.

First, people may rely on several substitutes for LTCI. At the individual level, private LTCI can be crowded out by informal care (De Donder and Pestieau, 2017). Potentially, LTCI can be crowded out by home equity as well. If home equity is illiquid, individuals may have to sell their house in order to pay for LTC. If reverse mortgages ensure that home equity is more liquid, then individuals could use these assets to purchase LTCI without directly selling their house (Davidoff, 2010, 2009; Shao et al., 2017). At the contextual level, private LTCI can be crowded out by means-tested public LTCI (Fabel, 1996; Pauly, 1990). Brown and Finkelstein (2008) predict that this is particularly the case for individuals with lower wealth levels. Friedberg, Sun and Webb (2014) extend these findings.¹ Still, policy interventions that protect against spending down – such as partnership programs – are predicted to barely increase LTCI uptake and to mostly benefit those who would purchase private LTCI anyway (Sun and Webb, 2013).

Second, it is argued that individuals with high LTC needs will adversely select into LTCI. For example, if young individuals have a low probability of needing LTC they will prefer to purchase LTCI later to avoid a loss in expected income (Meier, 1999). Consequently, only older individuals and those with high LTC risks will purchase LTCI. Even if insurers risk-rate premiums – by for example using age as a proxy of LTC risk – this will not reflect all private information on LTC risks that individuals possess and adverse selection could persist.

Third, individual preferences could deviate from those assumed in the standard bare bones insurance model based on expected utility theory. For example, it has been suggested – contrary to what is usually assumed – that marginal utility of consumption in a period of LTC needs is lower, than in a period of good health (Finkelstein et al., 2009). If that is the case, then LTCI is less attractive because it shifts consumption from a period with high marginal utility to a period with lower marginal utility (Meier, 1998). Furthermore, individuals may underestimate their LTC risk. Such probability underweighting (De Donder and Leroux, 2014) may ensure a lower valuation of insurance and decrease LTCI demand.

Additionally, family dynamics are expected to impact LTCI demand. Bequest motives can make LTCI more attractive, as these encourage individuals to protect their wealth (Lockwood, 2014). At the same time, buying LTCI can decrease informal caregiving and may therefore be unattractive even in view of bequest motives (e.g., Pauly, 1990; Zweifel and Strüwe, 1996, 1998). This suggests that if people prefer informal care they may strategically decide not to buy LTCI in order to increase informal caregiving.

Demand for annuities

For annuities, the seminal work of Yaari (1965) shows that an individual who (1) maximizes a time separable utility; (2) faces uncertainty about the timing of death only; and (3) has no bequest motive, should fully annuitize at actuarial fair prices. Subsequent theoretical research has analyzed whether different assumptions could explain why actual uptake is lower. For example, in a well-known extension Davidoff et al. (2005) show that the results of Yaari (1965) hold under less strict utility assumptions, but do not hold when insurance markets are incomplete. In this theoretical overview, we summarize the main

¹ This is likely at least partly due to affordability. Ma and Sun (2017) show that cheaper policies that protect only against tail-risks would increase private LTCI coverage among those with lower wealth levels.

demand-side extensions on Yaari (1965).

First, just as for LTCI, substitution has been highlighted as an explanation for low uptake. At the individual level, multiple studies show that families can rely on various substitutes for formal annuities. Some identify couples as a potential group for whom annuities might be less valuable, because they inherently already pool risks between themselves (Brown and Poterba, 2000). Similarly, others show that longevity risks can be pooled efficiently by families (Schmeiser and Post, 2005; Stamos, 2008). At the contextual level, substitution can also occur: social benefits can crowd out private annuities (Pashchenko, 2013; Purcal and Piggott, 2008). Moreover, social benefits can particularly deter individuals with shorter life expectancy from entering the annuity market and thus aggravate adverse selection effects (Heijdra et al., 2015; Walliser, 2000).

In addition, a broad range of papers has argued that the design of current annuity products is suboptimal, which may encourage substitutional strategies.² In addition, Kingston and Thorp (2005) show that – as annuitization is often irreversible – not annuitizing offers valuable flexibility through retention of the option to annuitize later on. Other studies show that annuitization is only valuable from a certain age (or wealth level). Moreover, self-annuitization (e.g., Milevsky, 1998; Stabile, 2006; Milevsky and Young, 2007b) or other investments (Di Giacinto and Vigna, 2012) may better protect the liquidity of assets and may be optimal until a certain age (or wealth threshold) and depending on the returns offered by other investments (Hainaut and Devolder, 2006). Studies allowing for flexible investment portfolios over time derive qualitatively similar results (Horneff et al., 2008a,b; Milevsky and Young, 2007a).

Second, adverse selection can play a role just as for LTCI; if risk-rated premiums do not reflect private information, only those with the worst risks will purchase annuities. Indeed, it is argued that individuals infer such private information on their longevity risk from their health status (e.g., Gupta and Li, 2013). Mitchell et al. (1999) show that prices are higher due to adverse selection, but with realistic parameters this cannot explain low uptake for estimated loading factors. Balls (2006) draws qualitatively similar conclusions and shows that adverse selection based on health status both decreases the value of annuities on the market and shrinks the market size.

Third, people can have different preferences than those assumed in the Yaari (1965) model. As for LTCI, at the individual level a common extension has been to introduce bequest motives (e.g., Kotlikoff and Spivak (1981)). Davidoff et al. (2005) show that under fair premiums it is still optimal to annuitize all wealth, except for the part that one wishes to bequeath. Still, under unfair premiums bequest motives can eliminate demand (Friedman and Warshawsky, 1990; Vidal-Meliá and Lejárraga-García, 2006, 2004). Bequest motives need not be strong; demand can be eliminated by modest bequest motives (Lockwood, 2012) or even by any positive bequest motive if an individual is sufficiently risk averse (Bommier and Grand, 2014). As for LTCI, it is also argued that parents may strategically purchase annuities (Bernheim et al., 1985). Specifically, parents may use bequests to influence behavior of their children. For example, they could decrease their bequest (or threaten to) by purchasing nonbequeathable annuities to stimulate their children to give them more attention.

Finally, uncertainty over future health costs may be important. Annuities may be used to hedge against the uncertain costs of health shocks when older (Ai et al., 2017; Pang and Warshawsky, 2008). Yet,

² Part of this research focuses on strategies or products that are either very recent innovations or that do not yet exist in practice and as such do not explain underannuitization. We will therefore suffice by referring the reader to some of this literature. Specifically on: annuity options (Sheshinsky, 2010), on products that concentrate on late-life payouts (Scott et al., 2011) and withdrawal rules (e.g., Dus, Maurer and Mitchell, 2005; Horneff, Maurer, Mitchell, et al., 2008). Finally, some recent studies analyze optimal combinations of innovative products and withdrawal strategies (e.g., Blanchett, 2015; Hanewald, Piggott and Sherris, 2013).

health risks may also impose liquidity constraints by requiring extra savings or insurance spending at a younger age and limit the assets available for annuitizing (Peijnenburg et al., 2017; Reichling and Smetters, 2015). Moreover, if longevity and health costs are negatively correlated – i.e., if a negative health shock leads to higher health costs while decreasing longevity – this provides a hedge for both uncertainties and decreases annuitization (Zhao, 2015).

Empirical literature

Uptake of LTCI

An extensive empirical literature analyzes LTCI uptake in different countries. A descriptive overview of this research and the data analyzed is presented in Table 1. A large share of the LTCI literature analyzes one or more of the 12 waves of the US Health and Retirement Study (HRS). Moreover, many studies focus on the ‘near elderly’ – usually between 50 and 70 years old – who are not in need of care as those individuals should be preparing for later. Of the 62 studies included, most (42) are observational studies without serious limitations (graded C). 5 studies are quasi-experimental (B), and 15 are observational studies that suffer from some limitations or fail to comprehensively describe their methods for data collection (D).

As for the dependent variable of LTCI uptake, different measurements are used throughout the empirical literature. Large longitudinal surveys such as the HRS or the Survey of Health Aging and Retirement in Europe (SHARE) elicit revealed preferences by asking for ownership status which is occasionally used to determine changes in ownership status (both purchasing and lapsing). For example, the HRS asks respondents: “Not including government programs, do you now have any long-term care insurance which specifically covers nursing home care for a year or more or any part of personal or medical care in your home?” Other studies have measure stated preferences, through willingness to pay elicitation, discrete choice experiments (Brau et al., 2010; Brau and Bruni, 2008) or referendum-approaches (Costa-Font and Font, 2009; Costa-Font and Rovira-Forns, 2008). When revealed and stated preference analyses systematically lead to qualitatively different results, we reflect on this in our interpretation. Generally, however, this is not the case.

Individual factors

Table 2 summarizes the main findings of the empirical studies on individual factors associated with LTCI uptake. We refer to Table C8 for a granular insight into our data, as it shows exactly which studies have found which associations and distinguishes between revealed and stated preferences. Below we reflect on these factors one-by-one.

Most studies either find that women are more likely to buy or own LTCI (35 percent) or that there are no significant differences in uptake between men and women (54 percent). Notably, there are differences between studies that analyze stated preferences and those that analyze revealed preferences; most hypothetical studies find no association with gender, whereas studies analyzing actual uptake, ownership and lapsing do. This overall positive association matches with the fact that LTCI is of more value for women as they live longer than men and are more likely to outlive their partner. This especially applies since gender-based premium differentiation in insurance products is forbidden in the EU (European Union, 2004) and has only recently been introduced for LTCI in the US (Carms, 2014).

The relationship between LTCI uptake and age is less straightforward, with 22 percent of the included studies finding negative associations and 30 percent reporting positive associations. Moreover, these results should be interpreted with caution as they may reflect cohort effects for studies that employ age-cohorts such as the HRS. Some studies additionally incorporate effects of age squared. These generally report a significantly positive (Konetzka and Luo, 2011) or negative sign (Bernet, 2004; Courbage and Roudaut, 2008; Gousia, 2016; Mellor, 2001, 2000), with only two studies finding no significant squared age

Table 1
Overview of included studies on LTCI uptake.

Authors	#	Dataset	Country	N	Sample restrictions
Akaichi, Costa-Font and Frank (2019)	1	Survey of Long-term Care Awareness and Planning	US	15,298 ind.	40 – 70 years old and not institutionalized
Allaire, Brown and Wiener (2016)	2	Survey of Long-term Care Awareness and Planning	US	12,936 ind.	40 – 70 years old and not institutionalized
Ameriks, Briggs, Caplin, Shapiro and Tonetti (2018)	3	Survey	US	1,086 ind.	over 55 years old with at least \$10K in Vanguard accounts
Barnett and Stum (2013)	4	Survey	US	803 ind.	public employees eligible to purchase LTCI
Bergquist, Costa-Font and Swartz (2018) [†]	5	NAIC sales	US	50 states + DC	n.a.
Bernet (2004)	6	HRS (wave 5)	US	16,851 ind.	over 53 years old
Boyer, De Donder, Fluet, Leroux and Michaud (2017)	7	Survey	Canada	2,000 ind.	50 – 70 years old
Brau and Bruni (2008)	8	Survey	Italy	1,176 ind.	25 – 70 years old
Brau, Bruni and Pinna (2010)	9	Survey	Italy	1,176 ind.	25 – 70 years old
Brown et al. (2007b) [†]	10	HRS (wave 3 – 5)	US	12,402 ind.	55 – 69 years old
Brown et al. (2012)	11	American Life Panel	US	1,569 ind.	over 50 years old
Browne and Zhou-Richter (2014)	12	Socio-Economic Panel	Germany	3,749 ind.	over 35 years old and not in need of care
Caro et al. (2011)	13	HRS (wave 6 – 7)	US	2,747 couples	married couples with partners both over 65 years old
Chatterjee and Fan (2017)	14	HRS (wave 11)	US	21,696 ind.	over 52 years old
Coe et al. (2015b)	15	HRS (wave 4 – 8)	US	8,349 ind.	51 – 61 years old and not institutionalized
Cornell and Grabowski (2018) [†]	16	HRS (wave 3 – 11)	US	13,285 ind.	50 – 69 years old
Costa-Font and Font (2009)	17	Survey	Spain	324 ind.	over 18 years old
Costa-Font and Rovira-Forns (2008)	18	Survey	Spain	324 ind.	over 18 years old
Courbage and Roudaut (2008)	19	SHARE (wave 2)	France	2,530 ind.	over 50 years old
Courtemanche and He (2009) [†]	20	HRS (wave 4 – 7)	US	8,566 ind.	55 – 65 years old
Cramer and Jensen (2006)	21	HRS (wave 6 – 7)	US	9,863 ind.	over 55 years old and without LTCI
Curry et al. and Kapp (2009)	22	Focus groups and in-depth interviews	US, CT	6 focus groups of 9 and 32 interviews	having a direct experience with LTCI
Cutler et al. (2008) ^a	23	AHEAD (wave 2)	US	7,183 ind.	65 – 90 years old
Doeringhaus and Gustavson (2002)	24	HIAA, AARP and NAIC sales	US	50 states + DC	n.a.
Finkelstein and McGarry (2006)	25	AHEAD (wave 2)	US	5,072 ind.	over 72 years old
Friedberg et al. (2017)	26	HRS (wave 6 – 11)	US	891 ind.	over 65 years old and owning LTCI in 2002
Gan et al. (2015)	27	HRS (wave 3 – 5)	US	5,000 ind.	over 73 years old
Goda (2011) [†]	28	HRS (wave 3 – 8)	US	15,822 ind.	50 – 69 years old
Gottlieb and Mitchell (2015)	29	HRS (wave 11)	US	487 ind.	over 50 years old
Gousia (2016)	30	SHARE (wave 5)	Austria, Italy, France, Denmark, Israel and Czech Republic	19,116 ind.	over 50 years old
He and Chou (2018)	31	Survey	Hong Kong	1,613 ind.	over 40 years old
Jiménez-Martin et al. (2016)	32	SHARE (wave 1, 2 and 5)	Spain	10,867 obs.	over 50 years old and owning either LTCI or private health insurance
Kennedy et al. (2016)	33	NHIS	US	14,393 ind.	40 – 65 years old
Kitajima (1999)	34	Survey	Japan, Tokyo	710 ind.	over 40 years old
Konetzka and Luo (2011)	35	HRS (wave 3 – 10)	US	3,974 ind.	over 50 years old and reporting LTCI ownership in at least one year
Kumar et al. (1995)	36	Survey	US	10,489 ind.	purchasing LTCI or being approached by an agent
Li and Jensen (2012)	37	HRS (wave 6 – 9)	US	2,085 ind.	over 50 years old and reporting LTCI ownership in at least one year
Lin and Prince (2013)	38	HRS (wave 6 – 10)	US	12,695 ind.	over 50 years old
Lin and Prince (2016)	39	HRS (wave 6 – 10)	US	12,695 ind.	over 50 years old
Lutzky and Alechih (1999)	40	Interviews	US	110 ind.	experts, insurance agents, consumer groups and regulators
McCall et al. (1998)	41	Survey	US	1,626 ind.	55 – 75 years old
McGarry et al. (2014)	42	NHATS (2011)	US	8245 ind.	over 65 years old
McGarry et al. (2016)	43	HRS (wave 10)	US	12,796 ind.	over 50 years old
McGarry et al. (2018)	44	HRS (wave 10)	US	15,963 ind.	over 50 years old
McNamara and Lee (2004)	45	HRS (wave 3 – 5)	US	6,220 ind.	over 50 years old and reporting LTCI ownership in at least one year
Mellor (2000)	46	AHEAD (wave 1)	US	8,021 ind.	over 70 years old
Mellor (2001)	47	AHEAD (wave 1)	US	7,775 ind.	over 70 years old
		PSD	US	1,634 ind.	over 50 years old
Nixon (2014)	48	AHIP sales data	US	50 states + DC	n.a.
Oster et al. (2010)	49	PHAROS and HRS (wave 5)	US and Canada	7,356 ind.	26 – 64 years old
Pincus et al. (2017)	50	Survey	US	1,305 ind.	30 – 79 years old
Pinquet et al. (2011)	51	Insurance data	Spain	150,123 ind.	n.a.
Schaber and Stum (2007)	52	Survey	US	509 ind.	state employees

(continued on next page)

Table 1 (continued)

Authors	#	Dataset	Country	N	Sample restrictions
Sloan and Norton (1997)	53	AHEAD (wave 1 – 2)	US	5,292 ind.	over 70 years old
		HRS (wave 1 – 2)	US	13,312 ind.	51 – 61 years old
Sperber et al. (2017)	54	Focus groups	US	80 ind.	elderly parents and adult children
Stevenson et al. (2009)	55	NAIC sales	US	50 states + DC	n.a.
Stum (2008)	56	Survey	US	446 ind.	state employees
Swamy (2004)	57	Survey	US, MD	1,394 ind.	40 – 70 years old
Tennyson and Yang (2014)	58	CRWB	US, NY	693 ind.	50 – 72 years old
Unruh et al. (2016)	59	AHIP/LifePlan	US	5,240 ind.	purchasing LTCI or being approached by an agent
Van Houtven et al. (2015)	60	HRS (wave 3 – 10)	US	22,742 ind.	over 50 years old
Wu, Bateman et al. (2017)	61	Survey	Australia	1,008 ind.	55 – 64 years old
Zhou-Richter et al. (2010)	62	Survey	Germany	914 ind.	adult children

† Quasi-experimental study (highest level of evidence available).

^a Also analyzes annuity uptake.

effects (Ameriks et al., 2018). This may be indicative of an ambiguous non-linear relationship between age and uptake with the directional impact of age changing around a certain age. However, studies analyzing the impact of reaching the age 65 on LTCI uptake find mixed directional effects (Allaire et al., 2016; Pinquet et al., 2011; Van Houtven et al., 2015).

Many studies also analyze the association of ethnicity with LTCI uptake. Although a dichotomous comparison between white and non-white as reported in Table 2 reveals no clear uptake pattern, comparisons with specific ethnicities do. These show that uptake of LTCI is markedly lower amongst Hispanics.³ At the same time, being black⁴ or having another non-white ethnicity⁵ does not seem to be associated with LTCI coverage.

Different aspects of socio-economic status seem to be important determinants of LTCI uptake. Specifically, some studies find a positive association of subjective social class (He and Chou, 2018) or subjective economic condition (Kitajima, 1999) and LTCI uptake. More generally, Table 2 shows that a majority of the studies finds a positive association between education, income or wealth and LTCI uptake. Evidence suggests that unaffordability of LTCI products may at least partially drive these associations (Brown et al., 2012; Schaber and Stum, 2007). Zooming in on income effects, all studies find negative income squared effects (Bernet, 2004; McNamara and Lee, 2004; Mellor, 2001, 2000). Together, these findings suggest that income initially enables purchase of LTCI, but above a certain income level people rely more on self-insurance. For squared wealth, the same association is found by two studies (Bernet, 2004; McNamara and Lee, 2004), while two other studies find no significant squared effects (Mellor, 2001, 2000). Additionally, home ownership is associated with lower uptake (Boyer et al., 2017; Costa-Font and Rovira-Forns, 2008; Stevenson et al., 2009; Wu et al., 2017), although studies that analyze the home value in addition to wealth do not find theoretically predicted lower LTCI uptake

³ Of the 10 studies analyzing this, 1 finds a positive association (Kennedy et al., 2016), 5 find a negative association (Caro et al., 2011; Konetzka and Luo, 2011; McGarry et al., 2016, 2014; McNamara and Lee, 2004), and 4 find no association (Cramer and Jensen, 2006; Li and Jensen, 2012; McGarry et al., 2018; Stevenson et al., 2009)

⁴ Of the 12 studies analyzing this, 4 find a positive association (Kennedy et al., 2016; McGarry et al., 2018; Stevenson et al., 2009; Van Houtven et al., 2015), 3 find a negative association (Caro et al., 2011; Konetzka and Luo, 2011; Li and Jensen, 2012), and 5 find no statistically significant association (Cramer and Jensen, 2006; McGarry et al., 2016, 2014; McNamara and Lee, 2004; Swamy, 2004).

⁵ Of the 8 studies analyzing this, 2 find a negative association (McGarry et al., 2018, 2016) and 6 find no statistically significant association (Konetzka and Luo, 2011; Li and Jensen, 2012; McNamara and Lee, 2004; Stevenson et al., 2009; Swamy, 2004; Van Houtven et al., 2015).

(McGarry et al., 2018; Mellor, 2000; Sloan and Norton, 1997).

Family dynamics, which have been extensively debated by theorists, are found to some extent in LTCI practice. Table 2 shows that bequest motives are likely associated positively with LTCI uptake.⁶ Furthermore, being married does not seem to be systematically associated with LTCI uptake. Having more children may decrease LTCI uptake (33 percent), but the majority of the studies (62 percent) reports no significant association. Analysis of other measures of contact with one's children, such as their vicinity (Kumar et al., 1995; Unruh et al., 2016), co-residence (Coe et al., 2015b; He and Chou, 2018) or size of the entire family (Brau and Bruni, 2008; Costa-Font and Font, 2009; Costa-Font and Rovira-Forns, 2008; Schaber and Stum, 2007) does not reveal a clear association with LTCI uptake.

In addition, Table 2 reveals that the subjective risk of needing LTC is generally positively associated with LTCI demand. In other words, individuals who think they are at higher risk of needing LTC are also more likely to buy LTCI. At the same time, self-rated health seems positively associated with LTCI demand, with one third of the studies finding a positive association and 61 percent finding no significant association. This indicates that healthier individuals may be more likely to buy LTCI. However, these two results are not necessarily contradictory. If people associate longevity with a higher risk of LTC needs, this may prompt the observed pattern; subjectively healthier individuals would expect to live longer and hence expect to have a higher LTC risk (Cramer and Jensen, 2006). At the same time, there is no evidence that objective health or subjective longevity is related to demand for LTCI.

Table 2 shows that the number of impairments in ADLs is not associated with LTCI uptake, despite the fact that ADL impairments are used for both underwriting and determining benefits eligibility (Cornell et al., 2016). Similarly, other measures of objective health such as the number of hospitalizations in the previous year (Brau and Bruni, 2008; Browne and Zhou-Richter, 2014), drug usage (Bernet, 2004), various existing conditions (e.g., Browne and Zhou-Richter, 2014; Gousia, 2016) and BMI (Jiménez-Martín et al., 2016), are not systematically associated with uptake.

Interestingly, risk aversion does not seem to be associated with insurance decisions. At the same time, LTCI uptake increases with ownership of health insurance (Brau et al., 2010; Brau and Bruni, 2008; Browne and Zhou-Richter, 2014; Chatterjee and Fan, 2017) and life insurance (Chatterjee and Fan, 2017; Jiménez-Martín et al., 2016; McNamara and Lee, 2004). Some studies argue that preventive health behaviors or wearing seatbelts may be indicative of risk behavior and show that these are

⁶ This relationship is even more clear for bequest expectations, as all studies that analyze bequest expectations find a positive association with LTCI uptake (Courbage and Roudaut, 2008; Konetzka and Luo, 2011; McGarry et al., 2018, 2016). Yet, this could also be driven by reverse causality.

Table 2
Overview of findings by studies on individual factors associated with LTCI uptake.

Factor	Association						Total #
	Negative		None		Positive		
	#	%	#	%	#	%	
<i>Demographics</i>							
Female ^a	4	11%	20	54%	13	35%	37
Age	8	22%	18	49%	11	30%	37
Non-white ^b	1	6%	13	81%	2	13%	16
<i>Socio-economic status</i>							
Education	2	7%	10	33%	18	60%	30
Income	0	0%	14	39%	22	61%	36
Home ownership	2	50%	2	50%	0	0%	4
Wealth	1	4%	10	37%	16	59%	27
<i>Family</i>							
Number of children ^{cd}	7	33%	13	62%	1	5%	21
Married ^{de}	3	9%	25	78%	4	13%	32
Bequest motive	0	0%	4	57%	3	43%	7
<i>Subjective risk</i>							
Subjective health	2	6%	19	61%	10	32%	31
Subjective LTC risk ^f	0	0%	5	26%	14	74%	19
Subjective longevity	0	0%	6	100%	0	0%	6
<i>Objective risk</i>							
ADL impairments	1	6%	14	78%	3	17%	18
<i>Preferences</i>							
Risk aversion	2	29%	3	43%	2	29%	7
Formal care preference	0	0%	0	0%	3	100%	3
Trust in insurers	0	0%	0	0%	2	100%	2
<i>Understanding</i>							
Financial literacy	1	20%	0	0%	4	80%	5
System knowledge	0	0%	4	80%	1	20%	5
Cognitive intactness	0	0%	3	75%	1	25%	4
<i>Salience</i>							
Awareness of LTC risks	0	0%	3	38%	5	63%	8
LTC experience ^g	2	11%	9	47%	8	42%	19

^a Discrepancy in results of stated and revealed preferences studies.

^b Seven studies report different associations for “black”, “Hispanic” and/or “other” and have been counted under “none”.

^c Three studies report having children (or not) rather than the number of children.

^d Four studies report household size and have been counted under both children and married.

^e Three studies report different associations for married individuals compared to individuals who are single, divorced, or widowed and have been counted under “none”.

^f Two studies reporting different associations for home care and nursing home expectations have been counted under “none”.

^g Three studies report different associations for different proxies of LTC experience and have been counted under “none”.

positively associated with LTCI uptake (Finkelstein and McGarry, 2006; Gan et al., 2015; Gottlieb and Mitchell, 2015; McGarry et al., 2018, 2016). However, other risk behaviors (smoking, drinking and exercising) are not found to have an effect on uptake (e.g., Courbage and Roudaut, 2008; Gottlieb and Mitchell, 2015; Jiménez-Martín et al., 2016). Altogether, this suggests that although risk aversion is unrelated with LTCI uptake, real life measures of more general insurance preferences or risk behaviors may be associated with LTCI uptake.

Furthermore, there is evidence that LTCI uptake varies with individual perceptions of the value of LTCI⁷ and preferences for LTC. That

⁷ Of course the actual insurance value is also important. Increases in daily benefits and benefit periods, as well as decreases in the deductible period are associated with higher LTCI uptake according to a recent stated-preferences study (Akaichi et al., 2019).

is, people who dislike informal care are more likely to take out LTCI, as displayed in Table 2. People who prefer to stay home to going to a nursing home are less likely to buy LTCI (McCall et al., 1998; Tennyson and Yang, 2014). And people who have a negative view of public care may buy more LTCI (Brau and Bruni, 2008), although another study finds no significant association (Ameriks et al., 2018). Similarly, people may well prefer freedom offered by private LTCI with voluntary coverage to public insurance with mandatory coverage (Akaichi et al., 2019). In line with this, Sperber et al. (2017) find that LTCI is perceived to support autonomy in arranging LTC and that expectations of future autonomy influence uptake decisions. This may also be reflected in the fact that valuing planning may increase uptake (Unruh et al., 2016), even though other studies find no significant effect (Gousia, 2016; He and Chou, 2018). Finally, Table 2 shows that people who trust their insurer to pay out future claims, are more likely to take out LTCI.

Measures of product understanding seem to be strongly associated with LTCI uptake according to Table 2. Financial literacy – measured as knowledge of percentages, compound interest, inflation and/or risk diversification – appears to be positively associated with LTCI demand. Also, having a financial planner (Kumar et al., 1995; McCall et al., 1998)⁸ or working in finance (Lin and Prince, 2016) seems to be associated with uptake. At the same time, measures of cognitive intactness such as the ability to count backwards or remember the current president are not associated with different levels of uptake, nor is knowledge of the LTC system (e.g., knowledge of nursing home costs (Boyer et al., 2017; Unruh et al., 2016)). Finally, two qualitative studies highlight the importance of access to information on LTC in decision making for LTCI (Curry et al., 2009; Lutzky and Alecxih, 1999).

Salience of LTC risks is also important in LTCI uptake. A risk is said to be salient when one has been previously confronted with it and is more aware of the risk because of that experience. Most studies show that various proxies of awareness – such as having discussed LTC, being adequately informed and knowing of LTCI existence – are associated positively with demand. However, it is unclear whether these results imply a causal relationship or show that people who purchase LTCI are simply more aware of LTC risks because of that purchase. An indirect way of analyzing this relationship further, is by looking at LTC experience, e.g., providing informal care to others or having close relatives needing LTC. The available evidence suggests that this may be positively associated with LTCI uptake, as 42 percent of the studies find a positive association and 47 percent find no significant association. Moreover, individuals who have experienced health shocks – whether positive or negative – are more likely to own LTCI (Konetzka and Luo, 2011), which may also suggest that awareness of LTC risks increases uptake. In addition, over or underweighting the risk of needing LTC could further impact uptake (Boyer et al., 2017).

Contextual factors

At the contextual level, Table 3 highlights the importance of both generosity of social benefits and tax incentives for LTCI uptake (see Table C9 for an in-depth overview). The evidence – including one quasi-experimental study – shows that more lenient means-tested social benefits schemes either decrease LTCI demand or have no effect.⁹ On the contrary, tax incentives¹⁰ (and consequently lower prices) lead to greater willingness to insure, according to three quasi-experimental

⁸ Only one study (Swamy, 2004) finds that having a financial advisor does not significantly change LTCI ownership.

⁹ This does not hold for Federal Partnership programs that protect a portion of an individual's assets that would otherwise need to be spent down in order to become eligible for Medicaid. Most research shows that these programs do not change coverage and are *de facto* a tax benefit for those who would have bought LTCI in any case (e.g., Bergquist et al., 2018).

¹⁰ There may be a differential effect of tax deductions and tax credits. Most studies explicitly focusing on tax deductions report a positive impact on uptake, whereas studies focusing on tax incentives in general do not.

Table 3

Overview of findings by studies on contextual factors associated with LTCI uptake (number of quasi-experimental studies between brackets).

Factor	Association						Total
	Negative		None		Positive		
	# (#)	%	# (#)	%	# (#)	%	
Social benefits	4 (1)	40%	6 (0)	60%	0 (0)	0%	10 (1)
Tax subsidies ^a	0 (0)	0%	4 (0)	44%	5 (3)	56%	9 (3)
Informal care availability	4 (0)	31%	7 (0)	54%	2 (0)	15%	13 (0)

^a One study reports different associations of tax deductions and tax credits and has been counted under “none”.

studies. Moreover, the impact of social benefit extensions and tax incentives on LTCI demand does not seem to be equally distributed among the targeted population. Rather, tax incentives may predominantly benefit wealthier (Lin and Prince, 2013) or healthier (Cornell and Grabowski, 2018) individuals. Perceptions also seem to be important as uptake is generally lower among individuals who perceive public coverage to be more extensive (Kumar et al., 1995; McCall et al., 1998; Unruh et al., 2016), with only two studies reporting no significant effects (Brown et al., 2012; Swamy, 2004). Similarly, framing of LTCI products is suggested to play a role in these decisions (Gottlieb and Mitchell, 2015; Pincus et al., 2017).

Finally, Table 3 shows that expected availability of informal care may negatively impact LTCI uptake, although a majority of the studies finds no significant association. At the same time, Courbage and Roudaut (2008) show with an objective measure of predicted availability that informal care availability can also increase uptake. This may be because purchasing LTCI can protect family and friends from informal caregiving.

Why is LTCI uptake so low?

From our theoretical (Section “Demand for LTCI”) and empirical overview (Sections “Individual factors” and “Contextual factors”) we infer four general explanations for the low uptake of private LTCI: (i) substitution by public LTCI or informal care; (ii) adverse selection; (iii) individual preferences that differ from those assumed in standard economic models of consumer behavior; (iv) financial illiteracy; and (v) discuss how these may relate to the distribution of LTCI uptake over the population.

(i) In line with theoretical predictions, there is strong evidence that private LTCI is to some extent substituted by public LTCI. LTCI may also be substituted with informal care, but this relationship is less clear cut. Our results suggests that both the number of children and the expected availability of informal care givers may decrease LTCI uptake, whereas marital status seems to have no impact on uptake. Potentially, these results reflect the fact that these measures are quite generic: if you have a partner or children this does not necessarily mean that they are able (and willing) to provide informal care. Alternatively, Coe et al. (2015a) have shown that LTCI ownership by parents, can induce children to live further away from their parents and to work more. In other words, purchasing private LTCI may could lower ex-post informal care expectations and the negative relationship may also reflect reverse causality.

(ii) As theoretically predicted, adverse selection could also play a role on the LTCI market, as the existence of private information has been proven both directly (Finkelstein and McGarry, 2006) and indirectly (Gan et al., 2015) and as people seem fairly responsive to the price of LTCI (Cornell and Grabowski, 2018; Costa-Font and Font, 2009; Cramer and Jensen, 2006; Goda, 2011).

The empirical literature highlights three potential sources of private information: objective knowledge of LTC risks, subjective knowledge of LTC risks and subjective knowledge of health. First, some individuals

know that they are objectively likely to have high LTC costs, for example because they suffer from a genetic diseases associated with higher LTC needs. These individuals are more likely to purchase LTCI (Oster et al., 2010). Second, individuals who expect to have LTC needs in the future take out more private LTCI. If this subjective risk assessment is accurate this would lead to adverse selection, but it is unclear whether this is actually the case.¹¹ Third, one would expect adverse selection to concentrate uptake among subjectively less healthy individuals, yet our review finds the opposite. Hence, some authors conclude that people do not realize that poor health can lead to LTC needs later in life (Browne and Zhou-Richter, 2014). Another potential explanation is that subjectively healthier people may expect to live longer and associate longevity with LTC needs (Cramer and Jensen, 2006), but it is unclear whether this is indeed the case.

In addition, some studies have analyzed whether dynamic adverse selection (i.e., individuals adversely select when receiving new information on their risk status) drives lapsing. These studies find higher LTC utilization among non-lapsers (Finkelstein et al., 2005; Konetzka and Luo, 2011). However, this could also be due to ex-post moral hazard. Moreover, Konetzka and Luo (2011) argue that such lapsing reflects personal finances and the availability of informal caregivers rather than private information.

Although adverse selection is taking place at the individual level, Finkelstein and McGarry (2006) show that the LTCI risk pool does not have a larger LTC risk than the population at large. This is unlikely to be a result of successful underwriting, since our review shows that ADL impairments – which are the main objective health factors used in underwriting – are not significantly associated with LTCI uptake. Instead, Finkelstein and McGarry (2006) show that adverse selection is compensated by the advantageous selection of low risk individuals with strong insurance preferences.

(iii) Low uptake could also be driven by preferences that deviate from those typically assumed in economic models. For example, our results highlight that risk aversion does not unambiguously increase insurance, which contrasts with standard economic theory. Possibly, people perceive LTCI as a risky investment rather than as a risk-reducing insurance product. In other words, if LTC is not needed then premiums do not ‘pay off’ (Kunreuther et al., 2012). Additionally, our review shows that preferences for formal care impact LTCI uptake.¹² Specifically, preferences for informal care over formal care may decrease LTCI uptake.

Moreover, people may fear that insurers will not pay out, as distrust of insurance companies is associated with lower LTCI uptake. Such a trust relationship may be especially important as LTCI provides coverage against risks that are often in the far future. The fact that LTCI may only pay out in the future, may also trigger nonstandard time preferences or state-dependent utility preferences. Nonetheless, we found no empirical evidence about the impact of time preferences on insurance uptake.

Finally, most evidence for the theoretically suggested impact of state-dependent utility remains indirect. For example, using the HRS Finkelstein et al. (2013) show that marginal utility decreases when health decreases, but they do not directly link this to LTCI uptake. One study suggests that people who prefer to spend resources on care when ill over spending them on other goods and services when healthy are indeed more likely to purchase LTCI (Brown et al., 2012). Still, this result should be interpreted with caution as by explicitly referring to

¹¹ Friedberg et al. (2017) find LTC expectations not to be a significant predictor of actual LTC use later in life, whereas Finkelstein and McGarry (2006) find the opposite.

¹² Bequest motives have also been left out of some standard economic predictions, even though they work to increase uptake, as is described theoretically and found empirically. As such, bequest motives only increase the discrepancy between prediction and actual uptake.

spending resources on LTC, this study may to some extent have measured preferences for LTCI itself rather than state dependent preferences.

(iv) People may find it difficult to make decisions on purchasing LTCI, which may cause them to deviate from expected utility maximization. This may be loss so for more financially literate individuals, who are consequently more likely to take out private LTCI. Additionally, in line with theoretical predictions of probability underweighting, our review shows that those who are aware of LTC risks purchase more insurance than those who do not. Finally, [Lin and Prince \(2016\)](#) show that wealthier individuals are also better able to make use of sponsored LTCI plans, indicating that socio-economic status may to some extent reflect such decision-making ability.

(v) From our review it follows that uptake of LTCI differs across different subgroups of the population, and that it is likely to be concentrated among individuals with higher education, income and wealth. This may well be seen as a byproduct of the causes for low uptake. First, as most social benefit schemes are means-tested, crowding out should theoretically take place predominantly among individuals with low income and wealth ([Brown and Finkelstein, 2008](#)). This is also what is observed empirically ([Brown et al., 2007b](#)) and works to increase relative uptake among wealthier individuals. Second, if people use subjective health as a proxy for LTC and longevity risks, adverse selection can work to concentrate uptake among individuals with high socio-economic status individuals as these are relatively healthy. Third, it has been shown that preferences for insurance differ and are an important determinant of LTCI uptake ([Browne and Zhou-Richter, 2014](#); [Cutler et al., 2008](#); [Gan et al., 2015](#)). These preferences are at least partially related to wealth, as research shows that wealthier individuals¹³ ([Finkelstein and McGarry, 2006](#)) are more likely to own LTCI, yet much less likely to enter a nursing home. Fourth, financial literacy could be correlated with socio-economic status and could thus lead to increased uptake among those with a higher socio-economic status.

Uptake of annuities

[Table 4](#) provides an overview of all 44 included empirical studies on annuity uptake decisions. Clearly, these studies are more diverse than those analyzing LTCI decisions. Datasets consist of experimental data, survey data (often from independently developed surveys) and administrative datasets. This variety in empirical methods is also reflected in the GRADE quality of the studies: 6 studies are graded 'B', 27 'C' and 11 'D'. Moreover, sample restrictions concerning age are generally much more inclusive than for LTCI, as they may compromise all adult age groups.

Annuity uptake itself is measured in two ways. Many studies measure revealed preferences. Such studies either follow cohorts of individuals that retire and measure their annuitization decisions (e.g., [Brown and Previtero, 2014](#); [Bütler and Teppa, 2007](#); [Hurd and Panis, 2006](#)) or use a survey to ask whether individuals own annuities (e.g., [Pfarr and Schneider, 2013](#); [Schreiber and Weber, 2016](#)). Another strand of research uses hypothetical annuitization measures to elicit stated preferences (e.g., [Knoller, 2016](#); [Wu et al., 2017](#)). Occasionally, associations found by stated and revealed preferences point to different directions. When suited, we reflect on this.

Individual factors

[Table 5](#) displays the main findings of the empirical studies on individual factors associated with annuity uptake. Below we reflect on these factors one-by-one. [Table D10](#) shows exactly which associations

were found by which studies and distinguishes between the results of revealed and stated preferences.

As to gender and age, uptake patterns displayed in [Table 5](#) are broadly similar to those of LTCI, including the differences between stated and revealed preference studies. Women may be more likely to opt for annuities than men, although the majority of included studies finds no significant difference. Again this may highlight the fact that without gender-based pricing annuities are effectively cheaper for women, who on average live longer. Gender-based risk differences are currently not allowed to be translated into premiums in the EU ([European Union, 2004](#)) and in employer-sponsored plans in the US ([Arizona Governing Committee for Tax Deferred Annuity and Deferred Compensation Plans v. Norris, 1983](#)). The impact of age on uptake remains difficult to interpret. To some extent, age effects may reflect cohort effects of studies employing age-cohorts, although there are admittedly fewer doing so for annuities than for LTCI. Even so, there is no clear pattern in the effects summarized in [Table 5](#), and the two studies analyzing squared age effects retrieve different results: one reports a positive effect of age squared ([Clark et al., 2014](#)), whereas the other finds no significant effect ([Teppa, 2011](#)). Finally, ethnicity may impact uptake. Yet, we find only one study ([Hurd and Panis, 2006](#)) that reports a positive association between being black and annuitization.

[Table 5](#) also shows that wealth is generally positively associated with annuity uptake, even though a large share of the stated preference studies find no significant association. At the same time, income and annuity uptake may be positively associated, but the majority of the studies reports no significant association. This effect is driven by stated preference studies, suggesting that although stated preferences may be similar, actual uptake may differ along income and wealth. Education and homeownership¹⁴ are found to be of limited relevance in explaining annuitization. The low number of studies finding any effect of education is markedly different from the strong association found with LTCI uptake and consistent between stated preferences and revealed preference studies.

As to the impact of family characteristics, [Table 5](#) shows that most studies do not find any effect of either having children¹⁵, being married¹⁶ or having bequest motives. This is clearly different from theoretical predictions that families could offer efficient risk pools. Still, our results do not rule out that some individuals pursue theoretically predicted strategic bequest motives. If some individuals have strategic negative bequest motives (increasing uptake) this could on average offset other people's positive bequest motives (decreasing uptake) such that the aggregate effect of bequest motives is indistinguishable from zero.

In addition, [Table 5](#) highlights the potential importance of subjective and objective risk factors in annuity decisions. One third of the included studies find that individuals with better subjective health and subjective longevity are more likely to purchase annuities, but the majority of studies does not find evidence of a significant relationship. Particularly, none of the revealed preference studies included reports a significant association. Few studies analyze the relationship between objective longevity risks and annuity uptake. One study notes that the number of chronic illnesses has no impact on annuity uptake ([Chou et al., 2016](#)). Studies analyzing realized longevity for historic annuity uptake all find that those who purchased annuities lived longer. Additionally, there is some evidence that the longevity of parents is also

¹⁴ One study looking into the impact of home equity rather than home ownership finds that increases in home equity may decrease annuity uptake among the lowest home equity quintiles ([Guillemette et al., 2016](#)).

¹⁵ One study shows a positive impact of having dependent children on annuity uptake ([Bütler and Teppa, 2007](#)).

¹⁶ There are no systematic differences when married individuals are compared to single, divorced or widowed individuals.

¹³ As well as individuals who use preventive health services and individuals who always wear their seatbelts ([Cutler et al., 2008](#); [Finkelstein and McGarry, 2006](#)).

Table 4
Overview of included studies on annuity uptake.

Authors	#	Dataset	Country	N	Restrictions
Agnew, Anderson, Gerlach and Szykman (2008)	1	Experiment	US, VA	845 ind.	18 – 89 years old nonstudents
Al et al. (2017)	2	Focus group	US, TX	n.a.	n.a.
Bateman et al. (2017)	3	Survey	Australia	923 ind.	gender and age quota
Benartzi, Previtro and Thaler (2011)	4	Administrative dataset	US	103,516 ind.	50 – 75 years old with over 5 years of job tenure and balance over \$5K retired between 2002 and 2008
Bernheim (1991)	5	LRHS (1975 wave)	US	2,091 ind.	64 – 69 years old with wealth under \$500K not widowed not eligible for government pensions
Beshears, Choi, Laibson, Madrian and Zeldes (2014) [†]	6	Survey	US	5,130 ind.	50 – 75 years old
Bockweg, Ponds, Steenbeek and Voncken (2016) [†]	7	Survey	Netherlands	3,161 ind.	members of an occupational pension plan
Brown (2001)	8	HRS (wave 1)	US	869 ind.	51 – 61 years old employed and with a defined contribution plan
Brown et al. (2017b)	9	Survey	US	4,549 ind.	over 18 years old
Brown et al. (2007a) [†]	10	Survey	US	2,112 ind.	over 18 years old
Brown et al. (2013)	11	Survey	US	4,055 ind.	over 50 years old
Brown and Previtro (2014)	12	Administrative dataset	US	27,231 ind.	retired between 2002 and 2008
Bütler et al. (2013) [†]	13	Administrative dataset	Switzerland	15,312 ind.	over 60 years old men retired between 2001 and 2005
Bütler and Teppa (2007)	14	Administrative dataset	Switzerland	4,544 ind.	retired between 1996 and 2006
Cannon et al. (2016)	15	ABI QLB and QPA Surveys	UK	27 quarters	n.a.
Cappelletti et al. (2013)	16	SHWI (2008 wave)	Italy	4,750 ind.	15 – 65 years old
Chalmers and Reuter (2012)	17	Administrative dataset	US, OR	31,809 ind.	retired between 1990 and 2002 public employees
Charupat and Milevsky (2001)	18	Data on annuity quotes and mortality	Canada	n.a.	n.a.
Chou et al. (2016)	19	Survey	Hong Kong	1,066 ind.	40 – 64 years old working full-time
Clark et al. (2014)	20	Administrative dataset	US, NC	46,913 ind.	under 50 years old and terminated a plan in 2007 or 2008
Cutler et al. (2008) ^a	21	AHEAD (wave 2)	US	7,183 ind.	65 – 90 years old
Doyle et al. (2004)	22	Data on mortality, annuity payments and interest rates	Singapore and Australia	n.a.	n.a.
Finkelstein and Poterba (2002)	23	Data on mortality, annuity payments and interest rates	UK	n.a.	n.a.
Friedman and Warshawsky (1990)	24	Data on mortality and annuity payments	US	n.a.	n.a.
Guillemette et al. (2016)	25	Survey	US	5,074 ind.	n.a.
Hagen (2015)	26	Administrative dataset	Sweden	73,555 ind.	retired between 2008 and 2010 with parents from Sweden
Hurd and Panis (2006)	27	HRS (wave 1 – 5)	US	3,651 ind.	over 50 years old retired between 1992 and 2000
Hurwitz and Sade (2017)	28	Administrative dataset	Israel	1,556 ind.	retired between 2009 and 2013 with a balance of over ₪500K
Inkmann et al. (2011)	29	ELSA (wave 1)	UK, England	5,233 ind.	over 50 years old
Knoller (2016) [†]	30	Experiment	Germany	140 ind.	students
Knoller et al. (2016)	31	Administrative dataset	Japan	15,180 policies	n.a.
Lee (2016)	32	Administrative dataset	South Korea	32,867 policies	deferred annuities that matured between 2008 and 2011
Mitchell et al. (1999)	33	Data on mortality, annuity payments and interest rates	US	n.a.	n.a.
Nosi et al. (2017)	34	Survey	Italy	7,840 ind.	25 – 35 years old without private pension
Payne et al. (2013) [†]	35	Survey	US	514 ind.	45 – 65 years old
Pfarr and Schneider (2013)	36	SAVE (wave 2005 – 2009)	Germany	5,242 ind.	under 65 years old, working, married and eligible for Riester pensions
Previtro (2014)	37	Administrative dataset	US	103,516 ind.	retired between 2002 and 2008
Schooley-Pettis and Worden (2013)	38	Survey	US	987 ind.	n.a.
Schreiber and Weber (2016)	39	Survey	Germany	3,077 ind.	18 – 86 years old
Shu et al. (2018)	40	Survey	US	1,020 ind.	40 – 65 years old
Teppa (2011)	41	DNB Household Survey (2005)	Netherlands	816 ind.	16 – 65 years old
Van der Grijn and Jonker (2016)	42	Survey	Netherlands	2,082 ind.	over 25 years old
Wuppermann (2017)	43	ELSA (wave 0 – 4)	UK, England	8,204 ind.	n.a.
Ziegelmeyer and Nick (2013)	44	SAVE (wave 2010)	Germany	1,432 ind.	working and eligible for Riester pensions

[†] Quasi-experimental study (highest level of evidence available).

^a Also analyzes LTCI uptake.

Table 5
Overview of findings by studies on individual factors associated with annuity uptake.

Factor	Association						Total #
	Negative		None		Positive		
	#	%	#	%	#	%	
<i>Demographics</i>							
Female ^a	4	17%	12	52%	7	30%	23
Age	8	36%	7	32%	7	32%	22
Non-white	0	0%	1	50%	1	50%	2
<i>Socio-economic status</i>							
Education	0	0%	14	82%	3	18%	17
Income ^a	1	7%	9	64%	4	29%	14
Home ownership	0	0%	4	100%	0	0%	4
Wealth ^a	1	7%	5	33%	9	60%	15
<i>Family</i>							
Number of children ^b	1	8%	12	92%	0	0%	13
Married ^c	2	12%	15	88%	0	0%	17
Bequest motive	1	14%	5	71%	1	14%	7
<i>Subjective risk</i>							
Subjective health	0	0%	6	67%	3	33%	9
Subjective longevity ^a	1	8%	7	58%	4	33%	12
<i>Objective risk</i>							
Longevity ^d	0	0%	2	50%	2	50%	4
<i>Preferences</i>							
Risk aversion	3	27%	5	45%	3	27%	11
Stock market participation	1	17%	3	50%	2	33%	6
Patience	0	0%	0	0%	4	100%	4
Trust insurer	0	0%	1	50%	1	50%	2
<i>Understanding</i>							
Financial literacy ^e	2	20%	4	40%	4	40%	10
<i>Salience</i>							
Awareness of longevity risk	0	0%	0	0%	2	100%	2

^a Discrepancy in results of stated and revealed preferences studies.

^b Three studies report having children (or not) rather than the number of children.

^c Three studies report different associations for married individuals compared to individuals who are single, divorced, or widowed and have been counted under “none”.

^d One study reports different associations for two measures of ex-ante mortality and has been counted under “none”.

^e One study reports different associations for three different measures of financial literacy and has been counted under “none”.

positively associated with annuity uptake.¹⁷ All in all, the evidence available suggests that experienced health and objective longevity are positively associated with annuity uptake.

Furthermore, there is no convincing evidence that risk preferences are associated with uptake decisions. First, the evidence we map in Table 5 does not show clear association of risk aversion or stock market participation with annuity holding. Second, another indicator of risky behavior, namely smoking, does not seem to be associated with annuity uptake (Guillemette et al., 2016; Hurwitz and Sade, 2017). Third, even though some studies find a positive relationship between annuity uptake and health insurance ownership (Hurd and Panis, 2006) or LTCI ownership (Pfarr and Schneider, 2013), others do not (Chou et al., 2016). Additionally, several studies found patience and personal trust in the insurance company¹⁸ positively associated with annuity uptake.

Next, Table 5 shows that financial literacy – again measured as knowledge of probabilities, inflation, compound interest and risk

diversification – may increase annuity uptake.^{19,20} In addition, two other studies find a positive association between a principal component of education, financial literacy and cognitive intactness on the one hand and annuity valuation on the other (Brown et al., 2017a,b). Using a financial advisor is also associated with higher uptake (Pfarr and Schneider, 2013). Even so, studies using subjective measures of financial literacy find that these are associated with lower uptake of annuity products (Bateman et al., 2017; Bockweg et al., 2016) or have no effect (Knoller, 2016; Shu et al., 2018; Van der Crujisen and Jonker, 2016). Potentially because these measures indicate financial (over) confidence, rather than actual financial literacy (Bateman et al., 2017).

Finally, Table 5 displays risk awareness as a relevant factor in annuity uptake. Two studies highlight that such awareness associated positively with annuity uptake. In addition, two quasi-experimental studies show that salience of longevity risks – achieved by asking respondents about their subjective longevity (Payne et al., 2013) or by showing a mortality graph (Beshears et al., 2014) before making an annuity uptake decision – increases uptake as well.

Contextual factors

Contextual factors that are associated with annuity uptake are summarized in Table 6 (see Table D11 for a more in-depth overview). Contrary to theoretical predictions, not all evidence shows that social benefits may decrease annuity uptake. That such substitution is not observed here, may be due to the fact that in many countries social benefits are additional to other pension rights, thus offering basic financial security for the majority of the population (Schreiber and Weber, 2016). Public policy seems to mainly impact uptake through setting annuitization rules. First, Cannon et al. (2016) show that flexibilization of mandatory annuitization led to lower annuity uptake in the UK. Clearly, annuitizing by default increases uptake, potentially because it decreases procrastination and makes annuitizing more simple.²¹ Second, tax incentives can also increase annuity uptake as shown in Table 6.²²

Annuity equivalent wealth is also positively associated with uptake, as shown in Table 6.²³ Similarly some studies have argued that uptake is low because policies have too little value compared to their costs (Brown, 2001; Doyle et al., 2004; Mitchell et al., 1999). One study analyzing the perceived fairness of a policy reports similar results for subjective policy value (Shu et al., 2018). The relative value of annuities can also impact uptake. Table 6 shows that a higher return on investment for other investment products can decrease the uptake of annuities. Although other investments can indeed serve as investment substitutes, overreliance on recent stock market developments in determining investment portfolios induces individuals to underinvest in annuities and leads to welfare losses (Previtero, 2014).

In addition, Table 6 shows that framing can be of great importance in uptake decisions. Multiple studies show that framing annuities as investment, rather than as insurance of consumption, decreases uptake. This is likely because investment framing emphasizes the possibility that people pay more annuity premiums than they will receive in terms of benefits, thus triggering loss aversion (Brown et al., 2008). Consequently, evidence including one quasi-experimental study suggests that annuities

¹⁹ Moreover, one of the studies that note a negative impact of financial literacy on uptake finds a positive impact of specific product knowledge (Chou et al., 2016).

²⁰ A hypothetical study that corrects for survey attention also finds that survey attention increases hypothetical annuity uptake (Bateman et al., 2017).

²¹ Procrastination is associated with lower uptake (Brown and Previtero, 2014), whereas two studies find that simplicity of the product is associated with higher uptake (Brown, Kapteyn, Luttmer, Mitchell, et al., 2017) or not associated with uptake (Bockweg et al., 2016).

²² Design of incentives is important, as poorly designed incentives can decrease the relative attractiveness of annuities (Charupat and Milevsky, 2001).

²³ One study suggests that this relationship is non-linear, as it finds a statistically significant positive squared effect (Clark et al., 2014).

¹⁷ Two studies looking at job mortality find a positive association (Cutler et al., 2008) and no association (Hurwitz and Sade, 2017) with annuity uptake.

¹⁸ One study analyzing the impact of objective financial strength of a company finds no association (Chou et al., 2016).

Table 6

Overview of findings by studies on contextual factors associated with annuity uptake (number of quasi-experimental studies between brackets).

Factor	Association						Total
	Negative		None		Positive		
	# (#)	%	# (#)	%	# (#)	%	
Social benefits ^a	1 (0)	33%	2 (0)	67%	0 (0)	0%	3 (0)
Tax incentives	0 (0)	0%	0 (0)	0%	3 (0)	100%	3 (0)
Annuity equivalent worth	1 (0)	17%	0 (0)	0%	5 (1)	83%	6 (1)
Return on investments	3 (0)	75%	1 (0)	25%	0 (0)	0%	4 (0)
Annuity as defaults	0 (0)	0%	1 (0)	75%	4 (0)	80%	5 (0)
Framing as investment	4 (1)	80%	1 (1)	20%	0 (0)	0%	5 (2)
Protections ^b	0 (0)	0%	1 (0)	20%	4 (1)	80%	5 (1)

^a One study reports different associations of different social benefit schemes and has been counted under “none”.

^b One study reports a positive association with period guarantees and a negative association with inflation protection and has been counted under “none”.

with additional protections – such as period guarantees, principal protections, or inflation coverage – can increase uptake. In line with this, one quasi-experimental study shows that framing annuities in terms of lack of flexibility and control significantly reduces uptake (Beshears et al., 2014). Other framing aspects may also be of importance, as another quasi-experimental study shows that using a “live to” (rather than “die by”) frame (Payne et al., 2013) increases uptake. Framing a specific annuity goal may (Knoller, 2016) or may not (Brown et al., 2013) increase uptake. Finally, one study shows that people annuitize less when risks are more ambiguous and when the choice tasks are more complex (i.e., more information is offered) (Brown et al., 2017b).

Why is annuity uptake so low?

From our theoretical (Section “Demand for annuities”) and empirical overview (Sections “Individual factors” and “Contextual factors”) we infer the same explanations for low uptake of annuities as those inferred earlier for LTCI: (i) substitution by social benefits; (ii) adverse selection; (iii) individual preferences that differ from those assumed in standard economic models of consumer behavior; and (iv) financial illiteracy. Subsequently, (v) we discuss how these may relate to the distribution of annuity uptake over the population.

(i) As theoretically predicted, substitution by social benefits can decrease annuity uptake. Whether it actually does, however, seems to depend crucially on the design of the social benefit system. If social benefits are used only as a safety net for those worst off, then it may substitute for annuity uptake. If social benefits provide a base consumption for all retirees, substitution does not seem to take place.

In addition, other investments have theoretically been proposed to substitute for annuity uptake (Hainaut and Devolder, 2006). In practice, we find evidence that people purchase annuities less when stock indices are high. However, this does not seem to indicate that stock market investments actually substitute for annuities. Rather, overreliance on recent stock price increases induces people to overestimate returns on annuities and to underannuitize for retirement altogether (Previtero, 2014). Hence, although stock prices are associated with lower uptake, it is not clear to what extent this is driven by substitution and to what extent by limited rationality.

(ii) Adverse selection seems to play a role in the annuity market, as predicted theoretically. Our results highlight that those who take up annuities have a higher longevity risk; they may be subjectively healthier, may have a higher subjective longevity risk and they live objectively longer. Additionally, studies analyzing annuity equivalent worth – or policy value – have shown that this is lower due to adverse selection (Brown, 2001; Doyle et al., 2004; Mitchell et al., 1999).

(iii) Nonstandard preferences may also explain lower than expected annuity demand. In line with theoretical predictions, our overview of

empirical studies suggests that higher levels of patience are associated with higher levels of annuity. However, our overview also highlights discrepancies between theoretical and empirical studies. First, there is no evidence that risk aversion or any proxy thereof is associated with higher annuity uptake. Second, bequest motives do not seem to increase annuity uptake, although this may indicate that some parents use bequests to strategically influence behavior of their children.

(iv) As for LTCI, it seems that annuity uptake decisions are difficult. Specifically, higher financial literacy and greater salience of longevity risks lead to increased annuity uptake, suggesting that those with greater knowledge or risk awareness are better protected against longevity risks. Additionally, one study has highlighted that people who are prone to procrastinate are less likely to own annuities (Brown and Previtero, 2014). Moreover, uptake decisions seem to be guided by contextual defaults and framing, rather than by expected utility maximization. Finally, trust in insurance companies is associated with higher annuity uptake and lack thereof may thus contribute to low uptake levels.

(v) From our review it follows that uptake of annuities differs across different subgroups of the population, as does the uptake of LTCI. Even though substitution by social benefits (among lower income individuals) plays a role in annuity uptake, we find that uptake is concentrated among individuals with high wealth (and likely also high income). Following our other explanations for low uptake we infer that these individuals may (a) have better subjective health and higher longevity and adversely select into the annuity market; (b) simply have other preferences than those with lower wealth, although this is not supported by stated preference studies; and/or (c) be better able to judge the value of those products.

Discussion

Our study provides an overview of the evidence from revealed preference studies, stated preference studies and theoretical models of demand for LTCI and annuities, integrating the limited quasi-experimental research available. Altogether, the evidence consistently suggests that low uptake follows from substitution, adverse selection, nonstandard preferences and limited rationality. Hence, our findings are unlikely to reflect measurement errors that are specific to these research methods. Rather, we show that employing different methods to answer the pressing LTCI and annuity puzzles renders qualitatively similar results on aggregate.

In addition, combining our results may provide valuable insight into the factors that impact insurance decisions for late-in-life risks in general. Particularly, this may elucidate to what extent groups with low LTCI and annuity uptake may overlap. Therefore, Table 7 summarizes which specific aspects limit uptake for both LTCI and annuities. Uptake of both LTCI and annuities is lower for individuals that (i) are eligible for public policies that can substitute for private insurance; (ii) that are subjectively less healthy; (iii) that have lower trust in insurance companies; and (iv) that are less financially literate or risk aware.

These results may contain lessons for integrated products that insure simultaneously against LTC and longevity risks. Such life-care annuities (LCAs) have been proposed on a theoretical basis to diminish adverse selection by combining negatively correlated LTC and longevity risks in one product (Murtaugh et al., 2001).²⁴ Although in the US uptake of annuities with LTC riders seems promising, it is unclear whether these products indeed broaden the market. Currently, only one study has analyzed demand for LCAs directly (Wu et al., 2018). This study finds no evidence of selection effects in purchase decisions for hypothetical integrated products, but also highlights that uptake is impacted by risk awareness as well as by ease of financial knowledge acquisition.

²⁴ This has been disputed by Zhou-Richter and Gründl (2011) who argue that long-term care and longevity risks are positively correlated and that LCAs hence may offer even more room for adverse selection.

Table 7
Explanations for low uptake of LTCI and annuities and their similarities.

	LTCI	Annuity	Similarities
Substitution	<ul style="list-style-type: none"> • Is substituted by social benefits that provide a safety net only • May be substituted by informal care availability 	<ul style="list-style-type: none"> • Is substituted by social benefits that provide a safety net only • Is not substituted by intra-family risk pooling 	<ul style="list-style-type: none"> • Social benefits that provide a safety net only may substitute for private insurance
Adverse selection	<ul style="list-style-type: none"> • Individuals with subjectively better health have higher uptake • Individuals with higher subjective LTC risks have higher uptake • Individuals with objectively worse health do not have higher uptake 	<ul style="list-style-type: none"> • Individuals with subjectively better health have higher uptake • Individuals with higher subjective longevity risks have higher uptake • Individuals with objectively higher longevity risks have higher uptake 	<ul style="list-style-type: none"> • Individuals with subjectively better health have higher uptake
Nonstandard preferences	<ul style="list-style-type: none"> • Trust in insurers is associated with higher uptake • Risk aversion is not associated with uptake 	<ul style="list-style-type: none"> • Trust in insurers is associated with higher uptake • Risk aversion is not associated with uptake 	<ul style="list-style-type: none"> • Trust in insurers is associated with higher uptake • Risk aversion is not associated with uptake
Limited rationality	<ul style="list-style-type: none"> • Financial literacy is associated with higher uptake • Risk awareness is associated with higher uptake 	<ul style="list-style-type: none"> • Financial literacy is associated with higher uptake • Risk awareness is associated with higher uptake 	<ul style="list-style-type: none"> • Financial literacy is associated with higher uptake • Risk awareness is associated with higher uptake

In particular, we speculate that integrated products are unlikely to substantially expand the market as a whole for three reasons. First, uptake is not only limited by adverse selection, but also impacted by substitution, nonstandard preferences and limited rationality. Second, all these explanations seem to result in a concentration of demand among healthy individuals with higher wealth, making it difficult to expand the market for LTCI and longevity insurance products to a broader population. Third, an integrated product may turn out to be more complex than two separate products and may thus work to decrease uptake amongst the least financial literate. Nonetheless, future work remains necessary to better understand the viability of such integrated products.

Conclusion and recommendations

Our systematic literature review shows that similar factors hinder the uptake of both LTCI and annuities. Specifically, we find that uptake is lowered by substitution by social security, adverse selection, non-standard preferences and limited rationality due to low financial literacy and risk unawareness. Moreover, these factors may also explain why insurance holding is concentrated among individuals with high wealth and good subjective health. An integrated product – only focusing on solving adverse selection issues – is unlikely to solve other aspects that limit uptake. Particularly, our results show that uptake for integrated products is likely to remain concentrated among wealthier and subjectively healthier individuals.

Further research is warranted to better understand the dynamics of LTCI and annuity uptake. Specifically, it is worth analyzing to what extent our findings can indeed explain the concentration of uptake among individuals with good subjective health and high wealth. The fact that uptake of private insurance is unequally distributed also has important consequences for policy makers. In so far as low uptake reflects an active choice to substitute for private insurance or reflects a dislike of private insurance, it echoes individual preferences and requires no action. However, to the extent that it reflects adverse selection or limited rationality, lower uptake is a product of underlying inequalities in health or longevity and related unequal capabilities, and that may warrant policy interventions.

If the goal is to increase insurance uptake on private LTCI or annuity markets, policy makers and insurers could undertake several actions to create a more inclusive insurance market. First, individuals with low financial literacy should be empowered to make their own insurance decisions. This may not only be achieved through educational policies that increase financial literacy and hence understanding of LTCI and annuity products. In addition, complexity of the choice environment should be reduced by making insurance policies easier to comprehend and by reducing the number of policy options. Second, risk awareness increases insurance

uptake; policy makers and insurers could thus focus on raising awareness of LTC and longevity risks. Particularly, governments should be clear about what social benefits do and do not reimburse and about what contribution is expected from citizens themselves. Even though large-scale awareness campaign sometimes have limited impact (Iwasaki et al., 2010), such campaigns are easy and relatively cheap to implement. Third, since our results show that distrust of insurers additionally drives low uptake, government regulation or insurance standards that protect insured persons by guaranteeing the pay out of fair claims may help to increase uptake. Fourth, evidence on the importance of perceptions, framing and defaults suggests that these may provide effective nudges for increasing insurance uptake (for an illustration, see: Bonsang and Costa-Font, 2019). In addition, offering products with guaranteed pay-outs when the insured risk does not (fully) materialize may prove particularly effective.

Finally, the fact that those with lower subjective health, risk awareness or financial literacy buy predictably less protection against late-in-life risks may provide an argument for stronger government intervention. Particularly, governments may aim not only to safeguard individual freedom of choice, but also to protect their citizens from major financial risks. Hence, compulsory coverage – through an individual mandate for those not-covered by social insurance schemes or through an extension of social insurance schemes – may be warranted.

CRedit authorship contribution statement

Timo R. Lambregts: Conceptualization, Methodology, Investigation, Formal analysis, Data curation, Writing - original draft, Project administration. **Frederik T. Schut:** Investigation, Writing - review & editing, Supervision, Funding acquisition.

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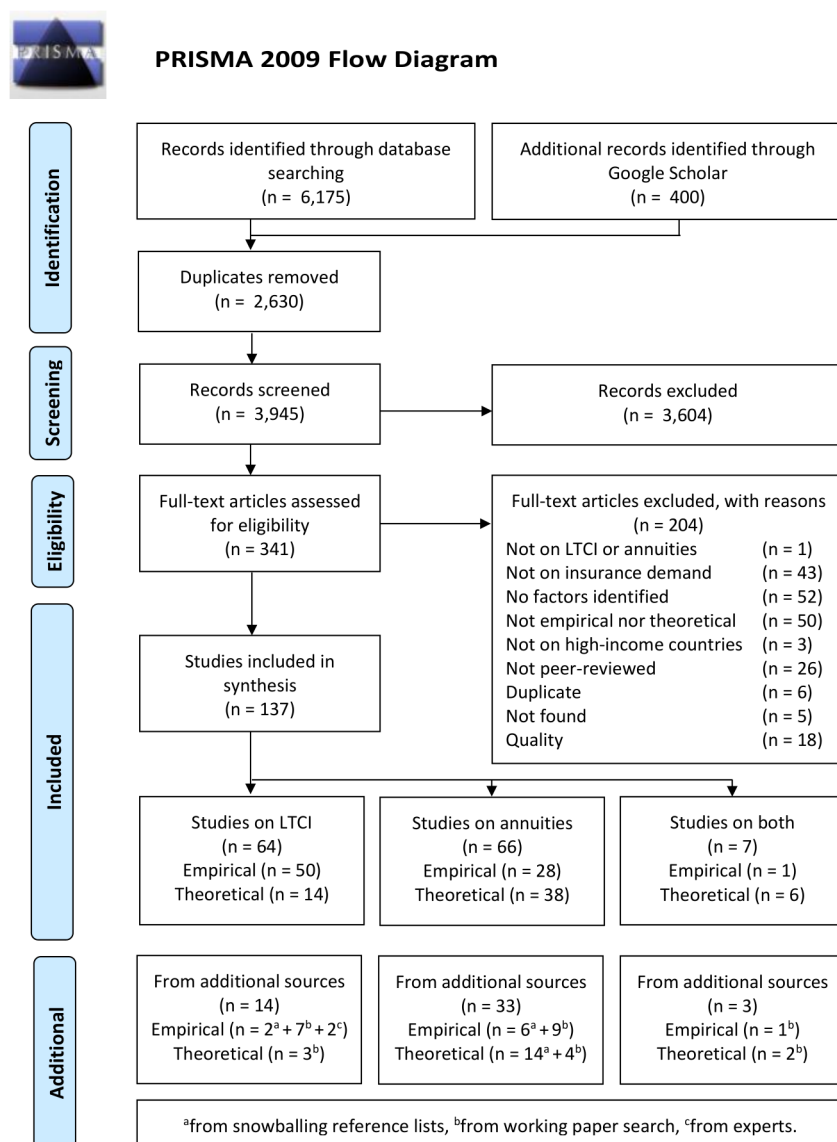
This work was supported by the Network for Studies on Pensions, Aging and Retirement (Netspar) through the project grant ‘optimal saving and insurance for old age: the role of public long-term care insurance’.

Appendix A. Search string Embase.com

((longevity/de OR 'long term care'/de OR 'elderly care'/exp OR retirement/de OR pensioner/de OR 'nursing home'/de) AND ('insurance'/de OR 'social insurance'/de OR 'social security'/de)) OR (((longevit* OR long-term-care OR longterm-care OR life OR ltc OR pension* OR retirement* OR nursing-home*) NEAR/6 (insur* OR annuit* OR Social-securit*)) OR ltc):ab,ti) AND ('decision making'/de OR 'purchasing'/de OR 'attitude'/de OR 'attitude to aging'/de OR 'attitude to disability'/de OR 'attitude to death'/de OR 'attitude to life'/de OR 'attitude to illness'/de OR 'attitude to health'/de OR 'consumer attitude'/de OR 'family attitude'/exp OR motivation/de OR 'decision support system'/de OR consumer/de OR (((decision* OR decid* OR uptake OR nonuptake OR purchase* OR nonpurchase* OR why OR buy OR buying OR reason* OR motivation* OR take-up OR choos* OR choice* OR procure OR willing* OR persua* OR selling OR crowd*.out* OR puzzle* OR obtain* OR select OR selecting OR selection OR take OR taking OR get OR getting OR interes* OR acquire* OR acquisition* OR afford* OR abilit* OR able OR pay OR paying OR preference* OR substit* OR exchang* OR replac* OR self-control* OR discount* OR invest* OR reference* OR consum* OR Participat* OR attain* OR wtp OR value* OR worth OR utilit* OR attitude* OR belief* OR confidence* OR overconfiden* OR confident OR trust* OR expectation* OR estimate* OR probabilit* OR weighting OR weighing OR bias* OR predispos* OR prejudice* OR approximat* OR guess OR assess* OR evaluat* OR uncertain* OR ambigu* OR attention* OR focus* OR sensitivit* OR concern OR concerns OR behav* OR perception* OR perceive* OR factor* OR salien* OR capacit* OR access* OR framing OR emotion* OR default OR familiar* OR pressure OR market* OR incentiv* OR disincentiv* OR barrier* OR facilitator*) NEAR/6 (insur* OR long-term-care-insurance* OR annuit*))):ab,ti) NOT ([Conference Abstract]/lim OR [Letter]/lim OR [Note]/lim OR [Editorial]/lim) AND [english]/lim

Appendix B. PRISMA flow diagram

Figure B1



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Appendix C. Individual and contextual level empirical evidence on LTCI uptake

Table C8

Overview of findings by studies on individual factors associated with annuity uptake.

Factor	Association		
	Negative	None	Positive
Female	4	20	13
Stated preferences	3 <ul style="list-style-type: none"> • Allaire et al. (2016) • Swamy (2004) • Stevenson et al. (2009) 	7 <ul style="list-style-type: none"> • Ameriks et al. (2018) • Brau et al. (2010) • Costa-Font and Font (2009) • Costa-Font and Rovira-Forns (2008) • He and Chou (2018) • Kennedy et al. (2016) • Wu et al. (2017) 	0
Revealed preferences	1 <ul style="list-style-type: none"> • Brau and Bruni (2008) 	13 <ul style="list-style-type: none"> • Caro et al. (2011) • Courbage and Roudaut (2008) • Cramer and Jensen (2006) • Friedberg et al. (2017) • Gousia (2016) • Gottlieb and Mitchell (2015) • Jiménez-Martín et al. (2016) • McGarry et al. (2014) • Mellor (2000) • Mellor (2001) • Schaber and Stum (2007) • Sloan and Norton (1997) • Stum (2008) 	13 <ul style="list-style-type: none"> • Barnett and Stum (2013) • Bernet (2004) • Chatterjee and Fan (2017) • Konetzka and Luo (2011) • Kumar et al. (1995) • Li and Jensen (2012) • McCall et al. (1998) • McGarry et al. (2016) • McGarry et al. (2018) • McNamara and Lee (2004) • Pinquet et al. (2011) • Unruh et al. (2016) • Van Houtven et al. (2015)
Age	8	18	11
Stated preferences	3 <ul style="list-style-type: none"> • Brau and Bruni (2008) • Brau et al. (2010) • Costa-Font and Font (2009) 	2 <ul style="list-style-type: none"> • Ameriks et al. (2018) • Wu et al. (2017) 	2 <ul style="list-style-type: none"> • Kennedy et al. (2016) • Pincus et al. (2017)
Revealed preferences	5 <ul style="list-style-type: none"> • Friedberg et al. (2017) • He and Chou (2018) • Konetzka and Luo (2011) • Kumar et al. (1995) • Swamy (2004) 	16 <ul style="list-style-type: none"> • Caro et al. (2011) • Chatterjee and Fan (2017) • Courtemanche and He (2009) • Gottlieb and Mitchell (2015) • Jiménez-Martín et al. (2016) • Li and Jensen (2012) • McGarry et al. (2014) • McGarry et al. (2016) • McNamara and Lee (2004) • Mellor (2001) • Sloan and Norton (1997)^a • Stevenson et al. (2009) • Stum (2008) • Unruh et al. (2016) • Van Houtven et al. (2015)^b • Zhou-Richter et al. (2010) 	9 <ul style="list-style-type: none"> • Barnett and Stum (2013) • Bernet (2004) • Courbage and Roudaut (2008) • Doeringhaus and Gustavson (2002) • Gousia (2016) • McCall et al. (1998) • McGarry et al. (2018) • Mellor (2000) • Schaber and Stum (2007)
Non-white	1	13	2
Stated preferences	1 <ul style="list-style-type: none"> • Kennedy et al. (2016) 	1 <ul style="list-style-type: none"> • Allaire et al. (2016) 	0
Revealed preferences	0	12 <ul style="list-style-type: none"> • Cramer and Jensen (2006)^c • Gottlieb and Mitchell (2015) • Konetzka and Luo (2011)^c • Li and Jensen (2012)^c • McGarry et al. (2014)^c • McGarry et al. (2016)^c • McGarry et al. (2018)^c • McNamara and Lee (2004)^c • Sloan and Norton (1997) • Stevenson et al. (2009)^c • Swamy (2004) • Van Houtven et al. (2015)^c 	2 <ul style="list-style-type: none"> • Bernet (2004) • Caro et al. (2011)

(continued on next page)

Table C8 (continued)

Factor	Association		
	Negative	None	Positive
Education	2	10	18
Stated preferences	0	4 <ul style="list-style-type: none"> • Allaire et al. (2016) • Ameriks et al. (2018) • Brau et al. (2010) • Costa-Font and Rovira-Forns (2008) 	2 <ul style="list-style-type: none"> • Brau and Bruni (2008) • He and Chou (2018)
Revealed preferences	2 <ul style="list-style-type: none"> • Gousia (2016) • Kumar et al. (1995) 	6 <ul style="list-style-type: none"> • Barnett and Stum (2013) • Courbage and Roudaut (2008) • Friedberg et al. (2017) • Li and Jensen (2012) • McGarry et al. (2018) • Swamy (2004) 	16 <ul style="list-style-type: none"> • Bernet (2004) • Caro et al. (2011) • Chatterjee and Fan (2017) • Cramer and Jensen (2006) • Jiménez-Martín et al. (2016) • Gottlieb and Mitchell (2015) • Konetzka and Luo (2011) • McCall et al. (1998) • McGarry et al. (2014) • McGarry et al. (2016) • McNamara and Lee (2004) • Mellor (2000) • Mellor (2001) • Sloan and Norton (1997) • Unruh et al. (2016) • Van Houtven et al. (2015)
Income	0	14	22
Stated preferences		2 <ul style="list-style-type: none"> • Ameriks et al. (2018) • Costa-Font and Font (2009) 	5 <ul style="list-style-type: none"> • Allaire et al. (2016) • Brau and Bruni (2008) • Brau et al. (2010) • Costa-Font and Rovira-Forns (2008) • Kennedy et al. (2016)
Revealed preferences	0	12 <ul style="list-style-type: none"> • Browne and Zhou-Richter (2014) • Courbage and Roudaut (2008) • Courtemanche and He (2009) • Doeringhaus and Gustavson (2002) • Friedberg et al. (2017) • Li and Jensen (2012) • McCall et al. (1998) • Sloan and Norton (1997) • Stevenson et al. (2009) • Stum (2008) • Swamy (2004) • Unruh et al. (2016) 	17 <ul style="list-style-type: none"> • Barnett and Stum (2013) • Bernet (2004) • Caro et al. (2011) • Chatterjee and Fan (2017) • Cramer and Jensen (2006) • Jiménez-Martín et al. (2016) • Konetzka and Luo (2011) • Kumar et al. (1995) • McGarry et al. (2014) • McGarry et al. (2016) • McNamara and Lee (2004) • Mellor (2000) • Mellor (2001) • Nixon (2014) • Schaber and Stum (2007) • Van Houtven et al. (2015) • Zhou-Richter et al. (2010)
Home equity	2	2	0
Stated preferences	1 <ul style="list-style-type: none"> • Costa-Font and Rovira-Forns (2008) 	1 <ul style="list-style-type: none"> • Wu et al. (2017) 	0
Revealed preferences	1 <ul style="list-style-type: none"> • Boyer et al. (2017) 	1 <ul style="list-style-type: none"> • Stevenson et al. (2009) 	0
Wealth	1	10	16
Stated preferences	0	2 <ul style="list-style-type: none"> • Ameriks et al. (2018) • Costa-Font and Rovira-Forns (2008) 	2 <ul style="list-style-type: none"> • Allaire et al. (2016) • He and Chou (2018)
Revealed preferences	1 <ul style="list-style-type: none"> • Barnett and Stum (2013) 	8 <ul style="list-style-type: none"> • Courtemanche and He (2009) • Kumar et al. (1995) • Lin and Prince (2013) • McGarry et al. (2016) • Mellor (2000) • Schaber and Stum (2007) • Sloan and Norton (1997)^a • Stum (2008) 	14 <ul style="list-style-type: none"> • Bernet (2004) • Caro et al. (2011) • Chatterjee and Fan (2017) • Finkelstein and McGarry (2006) • Friedberg et al. (2017) • Gousia (2016) • Jiménez-Martín et al. (2016) • Konetzka and Luo (2011)

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Table C8 (continued)

Factor	Association		
	Negative	None	Positive
			<ul style="list-style-type: none"> • McCall et al. (1998) • McGarry et al. (2014) • McGarry et al. (2018) • McNamara and Lee (2004) • Mellor (2001) • Unruh et al. (2016) • Van Houtven et al. (2015)
Number of children	7	13	1
Stated preferences	1 • Brau and Bruni (2008) ^d	3 • Costa-Font and Font (2009) ^d • Costa-Font and Rovira-Forns (2008) ^d • Wu et al. (2017)	0
Revealed preferences	6 • Cramer and Jensen (2006) • Gousia (2016) • Jiménez-Martín et al. (2016) ^d • McGarry et al. (2016) • McGarry et al. (2018) • Schaber and Stum (2007) ^d	10 • Barnett and Stum (2013) ^e • Browne and Zhou-Richter (2014) • Caro et al. (2011) • Friedberg et al. (2017) ^e • Konetzka and Luo (2011) • McGarry et al. (2014) • Mellor (2000) • Sloan and Norton (1997) • Van Houtven et al. (2015) • Zhou-Richter et al. (2010)	1 • Courbage and Roudaut (2008)
Married	3	25	4
Stated preferences	1 • Brau and Bruni (2008) ^d	5 • Allaire et al. (2016) • Costa-Font and Font (2009) ^d • Costa-Font and Rovira-Forns (2008) ^d • He and Chou (2018) • Wu et al. (2017)	0
Revealed preferences	2 • McNamara and Lee (2004) • Schaber and Stum (2007) ^d	20 • Browne and Zhou-Richter (2014) • Chatterjee and Fan (2017) • Courbage and Roudaut (2008) ^e • Courtemanche and He (2009) • Friedberg et al. (2017) • Gousia (2016) ^e • Jiménez-Martín et al. (2016) • Konetzka and Luo (2011) • Li and Jensen (2012) ^f • McCall et al. (1998) • McGarry et al. (2014) • McGarry et al. (2016) • McGarry et al. (2018) • Mellor (2000) • Mellor (2001) • Sloan and Norton (1997) • Stum (2008) • Swamy (2004) • Unruh et al. (2016) • Zhou-Richter et al. (2010)	4 • Bernet (2004) • Gottlieb and Mitchell (2015) • Kumar et al. (1995) • Van Houtven et al. (2015)
Bequest motive	0	4	3
Stated preferences	0	1 • He and Chou (2018)	0
Revealed preferences	0	3 • Schaber and Stum (2007) • Sloan and Norton (1997) • Stum (2008)	3 • Boyer et al. (2017) • Brown et al. (2012) • Chatterjee and Fan (2017)
Subjective health	2	19	10
Stated preferences	0	4 • Ameriks et al. (2018) • Allaire et al. (2016) • Brau et al. (2010) • Costa-Font and Font (2009)	2 • Brau and Bruni (2008) • Costa-Font and Rovira-Forns (2008)

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Table C8 (continued)

Factor	Association		
	Negative	None	Positive
Revealed preferences	2 • Li and Jensen (2012) • Stum (2008)	15 • Barnett and Stum (2013) • Browne and Zhou-Richter (2014) • Caro et al. (2011) • Chatterjee and Fan (2017) • Courbage and Roudaut (2008) • Courtemanche and He (2009) • Friedberg et al. (2017) • Gottlieb and Mitchell (2015) • Gousia (2016) • Konetzka and Luo (2011) • McGarry et al. (2016) • McGarry et al. (2018) • Mellor (2000) • Schaber and Stum (2007) • Sloan and Norton (1997) ^a	8 • Bernet (2004) • Cramer and Jensen (2006) • McCall et al. (1998) • McGarry et al. (2014) • McNamara and Lee (2004) • Mellor (2001) • Unruh et al. (2016) • Van Houtven et al. (2015)
Subjective LTC risk	0	5	14
Stated preferences	0	3 • Ameriks et al. (2018) • Costa-Font and Font (2009) ^g • Wu et al. (2017) ^h	1 • He and Chou (2018)
Revealed preferences	0	2 • Friedberg et al. (2017) • Kumar et al. (1995) ^h	13 • Brown et al. (2012) • Caro et al. (2011) • Chatterjee and Fan (2017) • Costa-Font and Rovira-Forns (2008) • Finkelstein and McGarry (2006) • Gottlieb and Mitchell (2015) • Kitajima (1999) • McGarry et al. (2016) • McGarry et al. (2018) • Schaber and Stum (2007) • Sloan and Norton (1997) • Swamy (2004) • Unruh et al. (2016)
Subjective longevity	0	6	0
Stated preferences	0	3 • Costa-Font and Font (2009) ^h • Costa-Font and Rovira-Forns (2008) • Wu et al. (2017)	0
Revealed preferences	0	3 • Caro et al. (2011) • Cramer and Jensen (2006) • Sloan and Norton (1997)	0
ADL impairments	1	14	3
Stated preferences	0	1 • Ameriks et al. (2018)	1 • Kennedy et al. (2016)
Revealed preferences	1 • Konetzka and Luo (2011)	13 • Bernet (2004) • Caro et al. (2011) • Chatterjee and Fan (2017) • Courtemanche and He (2009) • Friedberg et al. (2017) • Gottlieb and Mitchell (2015) • Li and Jensen (2012) • McCall et al. (1998) • McGarry et al. (2016) • McGarry et al. (2018) • Mellor (2000) • Mellor (2001) • Sloan and Norton (1997)	2 • Courbage and Roudaut (2008) • Nixon (2014)

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Table C8 (continued)

Factor	Association		
	Negative	None	Positive
Risk aversion	2	3	2
Stated preferences	0	1	0
Revealed preferences	2	2	2
	• Boyer et al. (2017) • Gousia (2016)	• Costa-Font and Rovira-Forns (2008) • Gottlieb and Mitchell (2015) • Sloan and Norton (1997)	• Chatterjee and Fan (2017) • Stum (2008)
Preference for formal care	0	0	3
Stated preferences	0	0	1
Revealed preferences	0	0	2
			• He and Chou (2018) • Boyer et al. (2017) • Brown et al. (2012)
Trust insurer	0	0	2
Stated preferences	0	0	0
Revealed preferences	0	0	2
			• Brown et al. (2012) • Curry et al. (2009)
Financial literacy	1	0	4
Stated preferences	0	0	1
Revealed preferences	1	0	3
	• Boyer et al. (2017)		• He and Chou (2018) • Gousia (2016) • McGarry et al. (2016) • McGarry et al. (2018)
System knowledge	0	4	1
Stated preferences	0	0	1
Revealed preferences	0	4	0
		• Boyer et al. (2017) • Schaber and Stum (2007) • Swamy (2004) • Unruh et al. (2016)	• Kitajima (1999)
Cognitive intactness	0	3	1
Stated preferences	0	0	0
Revealed preferences	0	3	1
		• Gottlieb and Mitchell (2015) • McGarry et al. (2016) • Sloan and Norton (1997)	• Friedberg et al. (2017)
Awareness	0	3	5
Stated preferences	0	1	0
Revealed preferences	0	2	5
		• Allaire et al. (2016) • Barnett and Stum (2013) • Browne and Zhou-Richter (2014)	• Boyer et al. (2017) • Schaber and Stum (2007) • Stum (2008) • Swamy (2004) • Zhou-Richter et al. (2010)
LTC experience	2	9	8
Stated preferences	1	2	3
	• Kitajima (1999)	• Allaire et al. (2016) • Wu et al. (2017)	• Brau and Bruni (2008) • Kennedy et al. (2016) • Tennyson and Yang (2014)

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Table C8 (continued)

Factor	Association		
	Negative	None	Positive
Revealed preferences	1 • Kumar et al. (1995)	7 • Barnett and Stum (2013) • Coe et al. (2015b) ⁱ • Cramer and Jensen (2006) • Li and Jensen (2012) ⁱ • Schaber and Stum (2007) • Swamy (2004) • Unruh et al. (2016) ⁱ	5 • Courbage and Roudaut (2008) • Jiménez-Martín et al. (2016) • Konetzka and Luo (2011) • McCall et al. (1998) • Stum (2008)

^a Reports different associations in equivalent analyses and is therefore counted under “none”.

^b Reports two different age associations and is therefore counted under “none”.

^c Reports different associations for “black”, “Hispanic” and/or “other” and is therefore counted under “none”.

^d Reports household size and is therefore counted under both children and married.

^e Reports having children (or not) rather than number of children.

^f Reports different associations for married individuals compared to individuals that are single, divorced or widowed and is therefore counted under “none”.

^g Reports an interaction of LTC risk and longevity risk.

^h Reports different associations for home care and nursing home expectations and is therefore counted under “none”.

ⁱ Reports different associations for different proxies of LTC experience and is therefore counted under “none”.

Table C9

Overview of findings by studies on individual factors associated with LTCI uptake.

Factor	Association		
	Negative	None	Positive
Social benefits	4	6	0
Stated preferences	0	1 • He and Chou (2018)	0
Revealed preferences	4 • Brown et al. (2007b) [†] • Doeringhaus and Gustavson (2002) • Jiménez-Martín et al. (2016) • Konetzka and Luo (2011)	5 • Kumar et al. (1995) ^a • Li and Jensen (2012) • McGarry et al. (2018) • Sloan and Norton (1997) ^b • Stevenson et al. (2009) ^a	0
Tax incentive	0	4	5
Stated preferences	0	0	0
Revealed preferences	0	4 • McGarry et al. (2018) • Nixon (2014) • Stevenson et al. (2009) ^c • Stum (2008)	5 • Cornell and Grabowski (2018) [†] • Cramer and Jensen (2006) • Courtemanche and He (2009) [†] • Goda (2011) [†] • Jiménez-Martín et al. (2016)
Informal care availability	4	7	2
Stated preferences	0	3 • Ameriks et al. (2018) • He and Chou (2018) • Wu et al. (2017)	0
Revealed preferences	4 • Bernet (2004) • Brown et al. (2012) • McCall et al. (1998) • McGarry et al. (2018)	4 • McGarry et al. (2016) • Mellor (2001) • Schaber and Stum (2007) • Stum (2008)	2 • Boyer et al. (2017) • Coe et al. (2015a,b)

[†] Quasi-experimental study (highest level of evidence available).

^a Reports different associations of various measures of social benefit generosity and is therefore counted under “none”.

^b Reports different associations in equivalent analyses and is therefore counted under “none”.

^c Reports different associations of tax deductions and tax credits and is therefore counted under “none”.

Appendix D. Individual and contextual level empirical evidence on annuity uptake

Table D10

Overview of findings per study on individual factors associated with annuity uptake.

Factor	Association		
	Negative	None	Positive
Female	4	12	7
Stated preferences	2 • Nosi et al. (2017) • Teppa (2011)	7 • Bateman et al. (2017) • Beshears, Choi et al. (2014) • Bockweg et al. (2016) • Cappelletti et al. (2013) • Chou, Inkmann et al. (2016) • Pfarr and Schneider (2013) • Shu et al. (2018)	1 • Guillemette et al. (2016)
Revealed preferences	2 • Büttler and Teppa (2007) • Inkmann et al. (2011)	5 • Hagen (2015) ^a • Hurd and Panis (2006) • Hurwitz and Sade (2017) • Schreiber and Weber (2016) • Zieglmeyer and Nick (2013)	6 • Benartzi, Previtro and Thaler (2011) • Brown and Previtro (2014) • Chalmers and Reuter (2012) • Clark et al. (2014) • Lee (2016) • Previtro (2014)
Age	8	7	7
Stated preferences	4 • Brown et al. (2017a) • Guillemette et al. (2016) • Schooley-Pettis and Worden (2013) • Schreiber and Weber (2016)	3 • Beshears et al. (2014) • Shu et al. (2018) • Teppa (2011)	4 • Bockweg et al. (2016) • Cappelletti et al. (2013) • Chou et al. (2016) • Van der Crujisen and Jonker (2016)
Revealed preferences	4 • Bernheim (1991) • Clark et al. (2014) • Hurd and Panis (2006) • Hurwitz and Sade (2017)	4 • Inkmann et al. (2011) • Pfarr and Schneider (2013) • Previtro (2014) ^a • Zieglmeyer and Nick (2013)	3 • Benartzi et al. (2011) • Brown and Previtro (2014) • Lee (2016)
Non-white	0	1	1
Stated preferences	0	0	0
Revealed preferences	0	1 • Brown (2001)	1 • Hurd and Panis (2006)
Education	0	14	3
Stated preferences	0	8 • Beshears et al. (2014) • Cappelletti et al. (2013) • Chou et al. (2016) • Guillemette et al. (2016) • Nosi et al. (2017) • Schooley-Pettis and Worden (2013) • Schreiber and Weber (2016) • Van der Crujisen and Jonker (2016)	2 • Bateman et al. (2017) • Brown et al. (2017a)
Revealed preferences	0	6 • Brown (2001) • Hagen (2015) • Hurd and Panis (2006) • Pfarr and Schneider (2013) • Previtro (2014) ^a • Zieglmeyer and Nick (2013)	1 • Inkmann et al. (2011)
Income	1	9	4
Stated preferences	0	8 • Bockweg et al. (2016) • Cappelletti et al. (2013) • Chou et al. (2016) • Guillemette et al. (2016) • Nosi et al. (2017) • Schreiber and Weber (2016) • Shu et al. (2018) • Van der Crujisen and Jonker (2016)	0
Revealed preferences	1 • Previtro (2014)	1 • Zieglmeyer and Nick (2013)	4 • Chalmers and Reuter (2012) • Clark et al. (2014) • Hagen (2015) • Pfarr and Schneider (2013)

(continued on next page)

Table D10 (continued)

Factor	Association		
	Negative	None	Positive
Home ownership	0	4	0
Stated preferences	0	2 • Beshears et al. (2014) • Van der Crujisen and Jonker (2016)	0
Revealed preferences	0	2 • Pfarr and Schneider (2013) • Zieglmeyer and Nick (2013)	0
Wealth	1	5	9
Stated preferences	0	5 • Bateman et al. (2017) • Chou et al. (2016) • Guillemette et al. (2016) • Shu et al. (2018) • Van der Crujisen and Jonker (2016)	2 • Bockweg et al. (2016) • Cappelletti et al. (2013)
Revealed preferences	1 • Brown (2001)	0	7 • Bernheim (1991) • Büttler et al. (2013) • Büttler and Teppa (2007) • Hurd and Panis (2006) • Inkmann et al. (2011) • Knoller, Kraut and Schoenmaekers (2016) • Zieglmeyer and Nick (2013)
Children	1	12	0
Stated preferences	1 • Schreiber and Weber (2016)	6 • Beshears et al. (2014) • Bockweg et al. (2016) • Cappelletti et al. (2013) • Chou et al. (2016) • Shu et al. (2018) ^b • Van der Crujisen and Jonker (2016) ^b	0
Revealed preferences	0	6 • Bernheim (1991) ^b • Büttler and Teppa (2007) • Hagen (2015) ^b • Inkmann et al. (2011) • Pfarr and Schneider (2013) • Zieglmeyer and Nick (2013)	0
Married	2	15	0
Stated preferences	0	9 • Bateman et al. (2017) • Beshears et al. (2014) • Bockweg et al. (2016) • Cappelletti et al. (2013) • Chou et al. (2016) ^c • Guillemette et al. (2016) • Schooley-Pettis and Worden (2013) • Schreiber and Weber (2016) • Shu et al. (2018)	0
Revealed preferences	2 • Brown (2001) • Inkmann et al. (2011)	6 • Bernheim (1991) ^c • Büttler and Teppa (2007) ^c • Hagen (2015) ^a • Hurwitz and Sade (2017) • Pfarr and Schneider (2013) • Zieglmeyer and Nick (2013)	0

(continued on next page)

Table D10 (continued)

Factor	Association		
	Negative	None	Positive
Bequest motive	1	5	1
Stated preferences	1 • Bateman et al. (2017)	4 • Schooley-Pettis and Worden (2013) • Shu et al. (2018) • Teppa (2011) • Van der Crujisen and Jonker (2016)	1 • Chou et al. (2016)
Revealed preferences	0	1 • Brown (2001)	0
Subjective health	0	6	3
Stated preferences	0	5 • Cappelletti et al. (2013) • Chou et al. (2016) • Schooley-Pettis and Worden (2013) • Shu et al. (2018) • Van der Crujisen and Jonker (2016)	1 • Bockweg et al. (2016)
Revealed preferences	0	1 • Wuppermann (2017)	2 • Hurd and Panis (2006) • Brown (2001)
Subjective longevity	1	7	4
Stated preferences	1 • Chou et al. (2016)	3 • Bateman et al. (2017) • Bockweg et al. (2016) • Shu et al. (2018)	4 • Payne et al. (2013) • Schreiber and Weber (2016) • Teppa (2011) • Van der Crujisen and Jonker (2016)
Revealed preferences	0	4 • Hurd and Panis (2006) • Inkmann et al. (2011) • Pfarr and Schneider (2013) • Brown (2001)	0
Objective longevity	0	2	2
Stated preferences	0	0	0
Revealed preferences	0	2 • Hurwitz and Sade (2017) ^{de} • Wuppermann (2017) ^f	2 • Chalmers and Reuter (2012) ^f • Lee (2016) ^d
Risk aversion	3	5	3
Stated preferences	3 • Guillemette et al. (2016) • Knoller (2016) • Shu et al. (2018)	4 • Agnew et al. (2008) ^a • Cappelletti et al. (2013) • Chou et al. (2016) • Schreiber and Weber (2016)	3 • Bockweg et al. (2016) • Schooley-Pettis and Worden (2013) • Van der Crujisen and Jonker (2016)
Revealed preferences	0	1 • Pfarr and Schneider (2013)	0
Stock market participation	1	3	2
Stated preferences	1 • Cappelletti et al. (2013)	2 • Chou et al. (2016) • Guillemette et al. (2016)	1 • Bockweg et al. (2016)
Revealed preferences	0	1 • Inkmann et al. (2011)	1 • Pfarr and Schneider (2013)
Patience	0	0	4
Stated preferences	0	0	3 • Bockweg et al. (2016) • Cappelletti et al. (2013) • Van der Crujisen and Jonker (2016)
Revealed preferences	0	0	1 • Brown (2001)

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Table D10 (continued)

Factor	Association		
	Negative	None	Positive
Trust in insurers	0	1	1
Stated preferences	0	1 • Bockweg et al. (2016)	1 • Van der Cruijsen and Jonker (2016)
Revealed preferences	0	0	0
Financial literacy	2	4	4
Stated preferences	2 • Agnew et al. (2008) • Chou et al. (2016)	4 • Bateman et al. (2017) • Bockweg et al. (2016) • Cappelletti et al. (2013) ^g • Shu et al. (2018)	3 • Ai, Brockett, Golden and Zhu (2017) • Brown et al. (2017a) • Schreiber and Weber (2016)
Revealed preferences	0	0	1 • Ziegelmeier and Nick (2013)
Awareness	0	0	2
Stated preferences	0	0	2 • Ai et al. (2017) • Brown et al. (2017b)
Revealed preferences	0	0	0

^a Reports different associations in equivalent analyses and is therefore counted under “none”.

^b Reports having children (or not) rather than number of children.

^c Reports different association for married individuals compared to individuals that are single, divorced or widowed and is therefore counted under “none”.

^d Reports ex-ante mortality.

^e Reports different associations for two measures of ex-ante mortality and is therefore counted under “none”.

^f Reports ex-post mortality.

^g Reports different associations for three different measures of financial literacy and is therefore counted under “none”.

Table D11

Overview of findings by studies on contextual factors associated with annuity uptake.

Factor	Association		
	Negative	None	Positive
Social benefits	1	2	0
Stated preferences	0	2 • Chou et al. (2016) ^a • Schreiber and Weber (2016)	0
Revealed preferences	1 • Bernheim (1991)	0	0
Tax incentive	0	0	3
Stated preferences	0	0	0
Revealed preferences	0	0	3 • Hagen (2015) • Lee (2016) • Pfarr and Schneider (2013)
Annuity equivalent worth	1	0	5
Stated preferences	0	0	0
Revealed preferences	1 • Chalmers and Reuter (2012)	0	5 • Brown (2001) • Bütler et al. (2013) [†] • Bütler and Teppa (2007) • Clark et al. (2014) ^b • Lee (2016)

(continued on next page)

Table D11 (continued)

Factor	Association		
	Negative	None	Positive
Return on investments	3	1	0
Stated preferences	0	0	0
Revealed preferences	3 • Brown and Previtero (2014) • Chalmers and Reuter (2012) • Previtero (2014)	1 • Lee (2016)	0
Annuity as default	0	1	4
Stated preferences	0	1 • Agnew et al. (2008)	2 • Bateman et al. (2017) • Bockweg et al. (2016)
Revealed preferences	0	0	2 • Bütler et al. (2013) • Bütler and Teppa (2007)
Framing as investment	4	1	0
Stated preferences	3 • Bockweg et al. (2016) ^{†c} • Brown et al. (2013) • Guillemette et al. (2016)	1 • Beshears et al. (2014) [†]	0
Revealed preferences	1 • Benartzi et al. (2011)	0	0
Protections	0	1	4
Stated preferences	0	1 • Chou et al. (2016) ^d	3 • Brown et al. (2013) ^e • Knoller (2016) ^{†e} • Lee (2016) ^f
Revealed preferences	0	0	1 • Knoller et al. (2016) ^e

[†] Quasi-experimental study (highest level of evidence available).

^a Reports different associations for different social benefit schemes and is therefore counted under “none”.

^b Reports a lump sum value rather than annuity equivalent worth.

^c Reports a negative association with framing annuities as investment with potential loss, but not with framing annuities as investment with potential gain.

^d Reports a positive association of period guarantees and a negative association of inflation protection and is therefore counted under “none”.

^e Reports the association with principal protection or guarantees.

^f Reports the association with fixed interest rates.

References

- Agnew, B.J.R., Anderson, L.R., Gerlach, J.R., Szykman, L.R., 2008. Who chooses annuities? An experimental investigation of the role of gender, framing, and defaults. *Am. Econ. Rev. Pap. Proc.* 98, 418–422.
- Ai, J., Brockett, P.L., Golden, L.L., Zhu, W., 2017. Health state transitions and longevity effects on retirees' optimal annuitization. *J. Risk Insur.* 84, 319–343. <https://doi.org/10.1111/jori.12168>.
- Akaichi, F., Costa-Font, J., Frank, R., 2019. Uninsured by Choice? A choice experiment on long term care insurance. *J. Econ. Behav. Organ.* <https://doi.org/10.1016/j.jebo.2019.07.012>.
- Allaire, B.T., Brown, D.S., Wiener, J.M., 2016. Who wants long-term care insurance? A stated preference survey of attitudes, beliefs, and characteristics. *Inquiry* 53, 1–8. <https://doi.org/10.1177/0046958016663728>.
- Ameriks, J., Briggs, J., Caplin, A., Shapiro, M.D., Tonetti, C., 2018. The Long-Term Care Insurance Puzzle: Modeling and Measurement (No. 22726), NBER Working Paper Series.
- Arizona Governing Committee for Tax Deferred Annuity and Deferred Compensation Plans v. Norris, 1983. 463 U.S. 1073.
- Balls, K.G., 2006. Immediate annuity pricing in the presence of unobserved heterogeneity. *North Am. Actuar. J.* 10, 103–116. <https://doi.org/10.1080/10920277.2006.10597416>.
- Barnett, A.E., Stum, M.S., 2013. Spousal decision making and long-term care insurance. *J. Financ. Couns. Plan.* 24, 5–19.
- Bateman, H., Eckert, C., Iskhakov, F., Louviere, J., Satchell, S., Thorp, S., 2017. Default and naive diversification heuristics in annuity choice. *Aust. J. Manage.* 42, 32–57. <https://doi.org/10.1177/0312896215617225>.
- Benartzi, S., Previtero, A., Thaler, R.H., 2011. Annuity puzzles. *J. Econ. Perspect.* 25, 143–164. <https://doi.org/10.1257/jep.25.4.143>.
- Bergquist, S., Costa-Font, J., Swartz, K., 2018. Long-term care partnerships: are they fit for purpose? *J. Econ. Ageing* 12, 151–158. <https://doi.org/10.1016/j.jeoa.2018.03.006>.
- Bernet, P.M., 2004. The influence of prescription drug use on long-term care insurance ownership. *Risk Manage. Insur. Rev.* 7, 107–120. <https://doi.org/10.1111/j.1098-1616.2004.00040.x>.
- Bernheim, B.D., 1991. How strong are bequest motives? Evidence based on estimates of the demand for life insurance and annuities. *J. Polit. Econ.* 99, 899–927. <https://doi.org/10.1086/261783>.
- Bernheim, B.D., Shleifer, A., Summers, L.H., 1985. The strategic bequest motive. *J. Polit. Econ.* 93, 1045–1076.
- Beshears, J., Choi, J.J., Laibson, D., Madrian, B.C., Zeldes, S.P., 2014. What makes annuitization more appealing? *J. Public Econ.* 116, 2–16. <https://doi.org/10.1016/j.jpubeco.2013.05.007>.
- Blanchett, D., 2015. Dynamic choice and optimal annuitization. *J. Retire.* 3, 38–49. <https://doi.org/10.3905/jor.2015.3.1.038>.
- Bockweg, C., Ponds, E., Steenbeek, O., Vonken, J., 2016. Framing and the annuitization decision: Experimental evidence from a Dutch pension fund (No. DP 03/2016-007), Netspar Discussion Paper Series.
- Bommier, A., Grand, F. Le, 2014. Too risk averse to purchase insurance? A theoretical glance at the annuity puzzle. *J. Risk Uncertain.* 48, 135–166. <https://doi.org/10.1007/s11166-014-9190-3>.
- Bonsang, E., Costa-Font, J., 2019. Behavioral regularities in old age planning. *J. Econ. Behav. Organ.* <https://doi.org/10.1016/j.jebo.2019.11.015>.
- Boyer, M., De Donder, P., Fluet, C., Leroux, M.-L., Michaud, P.-C., 2017. Long-Term Care Insurance: Knowledge Barriers, Risk Perception and Adverse Selection (No. 23918), NBER Working Paper Series.
- Bramer, W.M., Milic, J., Mast, F., 2017a. Reviewing retrieved references for inclusion in systematic reviews using EndNote. *J. Med. Libr. Assoc. JMLA* 105, 84. <https://doi.org/10.5195/jmla.2017.111>.
- Bramer, W.M., Rethlefsen, M.L., Kleijnen, J., Franco, O.H., 2017b. Optimal database combinations for literature searches in systematic reviews: a prospective exploratory study. *Syst. Rev.* 6, 245–256. <https://doi.org/10.1186/s13643-017-0644-y>.

- Brau, R., Bruni, M.L., 2008. Eliciting the demand for long-term care coverage: a discrete choice modelling analysis. *Health Econ.* 17, 411–433. <https://doi.org/10.1002/hec.1271>.
- Brau, R., Bruni, M.L., Pinna, A.M., 2010. Public versus private demand for covering long-term care expenditures. *Appl. Econ.* 42, 3651–3668. <https://doi.org/10.1080/00036840802167343>.
- Brown, J.R., 2007. Rational and behavioral perspectives on the role of annuities in retirement planning (No. 13537), NBER Working Paper Series.
- Brown, J.R., 2001. Private pensions, mortality risk, and the decision to annuitize. *J. Public Econ.* 82, 29–62. [https://doi.org/10.1016/S0047-2727\(00\)00152-3](https://doi.org/10.1016/S0047-2727(00)00152-3).
- Brown, J.R., Casey, M.D., Mitchell, O.S., 2007. Who Values the Social Security Annuity? New Evidence on the Annuity Puzzle (No. NB07-02), NBER Paper Series.
- Brown, J.R., Coe, N.B., Finkelstein, A., 2007b. Medicaid crowd-out of private long-term care insurance demand: evidence from the health and retirement survey. *Tax Policy Econ.* 21, 1–34. <https://doi.org/10.3386/w12536>.
- Brown, J.R., Finkelstein, A., 2007. Why is the market for long-term care insurance so small? *J. Public Econ.* 91 (10), 1967–1991. <https://doi.org/10.1016/j.jpubeco.2007.02.010>.
- Brown, J.R., Finkelstein, A., 2008. The interaction of public and private insurance: medicaid and the long-term care insurance market. *Am. Econ. Rev.* 98, 1083–1102. <https://doi.org/10.1257/aer.98.3.1083>.
- Brown, J.R., Goda, G.S., McGarry, K., 2012. Long-term care insurance demand limited by beliefs about needs, concerns about insurers, and care available from family. *Health Aff.* 31, 1294–1302. <https://doi.org/10.1377/hlthaff.2011.1307>.
- Brown, J.R., Kapteyn, A., Luttmer, E.F.P., Mitchell, O.S., 2017a. Cognitive constraints on valuing annuities. *J. Eur. Econ. Assoc.* 15, 429–462. <https://doi.org/10.1093/jea/jvw009>.
- Brown, J.R., Kapteyn, A., Luttmer, E.F.P., Mitchell, O.S., Samek, A., 2017. Behavioral Impediments to Valuing Annuities: Evidence on the Effects of Complexity and Choice Bracketing (No. 24101), NBER Working Paper Series.
- Brown, J.R., Kling, J.R., Mullainathan, S., Wrobel, M. V., 2013. Framing Lifetime Income (No. 19063), NBER Working Paper Series.
- Brown, J.R., Kling, J.R., Mullainathan, S., Wrobel, M.V., 2008. Why don't people insure late-life consumption? A framing explanation of the under-annuitization puzzle. *Am. Econ. Rev.* 98, 304–309. <https://doi.org/10.1257/aer.98.2.304>.
- Brown, J.R., Poterba, J.M., 2000. Joint life annuities and annuity demand by married couples. *J. Risk Insur.* 67, 527. <https://doi.org/10.2307/253849>.
- Brown, J.R., Previtero, A., 2014. Procrastination, Present-Biased Preferences, and Financial Behaviors (No. NB 14-04), NBER Retirement Research Center Paper.
- Browne, M.J., Zhou-Richter, T., 2014. Lemons or Cherries? Asymmetric information in the German private long-term care insurance market. *Geneva Pap. Risk Insur. Issues Pract.* 39, 603–624. <https://doi.org/10.1057/gpp.2014.25>.
- Bütler, M., Staubli, S., Zito, M.G., 2013. How much does annuity demand react to a large price change? *Scand. J. Econ.* 115, 808–824. <https://doi.org/10.1111/sjoe.12022>.
- Bütler, M., Teppa, F., 2007. The choice between an annuity and a lump sum: results from Swiss pension funds. *J. Public Econ.* 91, 1944–1966. <https://doi.org/10.1016/j.jpubeco.2007.09.003>.
- Cannon, E., Tonks, I., Yuille, R., 2016. The effect of the reforms to compulsion on annuity demand. *Natl. Inst. Econ. Rev.* 237, R47–R54. <https://doi.org/10.1177/002795011623700116>.
- Cappelletti, G., Guazzarotti, G., Tommasino, P., 2013. What determines annuity demand at retirement? *Geneva Pap. Risk Insur. Issues Pract.* 38, 777–802. <https://doi.org/10.1057/gpp.2012.43>.
- Caro, F.G., Porell, F.W., Kwan, N., 2011. Expectancies and ownership of long-term care insurance policies among older married couples. *J. Appl. Gerontol.* 30, 562–586. <https://doi.org/10.1177/0733464810376374>.
- Carrns, A., 2014. Long-term care insurance priced by gender. *New York Times*.
- Chalmers, J., Reuter, J., 2012. How do retirees value life annuities? Evidence from public employees. *Rev. Financ. Stud.* 25, 2601–2634. <https://doi.org/10.1093/rfs/hhs057>.
- Charupatt, N., Milevsky, M.A., 2001. Mortality swaps and tax arbitrage in the Canadian insurance and annuity markets. *J. Risk Insur.* 68, 277–302. <https://doi.org/10.2307/2678103>.
- Chatterjee, S., Fan, L., 2017. Household demand for private long term care insurance: an exploratory note. *Econ. Bull.* 37, 1975–1981.
- Chou, K.L., Inkmann, J., Van Kippersluis, H., Chan, W.-S., 2016. Assessing the Demand for Annuities in an Undeveloped Market Evidence from Hong Kong (No. DP 07/2016-023), Netspar Discussion Paper Series.
- Clark, R.L., Morrill, M.S., Vanderweide, D., 2014. Defined benefit pension plan distribution decisions by public sector employees. *J. Public Econ.* 116, 73–88. <https://doi.org/10.1016/j.jpubeco.2013.05.005>.
- Coe, N.B., Goda, G.S., Van Houtven, C.H., 2015. Family Spillovers of Long-Term Care Insurance (No. 21483), NBER Working Paper Series.
- Coe, N.B., Skira, M.M., Van Houtven, C.H., 2015b. Long-term care insurance: does experience matter? *J. Health Econ.* 40, 122–131. <https://doi.org/10.1016/j.jhealeco.2015.01.001>.
- Cornell, P.Y., Grabowski, D.C., 2018. The impact of policy incentives on long-term care insurance and medicaid costs: does underwriting matter? *Health Serv. Res.* 53, 3728–3749. <https://doi.org/10.1111/1475-6773.12870>.
- Cornell, P.Y., Grabowski, D.C., Cohen, M.A., Shi, X., Stevenson, D.G., 2016. Medical underwriting in long-term care insurance: market conditions limit options for higher-risk consumers. *Health Aff.* 35, 1494–1503. <https://doi.org/10.1377/hlthaff.2015.1133>.
- Costa-Font, J., Font, M., 2009. Does “early purchase” improve the willingness to pay for long-term care insurance? *Appl. Econ. Lett.* 16, 1301–1305. <https://doi.org/10.1080/13504850701720171>.
- Costa-Font, J., Rovira-Forns, J., 2008. Who is willing to pay for long-term care insurance in Catalonia? *Health Policy (New York)* 86, 72–84. <https://doi.org/10.1016/j.healthpol.2007.09.011>.
- Courbage, C., Roudaut, N., 2008. Empirical evidence on long-term care insurance purchase in France. *Geneva Pap. Risk Insur. Issues Pract.* 33, 645–658. <https://doi.org/10.1057/gpp.2008.30>.
- Courtemanche, C., He, D., 2009. Tax incentives and the decision to purchase long-term care insurance. *J. Public Econ.* 93, 296–310. <https://doi.org/10.1016/j.jpubeco.2008.05.007>.
- Cramer, A.T., Jensen, G.A., 2006. Why don't people buy long-term-care insurance? *J. Gerontol. Ser. B Psychol. Sci. Soc. Sci.* 61, S185–S193. <https://doi.org/10.1093/geronb/61.4.S185>.
- Curry, L.A., Robison, J., Shugrue, N., Keenan, P., Kapp, M.B., 2009. Individual decision making in the non-purchase of long-term care insurance. *Gerontologist* 49, 560–569. <https://doi.org/10.1093/geront/49.3.560>.
- Cutler, D.M., Finkelstein, A., McGarry, K., 2008. Preference heterogeneity and insurance markets: explaining a puzzle of insurance. *Am. Econ. Rev.* 98, 157–162. <https://doi.org/10.1257/aer.98.2.157>.
- Davidoff, T., 2010. Home equity commitment and long-term care insurance demand. *J. Public Econ.* 94, 44–49. <https://doi.org/10.1016/j.jpubeco.2009.09.006>.
- Davidoff, T., 2009. Housing, health, and annuities. *J. Risk Insur.* 76, 31–52. <https://doi.org/10.1111/j.1539-6975.2009.01287.x>.
- Davidoff, T., Brown, J.R., Diamond, P.A., 2005. Annuities and individual welfare. *Am. Econ. Rev.* 95, 1573–1590. <https://doi.org/10.1257/000282805775014281>.
- De Donder, P., Leroux, M.-L., 2014. Behavioral biases and long-term care insurance: a political economy approach. *B.E. J. Econ. Anal. Policy* 14, 551–575. <https://doi.org/10.1515/bejap-2012-0074>.
- De Donder, P., Pestieau, P., 2017. Private, social, and self-insurance for long-term care in the presence of family help. *J. Public Econ. Theory* 19, 18–37. <https://doi.org/10.1111/jpet.12163>.
- Di Giacinto, M., Vigna, E., 2012. On the sub-optimality cost of immediate annuitization in DC pension funds. *Cent. Eur. J. Oper. Res.* 20, 497–527. <https://doi.org/10.1007/s10100-011-0221-8>.
- Doeringhaus, H.I., Gustavson, S.G., 2002. Long-term care insurance purchase patterns. *Risk Manage. Insur. Rev.* 5, 31–43. <https://doi.org/10.1111/1098-1616.00008>.
- Doty, P., Nadash, P., Racco, N., 2015. Long-term care financing: lessons from France. *Milbank Q.* 93, 359–391. <https://doi.org/10.1111/1468-0009.12125>.
- Doyle, S., Mitchell, O.S., Piggott, J., 2004. Annuity values in defined contribution retirement systems: Australia and Singapore compared. *Aust. Econ. Rev.* 37, 402–416. <https://doi.org/10.1111/j.1467-8462.2004.00341.x>.
- Dus, I., Maurer, R.H., Mitchell, O.S., 2005. Betting on death and capital markets in retirement: a shortfall risk analysis of life annuities versus phased withdrawal plans. *Financ. Serv. Rev.* 14, 169–196.
- Eling, M., Ghavibazoo, O., 2019. Research on long-term care insurance: status quo and directions for future research. *Geneva Pap. Risk Insur. - Issues Pract.* 44, 303–356. <https://doi.org/10.1057/s41288-018-00114-6>.
- European Union, 2004. Implementing the principle of equal treatment between men and women in the access to and supply of goods and services (Directive 2004/113/EC).
- Fabel, O., 1996. Institutional change, the demand for LTC insurance, and savings. *Finanz./Public Financ. Anal.* 53, 582–605.
- Finkelstein, A., Luttmer, E.F.P., Notowidigdo, M.J., 2013. What good is wealth without health? The effect of health on the marginal utility of consumption. *J. Eur. Econ. Assoc.* 11, 221–258. <https://doi.org/10.1111/j.1542-4774.2012.01101.x>.
- Finkelstein, A., Luttmer, E.F.P., Notowidigdo, M.J., 2009. Approaches to estimating the health state dependence of the utility function. *Am. Econ. Rev.* 99, 116–121. <https://doi.org/10.1257/aer.99.2.116>.
- Finkelstein, A., McGarry, K., 2006. Multiple dimensions of private information: evidence from the long-term care insurance market. *Am. Econ. Rev.* 96, 938–958. <https://doi.org/10.1257/aer.96.4.938>.
- Finkelstein, A., McGarry, K., Sufi, A., 2005. Dynamic inefficiencies in insurance markets: evidence from long-term care insurance. *Am. Econ. Rev.* 95, 224–228. <https://doi.org/10.1257/000282805774669808>.
- Finkelstein, A., Poterba, J.M., 2002. Selection effects in the United Kingdom individual annuities market. *Econ. J.* 112, 28–50. <https://doi.org/10.1111/1468-0297.0j672>.
- Friedberg, L., Hou, W., Sun, W., Webb, A., 2017. Lapses in long-term care insurance (No. DP 08/2017-030), Netspar Discussion Paper Series.
- Friedberg, L., Sun, W., Webb, A., 2014. Medicaid and Crowd-Out of Long-Term Care Insurance (No. DP 10/2014-100), Netspar Discussion Paper Series.
- Friedman, B.M., Marshawsky, M.J., 1990. The cost of annuities: implications for saving behavior and bequests. *Q. J. Econ.* 105, 135. <https://doi.org/10.2307/2937822>.
- Gan, L., Huang, F., Mayer, A., 2015. A simple test for private information in insurance markets with heterogeneous insurance demand. *Econ. Lett.* 136, 197–200. <https://doi.org/10.1016/j.econlet.2015.09.039>.
- Goda, G.S., 2011. The impact of state tax subsidies for private long-term care insurance on coverage and Medicaid expenditures. *J. Public Econ.* 95, 744–757. <https://doi.org/10.1016/j.jpubeco.2010.11.001>.
- Gottlieb, D., Mitchell, O.S., 2015. Narrow Framing and Long-Term Care Insurance (No. 21048), NBER Working Paper Series.
- Gousia, K., 2016. Financial literacy and long-term care insurance coverage (No. 26–2016), SHARE Working Paper Series.
- Guillemette, M.A., Martin, T.K., Cummings, B.F., James, R.N., 2016. Determinants of the stated probability of purchase for longevity insurance. *Geneva Pap. Risk Insur. Issues Pract.* 41, 4–23. <https://doi.org/10.1057/gpp.2015.26>.
- Gupta, A., Li, Z., 2013. Optimal annuity purchase decisions under uncertain lifetime. *J. Fam. Econ. Issues* 34, 447–459. <https://doi.org/10.1007/s10834-012-9340-1>.
- Hagen, J., 2015. The determinants of annuitization: evidence from Sweden. *Int. Tax Public Financ.* 22, 549–578. <https://doi.org/10.1007/s10797-015-9360-5>.

- Hainaut, D., Devolder, P., 2006. Life annuitization: why and how much? *ASTIN Bull.* 36, 629–654. <https://doi.org/10.2143/AST.36.2.2017936>.
- Hanewald, K., Piggott, J., Sherris, M., 2013. Individual post-retirement longevity risk management under systematic mortality risk. *Insur. Math. Econ.* 52, 87–97. <https://doi.org/10.1016/j.insmatheco.2012.11.002>.
- He, A.J., Chou, K.L., 2018. What affects the demand for long-term care insurance? A study of middle-aged and older adults in Hong Kong. *J. Appl. Gerontol.* 1–20. <https://doi.org/10.1177/0733464818766598>.
- Heijdra, B.J., Jiang, Y., Mierau, J.O., 2015. Non-annuitization in the Annuity Market (No. DP 10/2015-066), Netspar Discussion Paper Series.
- Higgins, J.P.T., Green, S., 2011. *Cochrane Handbook for Systematic Reviews of Interventions*.
- Horneff, W.J., Maurer, R.H., Mitchell, O.S., Dus, I., 2008a. Following the rules: Integrating asset allocation and annuitization in retirement portfolios. *Insur. Math. Econ.* 42, 396–408. <https://doi.org/10.1016/j.insmatheco.2007.04.004>.
- Horneff, W.J., Maurer, R.H., Stamos, M.Z., 2008b. Life-cycle asset allocation with annuity markets. *J. Econ. Dyn. Control* 32, 3590–3612. <https://doi.org/10.1016/j.jedc.2008.01.007>.
- Hurd, M., Panis, C., 2006. The choice to cash out pension rights at job change or retirement. *J. Public Econ.* 90, 2213–2227. <https://doi.org/10.1016/j.jpubeco.2006.06.007>.
- Hurwitz, A., Sade, O., 2017. An Investigation of Time Preferences, Life Expectancy and Annuity versus Lump-Sum Choices: Can Smoking Harm Your Long-Term Saving Decisions? (No. DP 06/2017-026), Netspar Discussion Paper Series.
- Inkmann, J., Lopes, P., Michaelides, A., 2011. How deep is the annuity market participation puzzle? *Rev. Financ. Stud.* 24, 279–319. <https://doi.org/10.1093/rfs/hhq080>.
- Iwasaki, M., McCurry, S.M., Borson, S., Jones, J.A., 2010. The future of financing for long-term care: the own your future campaign. *J. Aging Soc. Policy* 22, 379–393. <https://doi.org/10.1080/08959420.2010.507584>.
- Jiménez-Martín, S., Labeaga-Azcona, J.M., Vilaplana-Prieto, C., 2016. Interactions between private health and long-term care insurance and the effects of the crisis: evidence for Spain. *Health Econ.* 25, 159–179. <https://doi.org/10.1002/hec.3440>.
- Kennedy, J., Gimm, G., Glazier, R., 2016. After CLASS - Is a voluntary public insurance program a realistic way to meet the long-term support and service needs of adults with disabilities? *Disabil. Health J.* 9, 197–200. <https://doi.org/10.1016/j.dhjo.2015.10.008>.
- Kingston, G., Thorp, S., 2005. Annuitization and asset allocation with HARA utility. *J. Pension Econ. Financ.* 4, 225–248. <https://doi.org/10.1017/S1474747205002088>.
- Kitajima, T., 1999. Willingness to pay for longterm care insurance system in a municipality in Tokyo. *Asia-Pacific J. Public Heal.* 11, 101–108. <https://doi.org/10.1177/101053959901100209>.
- Knoller, C., 2016. Multiple reference points and the demand for principal-protected life annuities: an experimental analysis. *J. Risk Insur.* 83, 163–179. <https://doi.org/10.1111/jori.12101>.
- Knoller, C., Kraut, G., Schoenmakers, P., 2016. On the propensity to surrender a variable annuity contract: an empirical analysis of dynamic policyholder behavior. *J. Risk Insur.* 83, 979–1006. <https://doi.org/10.1111/jori.12076>.
- Konetzka, R.T., Luo, Y., 2011. Explaining lapse in long-term care insurance markets. *Health Econ.* 20, 1169–1183. <https://doi.org/10.1002/hec.1661>.
- Kotlikoff, L.J., Spivak, A., 1981. The family as an incomplete annuities market. *J. Polit. Econ.* 89, 372–391. <https://doi.org/10.1086/260970>.
- Kumar, N., Cohen, M.A., Bishop, C.E., Wallack, S.S., 1995. Understanding the factors behind the decision to purchase varying coverage amounts of long-term care insurance. *Health Serv. Res.* 29, 653–678.
- Kunreuther, H.C., Pauly, M.V., Mc Morrow, S., 2012. In: *Insurance and Behavioral Economics*. Cambridge University Press, Cambridge. <https://doi.org/10.1017/CBO9781139050319>.
- Lee, K., 2016. Analysis of payout choice from individual deferred annuities in Korea. *J. Pension Econ. Financ.* 15, 224–248. <https://doi.org/10.1017/S1474747214000183>.
- Li, Y., Jensen, G.A., 2012. Why do people let their long-term care insurance lapse? Evidence from the health and retirement study. *Appl. Econ. Perspect. Policy* 34, 220–237. <https://doi.org/10.1093/aep/paps017>.
- Lin, H., Prince, J.T., 2016. Determinants of private long-term care insurance purchase in response to the partnership program. *Health Serv. Res.* 51, 687–703. <https://doi.org/10.1111/1475-6773.12353>.
- Lin, H., Prince, J.T., 2013. The impact of the partnership long-term care insurance program on private coverage. *J. Health Econ.* 32, 1205–1213. <https://doi.org/10.1016/j.jhealeco.2013.09.010>.
- Lockwood, L.M., 2014. Incidental Bequests and the Choice to Self-Insure Late-Life Risks (No. 20745), NBER Working Paper Series.
- Lockwood, L.M., 2012. Bequest motives and the annuity puzzle. *Rev. Econ. Dyn.* 15, 226–243. <https://doi.org/10.1016/j.red.2011.03.001>.
- Lutzy, S., Alexih, L.M.B., 1999. Enabling informed consumer choice in the long-term care insurance market. *J. Aging Soc. Policy* 10, 27–44. https://doi.org/10.1300/J031v10n03_03.
- Ma, G., Sun, W., 2017. Can catastrophic long-term care insurance policies increase private insurance coverage and reduce Medicaid expenditure? *B. E. J. Econ. Anal. Policy* 17. <https://doi.org/10.1515/bejeap-2016-0243>.
- McCall, N., Mangle, S., Bauer, E., Knickman, J., 1998. Factors important in the purchase of partnership long-term care insurance. *Health Serv. Res.* 33, 187–203.
- McGarry, B.E., Temkin-Greener, H., Chapman, B.P., Grabowski, D.C., Li, Y., 2016. The impact of consumer numeracy on the purchase of long-term care insurance. *Health Serv. Res.* 51, 1612–1631. <https://doi.org/10.1111/1475-6773.12439>.
- McGarry, B.E., Temkin-Greener, H., Grabowski, D.C., Chapman, B.P., Li, Y., 2018. Consumer decision-making abilities and long-term care insurance purchase. *J. Gerontol. – Ser. B Psychol. Sci. Soc. Sci.* 73, e1–e10. <https://doi.org/10.1093/geronb/gbx059>.
- McGarry, B.E., Temkin-Greener, H., Li, Y., 2014. Role of race and ethnicity in private long-term care insurance ownership. *Gerontologist* 54, 1001–1012. <https://doi.org/10.1093/geront/gnt102>.
- McNamara, P.E., Lee, N., 2004. Long-term care insurance policy dropping in the U.S. from 1996 to 2000: evidence and implications for long-term care financing. *Geneva Pap. Risk Insur. Issues Pract.* 29, 640–651. <https://doi.org/10.1111/j.1468-0440.2004.00307.x>.
- Meier, V., 1999. Why the young do not buy long-term care insurance. *J. Risk Uncertain.* 18, 83–98. <https://doi.org/10.1023/A:1007716528284>.
- Meier, V., 1998. Long-term care insurance and life insurance demand. *Geneva Pap. Risk Insur. Theory* 23, 49–61. <https://doi.org/10.1023/A:1008630030725>.
- Mellor, J.M., 2001. Long-term care and nursing home coverage: are adult children substitutes for insurance policies? *J. Health Econ.* 20, 527–547. [https://doi.org/10.1016/S0167-6296\(01\)00078-9](https://doi.org/10.1016/S0167-6296(01)00078-9).
- Mellor, J.M., 2000. Private long-term care insurance and the asset protection motive. *Gerontologist* 40, 596–604. <https://doi.org/10.1093/geront/40.5.596>.
- Milevsky, M.A., 1998. Optimal asset allocation towards the end of the life cycle: to annuitize or not to annuitize? *J. Risk Insur.* 65, 401. <https://doi.org/10.2307/253657>.
- Milevsky, M.A., Young, V.R., 2007a. The timing of annuitization: investment dominance and mortality risk. *Insur. Math. Econ.* 40, 135–144. <https://doi.org/10.1016/j.insmatheco.2006.03.005>.
- Milevsky, M.A., Young, V.R., 2007b. Annuitization and asset allocation. *J. Econ. Dyn. Control* 31, 3138–3177. <https://doi.org/10.1016/j.jedc.2006.11.003>.
- Mitchell, O.S., Poterba, J.M., Warshawsky, M.J., Brown, J.R., 1999. New evidence on the money's worth of individual annuities. *Am. Econ. Rev.* 89, 1299–1318. <https://doi.org/10.1257/aer.89.5.1299>.
- Modigliani, F., 1986. Life cycle, individual thrift, and the wealth of nations. *Am. Econ. Rev.* 76, 297–313.
- Murtaugh, C.M., Spillman, B.C., Warshawsky, M.J., 2001. In sickness and in health: an annuity approach to financing long-term care and retirement income. *J. Risk Insur.* 68, 225. <https://doi.org/10.2307/2678101>.
- National Association of Insurance Commissioners, 2016. *The State of Long-Term Care Insurance: The Market, Challenges and Future Innovations*. Washington, DC.
- Nixon, D.C., 2014. State tax subsidies to bolster the long-term care insurance market. *J. Public Policy* 34, 415–436. <https://doi.org/10.1017/S0143814X14000178>.
- Nosi, C., D'Agostino, A., Pagliuca, M., Pratesi, C.A., 2017. Securing retirement at a young age. Exploring the intention to buy longevity annuities through an extended version of the Theory of Planned Behavior. *Sustain.* 9. <https://doi.org/10.3390/su9061069>.
- Oster, E., Shoulson, I., Quaid, K., Dorsey, E.R., 2010. Genetic adverse selection: evidence from long-term care insurance and Huntington disease. *J. Public Econ.* 94, 1041–1050. <https://doi.org/10.1016/j.jpubeco.2010.06.009>.
- Pang, G., Warshawsky, M.J., 2008. Optimizing the Equity-Bond-Annuity Portfolio in Retirement: The Impact of Uncertain Health Expenses (No. WP2008-05), PRC Working Paper Series.
- Pashchenko, S., 2013. Accounting for non-annuitization. *J. Public Econ.* 98, 53–67. <https://doi.org/10.1016/j.jpubeco.2012.11.005>.
- Pauly, M.V., 1990. The rational nonpurchase of long-term-care insurance. *J. Polit. Econ.* 98, 153–168. <https://doi.org/10.1086/261673>.
- Payne, J.W., Sagara, N., Shu, S.B., Appelt, K.C., Johnson, E.J., 2013. Life expectancy as a constructed belief: evidence of a live-to or die-by framing effect. *J. Risk Uncertain.* 46, 27–50. <https://doi.org/10.1007/s11166-012-9158-0>.
- Peijnenburg, K., Nijman, T., Werker, B.J.M., 2017. Health cost risk: a potential solution to the annuity puzzle. *Econ. J.* 127, 1598–1625. <https://doi.org/10.1111/ecoj.12354>.
- Pestieau, P., Ponthière, P., 2012. Long-term care insurance Puzzle, in: Costa-Font, J., Courbage, C. (Eds.), *Financing Long-Term Care in Europe*. Palgrave Macmillan, London, pp. 44–52.
- Pfarr, C., Schneider, U., 2013. Choosing between subsidized or unsubsidized private pension schemes: evidence from German panel data. *J. Pension Econ. Financ.* 12, 62–91. <https://doi.org/10.1017/S1474747212000170>.
- Pincus, J., Hopewood, K., Mills, R., 2017. Framing the decision to buy long-term care insurance: losses and gains in the context of statistical and narrative evidence. *J. Financ. Serv. Mark.* 22, 33–40. <https://doi.org/10.1057/s41264-017-0019-4>.
- Pinquet, J., Guillén, M., Ayuso, M., 2011. Commitment and lapse behavior in long-term insurance: a case study. *J. Risk Insur.* 78, 983–1002. <https://doi.org/10.1111/j.1539-6975.2011.01420.x>.
- Previtera, A., 2014. Stock market returns and annuitization. *J. Financ. Econ.* 113, 202–214. <https://doi.org/10.1016/j.jfineco.2014.04.006>.
- Purcal, S., Piggott, J., 2008. Explaining low annuity demand: an optimal portfolio application to Japan. *J. Risk Insur.* 75, 493–516. <https://doi.org/10.1111/j.1539-6975.2008.00269.x>.
- Reichling, F., Smetters, K., 2015. Optimal annuitization with stochastic mortality and correlated medical costs. *Am. Econ. Rev.* 105, 3273–3320. <https://doi.org/10.1257/aer.20131584>.
- Rothgang, H., 2010. Social insurance for long-term care: an evaluation of the German model. *Soc. Policy Adm.* 44, 436–460. <https://doi.org/10.1111/j.1467-9515.2010.00722.x>.
- Rusconi, R., 2008. National annuity markets: features and implications (No. 24), OECD Working Papers on Insurance and Private Pensions.
- Schaber, P.L., Stum, M.S., 2007. Factors impacting group long-term care insurance enrollment decisions. *J. Fam. Econ. Issues* 28, 189–205. <https://doi.org/10.1007/s10834-007-9062-y>.
- Schmeiser, H., Post, T., 2005. Life annuity insurance versus self-annuitization: an analysis from the perspective of the family. *Risk Manage. A. Insur. Rev.* 8, 239–255. <https://doi.org/10.1111/j.1540-6296.2005.00058.x>.
- Schooley-Pettis, D.K., Worden, D.D., 2013. Accumulating and spending retirement assets:

- a behavioral finance explanation. *Financ. Serv. Rev.* 22, 173–186.
- Schreiber, P., Weber, M., 2016. Time inconsistent preferences and the annuitization decision. *J. Econ. Behav. Organ.* 129, 37–55. <https://doi.org/10.1016/j.jebo.2016.06.008>.
- Schünemann, H., Brožek, J., Guyatt, G., Oxman, A., 2013. GRADE handbook for grading quality of evidence and strength of recommendations.
- Scott, J.S., Watson, J.G., Hu, W.Y., 2011. What makes a better annuity? *J. Risk Insur.* 78, 213–244. <https://doi.org/10.1111/j.1539-6975.2010.01381.x>.
- Shao, A.W., Chen, H., Sherris, M., 2017. To Borrow or Insure? Long Term Care Costs and the Impact of Housing (No. 11), CEPAR Working Paper Series.
- Sheshinsky, E., 2010. Refundable annuities (Annuity Options). *J. Public Econ. Theory* 12, 7–21. <https://doi.org/10.1111/j.1467-9779.2009.01444.x>.
- Shu, S.B., Zeithammer, R., Payne, J.W., 2018. The Pivotal Role of Fairness: Which Consumers Like Annuities? (No. 25067), NBER Working Paper Series.
- Sloan, F.A., Norton, E.C., 1997. Adverse selection, bequests, crowding out, and private demand for insurance: evidence from the long-term care insurance market. *J. Risk Uncertain.* 15, 201–219. <https://doi.org/10.1023/A:1007749008635>.
- Sperber, N.R., Voils, C.I., Coe, N.B., Konetzka, R.T., Boles, J., Van Houtven, C.H., Bowers, B.J., 2017. How can adult children influence parents' long-term care insurance purchase decisions? *Gerontologist* 57, 292–299. <https://doi.org/10.1093/geront/gnu082>.
- Stabile, G., 2006. Optimal timing of the annuity purchase: combines stochastic control and optimal stopping problem. *Int. J. Theor. Appl. Financ.* 09, 151–170. <https://doi.org/10.1142/S0219024906003524>.
- Stamos, M.Z., 2008. Optimal consumption and portfolio choice for pooled annuity funds. *Insur. Math. Econ.* 43, 56–68. <https://doi.org/10.1016/j.insmatheco.2007.09.010>.
- Stevenson, D.G., Frank, R.G., Tau, J., 2009. Private long-term care insurance and state tax incentives. *Inquiry* 46, 305–321. <https://doi.org/10.5034/inquiryjrn1.46.03.305>.
- Stum, M.S., 2008. Group long-term care insurance: decision-making factors and implications for financing long-term care. *J. Aging Soc. Policy* 20, 165–181. <https://doi.org/10.1080/08959420801977533>.
- Sun, W., Webb, A., 2013. Can Long-Term Care Insurance Partnership Programs Increase Coverage and Reduce Medicaid Costs? (No. DP 03/2013-063), Netspar Discussion Paper Series.
- Swamy, N., 2004. The importance of employer-sponsorship in the long-term care insurance market. *J. Aging Soc. Policy* 16, 67–84. https://doi.org/10.1300/J031v16n02_05.
- Swiss Re, 2014. How will we care? Finding sustainable long-term care solutions for an ageing world (No. 5), Sigma Report.
- Tennyson, S., Yang, H.K., 2014. The role of life experience in long-term care insurance decisions. *J. Econ. Psychol.* 42, 175–188. <https://doi.org/10.1016/j.joep.2014.04.002>.
- Teppa, F., 2011. Can the Longevity Risk Alleviate the Annuitization Puzzle? Empirical Evidence from Dutch Data (No. DP 09/2011-075), Netspar Discussion Paper Series.
- Unruh, M.A., Stevenson, D.G., Frank, R.G., Cohen, M.A., Grabowski, D.C., 2016. Demand-side factors associated with the purchase of long-term care insurance. *Forum Heal. Econ. Policy* 19, 23–43. <https://doi.org/10.1515/fhep-2014-0020>.
- Van der Cruysen, C., Jonker, N., 2016. Flat annuities or flexible pension schemes : the influence of expected expenses and (dis)trust in pension funds (No. DP 08/2016-049), Netspar Discussion Paper Series.
- Van Houtven, C.H., Coe, N.B., Konetzka, R.T., 2015. Family structure and long-term care insurance purchase. *Health Econ.* 24, 58–73. <https://doi.org/10.1002/hec.3145>.
- Vidal-Meliá, C., Lejárraga-García, A., 2006. Demand for life annuities from married couples with a bequest motive. *J. Pension Econ. Financ.* 5, 197. <https://doi.org/10.1017/S1474747205002349>.
- Vidal-Meliá, C., Lejárraga-García, A., 2004. The bequest motive and single people's demand for life annuities. *Belgian Actuar. Bull.* 4, 5–18.
- Walliser, J., 2000. Adverse selection in the annuities market and the impact of privatizing social security. *Scand. J. Econ.* 102, 373–393. <https://doi.org/10.1111/1467-9442.00206>.
- [dataset] World Bank, 2018. World Bank list of economies (June 2018). Retrieved from: <http://databank.worldbank.org/data/download/site-content/CLASS.xls>.
- Wu, S., Bateman, H., Stevens, R., Thorp, S., 2018. Reducing the under-insurance puzzle by product design: Experimental evidence of life care annuity demand (No. 2018/2), Cepar Working Paper Series.
- Wu, S., Bateman, H., Stevens, R., Thorp, S., 2017. Income-indemnity long-term care insurance: Selection, informal care, and precautionary savings (No. 08), CEPAR Working Paper Series.
- Wuppermann, A.C., 2017. Private information in life insurance, annuity, and health insurance markets. *Scand. J. Econ.* 119, 855–881. <https://doi.org/10.1111/sjoe.12189>.
- Yaari, M.E., 1965. Uncertain lifetime, life insurance, and the theory of the consumer. *Rev. Econ. Stud.* 32, 137. <https://doi.org/10.2307/2296058>.
- Zhao, K., 2015. The impact of the correlation between health expenditure and survival probability on the demand for insurance. *Eur. Econ. Rev.* 75, 98–111. <https://doi.org/10.1016/j.eurocorev.2015.01.003>.
- Zhou-Richter, T., Browne, M.J., Gründl, H., 2010. Don't they care? or, are they just unaware? Risk perception and the demand for long-term care insurance. *J. Risk Insur.* 77, 715–747. <https://doi.org/10.1111/j.1539-6975.2010.01362.x>.
- Zhou-Richter, T., Gründl, H., 2011. Life care annuities-trick or treat for insurance companies? (No. 1856994), SSRN Working Papers.
- Ziegelmeier, M., Nick, J., 2013. Backing out of private pension provision: lessons from Germany. *Empirica* 40, 505–539. <https://doi.org/10.1007/s10663-013-9220-4>.
- Zweifel, P., Strüwe, W., 1998. Long-term care insurance in a two-generation model. *J. Risk Insur.* 65, 13. <https://doi.org/10.2307/253489>.
- Zweifel, P., Strüwe, W., 1996. Long-term care insurance and bequests as instruments for shaping intergenerational relationships. *J. Risk Uncertain.* 12, 65–76. <https://doi.org/10.1007/BF00353331>.