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A systematic review of the reasons for low uptake of long-term care insurance and life annuities: Could integrated products counter them?

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A systematic review of the reasons for low uptake of long-term care insurance and life annuities: Could integrated products counter them?

With aging populations, the role of private insurance in financing long-term care and longevity risks is likely to grow in developed countries. Nonetheless, the demand for long-term care insurance (LTCI) and life annuities (hereafter annuities) is very limited and lags behind economic projections. A recurrent explanation holds that adverse selection dampens insurance demand. Integrating these products in a life care annuity (LCA) may effectively mitigate such adverse selection. In this Netspar Survey Paper we first analyze which factors impact the demand for LTCI and annuities. Next, we discuss whether LCAs can indeed increase insurance uptake. To do so, we systematically review the large and growing body of theoretical and empirical literature that analyzes LTCI and annuity uptake.

Our results show that similar factors hinder the uptake of both LTCI and annuities. Specifically, we find that uptake is lowered not only by adverse selection, but also by substitution, nonstandard preferences, and limited rationality. Moreover, these factors may also explain why uptake is concentrated among wealthier and subjectively healthier individuals. 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 will likely continue to be concentrated among wealthier and subjectively healthier individuals. However, when insurers are able to cater to country-specific demand-side traits of substitution and nonstandard preferences, this may well increase the uptake of both separate and integrated products.

The fact that uptake of private insurance is unequally distributed has important consequences for policymakers. Insofar 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, insofar as it reflects adverse selection or limited rationality, lower uptake is a product of underlying inequalities in health, longevity and financial literacy and may warrant policy interventions.

If the goal is to increase insurance uptake in private insurance markets, policymakers 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 can be achieved not only by policies that increase financial literacy, to provide for a better understanding of LTCI and annuity products, but also by making insurance decisions easier to comprehend. Second, risk

awareness increases insurance uptake; policymakers and insurers could thus focus on raising awareness of LTC and longevity risks. Particularly, governments should be clear as to the scope of social benefits and as to the contribution that is expected from citizens themselves. Third, since our results show that distrust of insurers additionally drives low uptake, regulation that protects insured persons by guaranteeing the payout of fair claims may help to increase uptake. Finally, evidence on the importance of perceptions, framing, and defaults suggests that these may provide effective means for increasing insurance uptake.

Samenvatting en beleidsaanbevelingen

Een systematisch overzicht van de redenen voor de lage verzekeringsgraad bij ouderenzorgverzekeringen en annuiteiten: kan een geïntegreerd product dit tegengaan?

Door de vergrijzing zal de rol van particuliere verzekeringen in de financiering van verzorgings- en langlevenrisico's in ontwikkelde landen waarschijnlijk toenemen. Toch is het aantal mensen dat zichzelf verzekert tegen de kosten van verzorging (*long-term care insurance* (LTCI)) of langleven (annuïteiten) zeer beperkt. Dit aantal blijft bovendien ver achter bij economische voorspellingen. Een terugkerende verklaring is dat adverse selectie de vraag naar deze verzekeringen dempt. Het integreren van deze twee verzekeringen in een *life-care annuity* (LCA) zou zulke adverse selectie kunnen verminderen. In dit Netspar Survey Paper onderzoeken we eerst welke factoren van invloed zijn op het bezit van LTCI en annuïteiten. Vervolgens bespreken we of LCA's deze vraag kunnen doen groeien. Hiervoor ontwikkelen we een systematisch overzicht van de bestaande wetenschappelijke literatuur naar het bezit van LTCI en annuïteiten.

Onze resultaten laten zien dat vergelijkbare factoren het bezit van zowel LTCI als annuïteiten belemmeren. Niet alleen wordt dit beperkt door adverse selectie, maar ook door substitutie, niet-standaard voorkeuren en beperkte rationaliteit. Bovendien kunnen deze factoren ook verklaren waarom het bezit geconcentreerd is bij mensen met een hoger vermogen en betere subjectieve gezondheid. Een geïntegreerd product − uitsluitend gericht op het oplossen van adverse selectieproblemen − zal deze andere factoren waarschijnlijk niet oplossen. Onze resultaten laten daarmee zien dat het bezit van geïntegreerde producten waarschijnlijk geconcentreerd zal blijven bij meer vermogende en subjectief gezondere mensen. Wanneer verzekeraars echter producten aanbieden die rekening houden met substitutie en niet-standaard voorkeuren, kan dit de vraag naar zowel afzonderlijke producten als geïntegreerde producten vergroten.

Het feit dat het bezit van deze verzekeringen op een vrije markt ongelijk verdeeld is, heeft belangrijke consequenties voor beleidsmakers. Voor zover verminderd bezit een gevolg is van verzekeringsvoorkeuren of substitutie door een sociaal vangnet, reflecteert het individuele voorkeuren en zijn er geen beleidsinterventies nodig. Voor zover verminderd bezit een gevolg is van adverse selectie of beperkte rationaliteit, reflecteert het echter de onderliggende ongelijkheid in gezondheid, levensduur of financiële geletterdheid. Beleidsinterventies kunnen nodig zijn om deze ongeli-jkheden te verminderen.

Als het doel is om het bezit van verzekeringen op particuliere verzekeringsmarkten te vergroten, kunnen beleidsmakers en verzekeraars verschillende stappen ondernemen om een meer inclusieve verzekeringsmarkt te creëren. Ten eerste moeten individuen met weinig financiële kennis in staat gesteld worden om verzekeringsbeslissingen te nemen. Dit kan niet alleen worden bereikt door de financiële geletterdheid te vergroten, en zo een beter begrip van LTCI en annuïteiten te creëren, maar ook door verzekeringsbeslissingen gemakkelijker te maken. Ten tweede vergroot risicobewustzijn verzekeringsbezit; beleidsmakers en verzekeraars zouden zich daarom kunnen richten op het vergroten van het bewustzijn van verzorgings- en langlevenrisico's. Overheden dienen daarbij vooral duidelijk te maken welke kosten zij zullen vergoeden en welke bijdrage van de burgers zelf wordt verwacht. Ten derde blijkt uit onze resultaten dat wantrouwen ten opzichte van verzekeraars leidt tot lager verzekeringsbezit. Regelgeving, die verzekerden beschermt door de uitbetaling van billijke verzekeringsaanspraken te garanderen, kan helpen dit wantrouwen weg te nemen en verzekeringsbezit te vergroten. Ten slotte suggereren onze resultaten dat *framing* en *defaults* effectief kunnen zijn in het vergroten van verzekeringsbezit.

1. Introduction

In the face of aging populations, many developed countries strive to ensure adequate elderly care and retirement income through public policies. The fiscal affordability of such policies, however, is at the same time impeded by this demographic trend. Consequently, the role of public policy in protecting against long-term care (LTC) and longevity risks remains small in countries where government involvement has traditionally been limited and is decreasing in countries that in the past had extensive public programs. As such, public benefits for LTC and longevity risks often provide a minimal safety net for those worst off, while others need to buy private insurance to cover those risks.

As such, the limited public programs and the considerable individual uncertainty about LTC and longevity risks provide a strong reason for taking out private insurance. Moreover, a market with limited government intervention should offer individuals a significant degree of freedom to divide resources and smooth consumption over their lifecycle. That is, one can purchase a preferred amount of insurance coverage at a preferred point in time, such as when income and wealth are high, to protect against depleting assets due to late-in-life risks when income is lower. In practice, however, private insurance against LTC and longevity risks lags behind economic projections. The uptake of long-term care insurance (LTCI) is much lower than predicted (Pestieau & Ponthière, 2012). Similarly, economic theory concludes 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, a broad body of 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 purchase enough of these products. We focus on demand side analyses and group this literature into four explanatory categories. First, people could have private information about their LTC and longevity risk that risk-rated insurance premiums do not control for. Then especially the worst risks adversely select into LTCI and annuities, driving up premiums and lowering demand (e.g., Sloan & Norton, 1997). Second, people could substitute for private insurance with public insurance or family help (e.g., Brown, Coe, & Finkelstein, 2007). Third, people could have different preferences than those assumed in expected utility models (e.g., Brown, Goda, & McGarry, 2012). Fourth, there could be behavioral aspects of these products – not reflected in expected utility evaluations – that impact uptake, such as financial literacy (e.g., Brown, 2007).

To counteract adverse selection, it has been proposed to merge both products into a single integrated life care annuity (LCA) that offers a stream of annuity income as from a certain age as well as LTC benefits when disabled (Murtaugh, Spillman, & Warshawsky, 2001). The rationale behind this is that an integrated product offers fewer opportunities for adverse selection, because both risks would be negatively associated.[1] Individuals with private information that they constitute a high LTC risk would have a low longevity risk and vice versa. Hence, such an integrated product could be sold at a lower price than the sum of the separate insurance products and could thus increase uptake.

Initial uptake of annuities combined with LTC riders is promising (NAIC, 2016). Still, these are different from integrated LCAs as such riders do not offer a double insurance against LTC and longevity risks but only advance annuity payments in case of LTC needs. It therefore remains to be seen whether LCAs can effectively resolve all demand-side problems that LTCI and annuities encounter. That is, assuming that LCAs indeed lead to less adverse selection, the impact of an integrated product on uptake may still be small if other demand-side problems are more important. Currently, we know of only one study (Wu, Bateman, Stevens, & Thorp, 2018) that has empirically analyzed the demand for LCAs directly.

To evaluate why uptake of LTCI and annuities is so low and to integrally assess the viability of LCAs, our paper provides an overview of all factors that impact LTCI and annuity purchase decisions. To date, only one review in the fast growing field of literature on LTCI extensively evaluates three major research areas (financing, demand, and insurability), by identifying the most significant paths in a citation network (Eling & Ghavibazoo, 2019). By contrast, our review provides a more in-depth analysis of the potential explanations for the low uptake of LTCI − including more than double the number of 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 summaries of previous results by employing our descriptive results to unravel the underlying reasons for low uptake. Fourth, based on the reasons for low uptake in both markets, we discuss the potential of integrated products to increase uptake.

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1   This has been disputed by Zhou-Richter & Gründl (2011). They argue that longevity risk and long-term care risk are positively correlated and that LCAs may therefore offer even more room for adverse selection.

Our paper continues as follows. Section 2 gives an overview of the main LTCI and annuity markets and products. Section 3 describes the state-of-the art method of our systematic review. In section 4 we integrate the findings of previous theoretical research. In section 5 we describe empirical findings and explain why uptake of LTCI and annuities is so low. In section 6 we discuss our findings as well as the potential of integrated products. Finally, our conclusion and recommendations follow in section 7.

2. Background

The uptake of private LTCI varies greatly from one country to the next, partly because there are large differences between public benefits schemes. Still, private LTCI markets do not necessarily thrive in countries with less beneficial schemes. In the US, for example, LTCI is the primary risk-sharing mechanism for many individuals since Medicaid – the public benefits scheme for long-term care – only provides a means-tested safety net for the lowest income groups. Nonetheless, the American LTCI market covers just a fraction of total LTC expenditures (Brown & 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 (e.g., Doty, Nadash, & Racco, 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 barebones policies, which do not come close to covering the costs of LTC and offer only limited relief from pressure on public expenditures. Nonetheless, such meagre policies are viewed to be more marketable. With public programs 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.

Table 1 provides an overview of typical American and French products, based on reports from the National Association of Insurance Commissioners (2016) and Fédération Française de l'Assurance (2018). In addition to differing in price and coverage, these products differ in three other important aspects. First, LTC insurers in the US follow relatively stringent federal guidelines to determine eligibility (Health Insurance

Table 1: Overview of average American and French LTCI policies in 2015 and 2017 respectively

	Average US policy in 2015	Average individual French policy in 2017
Annual price	€ 2,497 ($2,772)	€457
Type of benefits	Reimbursement	Cash
Benefits cap	€137 ($152) daily (home care) €143 ($159) daily (nursing home care)	€598 monthly
Inflation coverage	For 75% of all policies	For 75% of all policies[a]
Eligibility	≥ 2 ADL impediments or severe cognitive impairments	Based on ADL and/or IADL impediments
Waiting period	93 days	90 days

a In 2008 (Colombo, Llena-Nozal, Mercier, & Tjadens, 2011).

Portability and Accountability Act of 1996). This means that only when an individual fails to perform two or more activities of daily living (ADLs) – i.e., eating, bathing, dressing, walking, going to the toilet and maintaining personal hygiene – or suffers from severe cognitive impairments (such as dementia or Alzheimer's disease), benefits will be paid out. In France, eligibility is determined through ADLs as well as less stringent instrumental ADLs (e.g., ability to clean and maintain the house). Second, whereas American policies offer reimbursement of actual costs, French policies offer cash benefits that are independent of actual costs. Third, whereas American policies offer a lot of choice (e.g., in inflation protection or waiting period), French policies offer a fixed product with the only option being to extend coverage to include not only 'severe' disability, but also 'partial' disability.

Similarly, even though different types of annuity products and social security settings exist, annuity markets are hardly ever substantial (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 the UK, the US and Australia. Second, there are deferred annuities, in which annuitants pay premiums in order to receive annuity payments at a certain point in time. 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, Casey, & Mitchell, 2007).

In addition to the timing of the purchase, annuities differ in multiple ways. The specific products that are available greatly differ between countries as these often reflect relevant national legislation (see Rusconi (2008) for a detailed overview per country). However, generally such differences pertain to the possibility to extend coverage beyond periodic benefits until death. As such, a policy can pay out death benefits when annuity savings have not yet been depleted, provide dependent's benefits, provide coverage against inflation, differently share investment risks, and allow for premium increases (for deferred annuities).

As for integrated products, LCAs such as proposed by Murtaugh, Spillman, & Warshawsky (2001) are not yet available. 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 & Gründl, 2011).

3. Methods

Our research provides an overview of factors impacting the uptake of LTCI and annuities. To develop this overview, we performed a systematic literature review based on state-of-the-art methods (Higgins & Green, 2011). Specifically, we (1) formulated a protocol with clear research questions and eligibility criteria; (2) approached an information specialist to develop a highly sensitive search string and to 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 studies included; (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 listed 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 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 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.

This search string (see Appendix A) 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,

Rethlefsen, Kleijnen, & Franco (2017). 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 3, 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 Appendix B.

(3) Titles and abstracts of the identified records were stored in EndNote and reviewed simultaneously by both of us, following Bramer, Milic, & Mast (2017). 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 which met eligibility criteria 1 to 7 but which had not yet been published in a peer-reviewed journal. Second, we similarly snowballed all reference lists of articles and working papers included. Third, a group of eight experts was invited to reflect on the list of publications included and to indicate whether any relevant studies were still missing. In this way, we ultimately included a total of 185 studies, of which 104 are empirical and 81 theoretical.

(5) Relevant data were extracted from the studies included using the predefined data-extraction form. This data extraction – which focused on either the most extensive analyses performed or the preferred specification as identified by the authors – derived the outcome variable used, the independent variables analyzed, the corresponding directional effects, and whether these were significant at a 5 percent significance level. As our goal was to gain an overview of the directional effects found across different studies – and not to perform a meta-analysis – we do not report effect sizes. 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 to 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, Brożek, Guyatt, & Oxman, 2013). Specifically, an initial grade was based on study design, with 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 malus points in excess of rank D were excluded retrospectively. In total, 19 studies have been excluded because of quality issues (see Appendix B). The main reason for exclusion was that studies failed to apply (or improperly applied) multivariate analyses and hence reported monocausal results. As such, all studies included contained multivariate analyses.

(7) We present findings of both theoretical and empirical literature in our systematic review. First, we provide an overview of the main findings of theoretical papers on LTCI and annuity uptake. 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. Next, we give an overview of the results of included empirical studies using a vote count. 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 descriptive results, we discuss how the findings can explain low uptake through adverse selection, substitution, insurance preferences, and limited rationality. Finally, we show which factors impact uptake of both products and discuss the potential impact for integrated LCAs.

4. Theoretical literature

4.1 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). 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 adaptions of the basic model.

First, 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 of expected income (Meier, 1999). Consequently, only older individuals and those with high LTC risks will purchase LTCI. Nonetheless, insurers could 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 face, and adverse selection could persist.

Second, people may substitute for LTCI. At the individual level, private LTCI can be crowded out by informal care (De Donder & 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 when they need it. 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, 2009, 2010; Shao, Chen, & Sherris, 2017). At the contextual level, private LTCI can be crowded out by means-tested public LTCI (Fabel, 1996; Pauly, 1990). Brown & Finkelstein (2008) predict that this is particularly the case for individuals with lower wealth. Friedberg, Sun, & Webb (2014) extend these findings.[2] Still, policy interventions that protect against spending down – such as partnership programs – would hardly lead to higher LTCI uptake and mostly benefit those who would purchase private LTCI anyway (Sun & Webb, 2013).

Third, individual preferences could deviate from those assumed in the standard barebones insurance model. 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, Luttmer, & Notowidigdo, 2009).

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2   In addition, Ma & Sun (2017) show that policies protecting only against tail risks would make private LTCI attractive for those with lower wealth.

If that is the case, then LTCI is less attractive for 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 under-weighting (De Donder & Leroux, 2014) may change the *a priori* 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 & 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.

4.2 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 of the timing of own death only, and (3) has no bequest motive, should fully annuitize at actuarial fair prices. In later work, a main goal of theoretical research was to analyze whether different assumptions could explain why actual uptake is lower. For example, in a well-known extension, Davidoff, Brown, & Diamond (2005) show that the results of Yaari (1965) hold under less strict utility assumptions but do not hold when markets are incomplete. In this theoretical overview, we provide an overview of the main demand-side extensions on Yaari (1965).

First, adverse selection can play a role just as for LTCI; if risk-rated premiums do not reflect private information, only persons with the worst longevity 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 & Li, 2013). Mitchell, Poterba, Warshawsky, & Brown (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.

Second, just as for LTCI, substitution has been highlighted as an explanation for low uptake. At the individual level, multiple studies show that families can substitute for formal annuities. Some identify couples as a potential group for whom annuities might be less valuable, because they inherently pool risks already between themselves (Brown & Poterba, 2000). Similarly, others argue that longevity risks can be pooled efficiently by families (Schmeiser & Post, 2005; Stamos, 2008). At the

contextual level, substitution can also occur: social benefits can crowd out private annuities (Pashchenko, 2013; Purcal & Piggott, 2008). Moreover, social benefits can particularly deter individuals with shorter life expectancy from entering the annuity market and as such aggravate adverse selection effects (Heijdra, Jiang, & Mierau, 2015; Walliser, 2000).

In addition, a broad set of papers has argued that the design of current annuity products is suboptimal, which may encourage substitutional strategies.[3] In addition, Kingston & 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 & Young, 2007b) or other investments (Di Giacinto & 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 & Devolder, 2006). Studies allowing for flexible investment portfolios over time derive qualitatively similar results (Horneff, Maurer, Mitchell, & Dus, 2008; Horneff, Maurer, & Stamos, 2008; Milevsky & Young, 2007a).

Third, people can have different preferences compared to 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 & Spivak (1981)). Davidoff, Brown, & Diamond (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 & Warshawsky, 1990; Vidal-Meliá & Lejárraga-García, 2004, 2006). 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 & Grand, 2014). As for LTCI, it is also argued that parents may strategically purchase annuities (Bernheim, Shleifer, & Summers, 1985). Specifically, parents may use bequests to influence the behavior of their children. For example, they could (threaten to) lower their bequest

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3   Part of this research focuses on strategies or products that are either very recent innovations or that do not yet exist in practice. Moreover, sub-optimality does not imply optimality of non-annuitization and hence offers no explanation for the annuity puzzle. 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, Watson, & Hu, 2011), and on withdrawal rules (e.g., Dus, Maurer, & 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, & Sherris, 2013).

by purchasing nonbequeathable annuities and hence motivate their children to give them more attention.

Finally, uncertainty of future health costs can be important. Annuities may be useful since the income stream that they provide can be used to hedge against the uncertain cost of health shocks at a higher age (Ai, Brockett, Golden, & Zhu, 2017; Pang & Warshawsky, 2008). Still, health risks may also impose liquidity constraints by requiring extra savings or insurance spending at a younger age and hence limit the equity available for annuitizing (Peijnenburg, Nijman, & Werker, 2017; Reichling & Smetters, 2015). In addition, 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 thus decreases annuitization (Zhao, 2015).

5. Empirical literature

5.1 Uptake of LTCI

Much empirical research has been conducted to analyze LTCI uptake in different countries. A descriptive overview of these papers and the data they use is presented in Table 2. A large share of the LTCI literature analyzes one or more of the twelve 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 and should be preparing for later. Of the 60 studies included, 42 are observational studies without serious limitations (graded 'C'). 3 studies utilize a semi-randomized experimental approach ('B'), and 15 are observational studies that suffer from some limitations or fail to comprehensively describe their methods for data collection ('D').

Table 2: Overview of included studies on LTCI uptake

Authors	#	Data set	Country	N	Sample restrictions
Ameriks, Briggs, Caplin, Shapiro, & Tonetti (2018)	1	Survey	US	1,086 ind.	over 55 years old with at least $10k in Vanguard accounts
Barnett & Stum (2013)	2	Survey	US	803 ind.	Public employees eligible to purchase LTCI
Bergquist, Costa-Font, & Swartz (2018)	3	NAIC sales	US	50 states + DC	n.a.
Bernet (2004)	4	HRS (wave 5)	US	16,851 ind.	over 53 years old
(Boyer, De Donder, Fluet, Leroux, & Michaud (2017)	5	Survey	Canada	2,000 ind.	50 – 70 years old
Brau & Bruni (2008)	6	Survey	Italy	1,176 ind.	25 – 70 years old
Brau, Bruni, & Pinna (2010)	7	Survey	Italy	1,176 ind.	25 – 70 years old
Brown, Coe, et al. (2007)	8	HRS (wave 3 – 5)	US	12,402 ind.	55 – 69 years old
Brown et al. (2012)	9	American Life Panel	US	1,569 ind.	over 50 years old
Browne & Zhou-Richter (2014)	10	Socio-Economic Panel	Germany	3,749 ind.	over 35 years old and not in need of care
Caro, Porell, & Kwan (2011)	11	HRS (wave 6 – 7)	US	2,747 couples	married couples with partners both over 65 years old
Chatterjee & Fan (2017)	12	HRS (wave 11)	US	21,696 ind.	over 52 years old
Coe, Skira, & Van Houtven (2015)	13	HRS (wave 4 – 8)	US	8,349 ind.	51 – 61 years old and not institutionalized
Cornell & Grabowski (2018)	14	HRS (wave 3 – 11)	US	13,285 ind.	50 – 69 years old
Costa-Font & Font (2009)	15	Survey	Spain	324 ind.	over 18 years old
Costa-Font & Rovira-Forns (2008)	16	Survey	Spain	324 ind.	over 18 years old
Courbage & Roudaut (2008)	17	SHARE (wave 2)	France	2,530 ind.	over 50 years old
Courtemanche & He (2009)	18	HRS (wave 4 – 7)	US	8,566 ind.	55 – 65 years old

Authors	#	Data set	Country	N	Sample restrictions
Cramer & Jensen (2006)	19	HRS (wave 6 – 7)	US	9,863 ind.	over 55 years old and without LTCI
Curry, Robison, Shugrue, Keenan, & Kapp (2009)	20	Focus groups and in-depth interviews	US, CT	6 focus groups and 32 interviews	having a direct experience with LTCI
Cutler, Finkelstein, & McGarry (2008)[a]	21	AHEAD (wave 2)	US	7,183 ind.	65 – 90 years old
Doerpinghaus & Gustavson (2002)	22	HIAA, AARP and NAIC sales	US	50 states + DC	n.a.
Finkelstein & McGarry (2006)	23	AHEAD (wave 2)	US	5,072 ind.	over 72 years old
Friedberg, Hou, Sun, & Webb (2017)	24	HRS (wave 6 – 11)	US	891 ind.	over 65 years old and owning LTCI in 2002
Gan, Huang, & Mayer (2015)	25	HRS (wave 3 – 5)	US	5,000 ind.	over 73 years old
Goda (2011)	26	HRS (wave 3 – 8)	US	15,822 ind.	50 – 69 years old
Gottlieb & Mitchell (2015)	27	HRS (wave 11)	US	487 ind.	over 50 years old
Gousia (2016)	28	SHARE (wave 5)	Austria, Italy, France, Denmark, Israel & Czech Republic	19,116 ind.	over 50 years old
He & Chou (2018)	29	Survey	Hong Kong	1,613 ind.	over 40 years old
Jiménez-Martín, Labeaga-Azcona, & Vilaplana-Prieto (2016)	30	SHARE (wave 1, 2 and 5)	Spain	10,867 obs.	over 50 years old and owning either LTCI or private health insurance
Kennedy, Gimm, & Glazier (2016)	31	NHIS	US	14,393 ind.	40 – 65 years old
Kitajima (1999)	32	Survey	Japan, Tokyo	710 ind.	over 40 years old
Konetzka & Luo (2011)	33	HRS (wave 3 – 10)	US	3,974 ind.	over 50 years old and reporting LTCI ownership in at least one year
Kumar, Cohen, Bishop, & Wallack (1995)	34	Survey	US	10,489 ind.	purchasing LTCI or being approached by an agent
Li & Jensen (2012)	35	HRS (wave 6 – 9)	US	2,085 ind.	over 50 years old and reporting LTCI ownership in at least one year
Lin & Prince (2013)	36	HRS (wave 6 – 10)	US	12,695 ind.	over 50 years old
Lin & Prince (2016)	37	HRS (wave 6 – 10)	US	12,695 ind.	over 50 years old
Lutzky & Alecxih (1999)	38	Interviews	US	110 ind.	experts, insurance agents, consumer groups and regulators
McCall, Mangle, Bauer, & Knickman (1998)	39	Survey	US	1,626 ind.	55 – 75 years old
McGarry, Temkin-Greener, & Li (2014)	40	NHATS (2011)	US	8,245 ind.	over 65 years old

Authors	#	Data set	Country	N	Sample restrictions
McGarry, Temkin-Greener, Chapman, Grabowski, & Li (2016)	41	HRS (wave 10)	US	12,796 ind.	over 50 years old
McGarry, Temkin-Greener, Grabowski, Chapman, & Li (2018)	42	HRS (wave 10)	US	15,963 ind.	over 50 years old
McNamara & Lee (2004)	43	HRS (wave 3 – 5)	US	6,220 ind.	over 50 years old and reporting LTCI ownership in at least one year
Mellor (2000)	44	AHEAD (wave 1)	US	8,021 ind.	over 70 years old
Mellor (2001)	45	AHEAD (wave 1) PSD	US	7,775 ind. 1,634 ind.	over 70 years old over 50 years old
Nixon (2014)	46	AHIP sales data	US	50 states + DC	n.a.
Oster, Shoulson, Quaid, & Dorsey (2010)	47	PHAROS HRS (wave 5)	US & Canada	7,356 ind.	26 – 64 years old 50 – 64 years old
Pincus, Hopewood, & Mills (2017)	48	Survey	US	1,305 ind.	30 – 79 years old
Pinquet, Guillén, & Ayuso (2011)	49	Insurance data	Spain	150,123 ind.	n.a.
Schaber & Stum (2007)	50	Survey	US	509 ind.	state employees
Sloan & Norton (1997)	51	AHEAD (wave 1 – 2) HRS (wave 1 – 2)	US	5,292 ind. 13,312 ind.	over 70 years old 51 – 61 years old
Sperber et al. (2017)	52	Focus groups	US	80 ind.	elderly parents and adult children
Stevenson, Frank, & Tau (2009)	53	NAIC sales	US	50 states + DC	n.a.
Stum (2008)	54	Survey	US	446 ind.	state employees
Swamy (2004)	55	Survey	US, MD	1,394 ind.	40 – 70 years old
Tennyson & Yang (2014)	56	CRWB	US, NY	693 ind.	50 – 72 years old
Unruh, Stevenson, Frank, Cohen, & Grabowski (2016)	57	AHIP/LifePlan	US	5,240 ind.	purchasing LTCI or being approached by an agent
Van Houtven, Coe, & Konetzka (2015)	58	HRS (wave 3 – 10)	US	22,742 ind.	over 50 years old
Wu, Bateman, Stevens, & Thorp (2017)	59	Survey	Australia	1,008 ind.	55 – 64 years old
Zhou-Richter, Browne, & Gründl (2010)	60	Survey	Germany	914 ind.	adult children

a Also analyzes annuity uptake.

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) inquire about 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 employed methods to determine willingness to pay, such as discrete choice experiments (Brau & Bruni, 2008; Brau et al., 2010) or referendum approaches (Costa-Font & Font, 2009; Costa-Font & Rovira-Forns, 2008). Where the results of such differing measurements systematically lead to qualitatively different results, we reflect on this in our interpretation. Generally, however, this is not the case.

5.1.1 Individual characteristics

Table 3 summarizes the main findings of the empirical studies on individual factors associated with LTCI uptake. Most studies either find that women are more likely to buy or own LTCI (36%) or that there are no significant differences in uptake between men and women (56%). Notably, there are differences between studies that analyze willingness to pay for LTCI (stated preferences) and those that analyze LTCI ownership (revealed preferences). Most hypothetical studies find no effect of gender, whereas studies that analyze 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 (Carrns, 2014).

The correlation of LTCI uptake with age is less straightforward, with 22% of the studies included finding negative associations and 30% reporting positive associations. At the same time, studies incorporating effects of age squared generally report a significantly positive (Konetzka & Luo, 2011) or negative sign (Bernet, 2004; Courbage & Roudaut, 2008; Gousia, 2016; Mellor, 2000, 2001), with only two studies finding no significant squared age effects (Ameriks et al., 2018). This is indicative of an ambiguous non-linear relationship between age and uptake with the directional impact of age changing around a certain age. Still, at what age this turning point occurs is unclear. Studies analyzing the impact of reaching the age of 65 on LTCI uptake find mixed directional effects (Pinquet et al., 2011; Van Houtven et al., 2015).

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 & Chou, 2018) or subjective economic condition (Kitajima, 1999) and LTCI uptake. More generally, Table 3 shows that a majority of the studies finds a positive correlation between education, income, or wealth and LTCI uptake. Zooming in on income effects, all studies find negative income squared effects (Bernet, 2004;

Table 3: Overview of findings by studies on individual factors associated with LTCI uptake

Factor	Negative effect		No effect		Positive effect		Total
	#	%	#	%	#	%	#
Being female	3	**8%**	20	**56%**	13	**36%**	36
Age	8	**22%**	18	**49%**	11	**30%**	37
Socio-economic status							
Education	2	**7%**	9	**31%**	18	**62%**	29
Income	0	**0%**	14	**40%**	21	**60%**	35
Home ownership	2	**50%**	2	**50%**	0	**0%**	4
Wealth	1	**4%**	10	**38%**	15	**58%**	26
Family							
Number of children[a][b]	7	**33%**	13	**62%**	1	**5%**	21
Married[b][c]	3	**10%**	24	**77%**	4	**13%**	31
Bequest motive	0	**0%**	4	**57%**	3	**43%**	7
Understanding							
Financial literacy	1	**17%**	0	**0%**	5	**83%**	6
System knowledge	0	**0%**	4	**80%**	1	**20%**	5
Cognition	0	**0%**	3	**75%**	1	**25%**	4
Salience							
Awareness of LTC risks	0	**0%**	2	**29%**	5	**71%**	7
LTC experience[d]	2	**11%**	8	**44%**	8	**44%**	18
Risk aversion	2	**29%**	3	**43%**	2	**29%**	7
Subjective risk							
Subjective health	2	**7%**	18	**60%**	10	**33%**	30
Subjective LTC risk[e]	0	**0%**	5	**26%**	14	**74%**	19
Subjective longevity	0	**0%**	6	**100%**	0	**0%**	6
Objective risk (ADL impairments)	1	**6%**	14	**78%**	3	**17%**	18
Formal care preference	0	**0%**	0	**0%**	3	**100%**	3
Trust insurer	0	**0%**	0	**0%**	2	**100%**	2

a   Three studies report having children (or not) rather than the number of children.
b   Four studies report household size and have been counted under both children and married.
c   Three studies report differential effects for married individuals compared to individuals who are single, divorced, or widowed and are counted under "no effect".
d   Three studies report differential effects for different proxies of LTC experience and are counted under "no effect".
e   Two studies reporting differential effects for home care and nursing home expectations are counted under "no effect".

McNamara & Lee, 2004; Mellor, 2000, 2001). These findings suggest that income initially enables purchase of LTCI, but that above a certain income level people rely more on self-insurance. For squared wealth, the same directional effect is found by two studies (Bernet, 2004; McNamara & Lee, 2004), while two other studies find no significant squared effects (Mellor, 2000, 2001). Additionally, home ownership may

have a negative effect (Boyer et al., 2017; Costa-Font & Rovira-Forns, 2008; Stevenson et al., 2009; Wu et al., 2017), although studies that analyze home value in addition to wealth do not find theoretically predicted decreases of LTCI uptake (McGarry et al., 2018; Mellor, 2000; Sloan & Norton, 1997).

Family dynamics, which have been extensively debated by theorists, are found to some extent in LTCI practice. Table 3 shows that bequest motives are likely associated positively with LTCI uptake.[4] Furthermore, being married does not seem to be systematically associated with LTCI uptake. More children may lead to a decrease of LTCI uptake (33%), but the majority of the studies (62%) 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, Skira, et al., 2015; He & Chou, 2018), or size of the entire family (Brau & Bruni, 2008; Costa-Font & Font, 2009; Costa-Font & Rovira-Forns, 2008; Schaber & Stum, 2007) does not reveal a clear correlation with LTCI uptake.

Measures of limited rationality seem to be strongly associated with LTCI uptake according to Table 3. Financial literacy appears to be positively associated with LTCI demand. Also having a financial planner seems to correlate with uptake (Kumar et al., 1995; McCall et al., 1998).[5] At the same time, knowledge of the LTC system (e.g., knowledge of nursing home costs (Boyer et al., 2017; Unruh et al., 2016)) and cognition are not found to have an impact. Finally, some qualitative studies highlight the importance of access to information on LTC in decision-making for LTCI (Curry et al., 2009; Lutzky & 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. Our evidence suggests that this may correlate positively with LTCI uptake, as 44% of the studies find a positive correlation

4   This effect is even clearer for bequest expectations, as all studies that analyze bequest expecta-
    tions find a positive association with LTCI uptake (Courbage & Roudaut, 2008; Konetzka & Luo,
    2011; McGarry et al., 2016, 2018). However, this could also be driven by reverse causality.
5   Only one study (Swamy, 2004) finds that having a financial advisor does not significantly
    change LTCI ownership.

and 44% find no significant correlation. Moreover, individuals who have experienced health shocks – whether positive or negative – are more likely to own LTCI (Konetzka & 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).

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 & Bruni, 2008; Brau et al., 2010; Browne & Zhou-Richter, 2014; Chatterjee & Fan, 2017) and life insurance (Chatterjee & Fan, 2017; Jiménez-Martín et al., 2016; McNamara & Lee, 2004). Some studies argue that preventive health behavior or wearing seatbelts may be indicative of risk behavior and show that these are positively correlated with LTCI uptake (Finkelstein & McGarry, 2006; Gan et al., 2015; Gottlieb & Mitchell, 2015; McGarry et al., 2016, 2018). However, other risk behaviors (smoking, drinking, and exercising) are not found to have an effect on uptake (e.g., Courbage & Roudaut, 2008; Gottlieb & Mitchell, 2015; Jiménez-Martín, Labeaga-Azcona, & Vilaplana-Prieto, 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 correlate with LTCI uptake.

In addition, Table 3 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 60% 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 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 & Jensen, 2006). At the same time, there is no evidence that objective health or subjective longevity is related to demand for LTCI.

Table 3 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, Grabowski, Cohen, Shi, & Stevenson, 2016). Similarly, other measures of objective health, such as the number of hospitalizations in the previous year (Brau & Bruni, 2008; Browne & Zhou-Richter, 2014), drug usage (Bernet, 2004), various existing conditions (e.g., Browne & Zhou-Richter, 2014; Gousia, 2016) and BMI (Jiménez-Martín et al., 2016), are not systematically associated with uptake.

Furthermore, there is evidence that LTCI uptake correlates with individual per-ceptions about the value of LTC and preferences for LTC. That is, people who dislike informal care are more likely to take out LTCI, as displayed in Table 3. People who prefer to stay home to going to a nursing home are less likely to buy LTCI (McCall et al., 1998; Tennyson & Yang, 2014). And people who have a negative view of public care may buy more LTCI (Brau & Bruni, 2008), although another study finds no significant correlation (Ameriks et al., 2018). 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 & Chou, 2018). Finally, Table 3 shows that people who trust their insurer to pay out future claims are more likely to take out LTCI.

5.1.2 Contextual characteristics

At the contextual level, Table 4 highlights the importance of both generosity of social benefits and tax incentives for LTCI uptake. The studies included show that more lenient means-tested social benefit schemes either decrease LTCI demand or have no effect.[6] On the contrary, tax incentives[7] (and consequently lower prices) lead to greater willingness to insure. 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 & Prince, 2013) or healthier (Cornell & 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 & Mitchell, 2015; Pincus et al., 2017).

Finally, Table 4 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 & Roudaut (2008) show with an objective measure of

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6 This does not hold for Federal Partnership programs that protect a portion of an individual's assets that would otherwise need to be spend 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).

7 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 4: Overview of findings by studies on contextual factors associated with LTCI uptake

Factor	Negative effect		No effect		Positive effect		Total
	#	%	#	%	#	%	#
Social benefits	4	**40%**	6	**60%**	0	**0%**	10
Tax subsidies[a]	0	**0%**	5	**56%**	4	**44%**	9
Informal care availability	4	**31%**	7	**54%**	2	**15%**	13

a   One study reports a differential effect of tax deductions and tax credits and is counted under "no effect".

predicted availability that informal care availability can also increase uptake. This may be because purchasing LTCI can protect family and friends from informal caregiving.

5.1.3 Why is LTCI uptake so low?

From the results reported in Table 3 and Table 4 we infer four general explanations for the low uptake of private LTCI: (i) adverse selection; (ii) crowding out by public LTCI or informal care; (iii) individual preferences that differ from those assumed in standard economic models of consumer behavior; and (iv) financial illiteracy.

As theoretically predicted, adverse selection could play a role on the LTCI market, as the existence of private information has been proven both directly (Finkelstein & McGarry, 2006) and indirectly (Gan et al., 2015) and as people seem fairly responsive to the price of LTCI (Cornell & Grabowski, 2018; Costa-Font & Font, 2009; Cramer & 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 disease 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.[8] Third, adverse selection is often assumed to concentrate uptake among subjectively less healthy individuals, yet our review finds the opposite. Some authors hence conclude that people do not realize that current poor health can lead to LTC needs later in life (Browne & Zhou-Richter, 2014). Another potential explanation is that subjectively healthier people may expect

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

to live longer and associate longevity with LTC needs (Cramer & 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, McGarry, & Sufi, 2005; Konetzka & Luo, 2011). However, this could also be due to *ex post* moral hazard. Moreover, Konetzka & Luo (2011) argue that such lapsing reflects personal finances and the availability of informal caregivers rather than private information.

Although adverse selection takes place at the individual level, Finkelstein & 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 some of the main objective health factors used in underwriting – do not significantly correlate with LTCI uptake. Instead, Finkelstein & McGarry (2006) show that adverse selection is compensated by the advantageous selection of low-risk individuals with strong insurance preferences.

It is thus unlikely that low uptake is caused by adverse selection alone. Although our overview shows that uptake of LTCI is higher for those with high subjective LTC risks and with good subjective health, uptake is unrelated to objective health. Moreover, it is not clear whether higher uptake among subjectively healthy individuals is the result of perfectly integrating private risk information in uptake decisions or that these patterns simply reflect individual preferences or capabilities correlated with subjective health.

(ii) In line with theoretical predictions, it is clear that private LTCI is to some extent substituted by public LTCI. LTCI may also be substituted by informal care, but this relationship is less clear cut. Our results suggests that both the number of children and the expected availability of informal caregivers 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, Goda, & Van Houtven (2015) 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 could also lower ex-post informal care expectations, and the negative relationship could reflect reverse causality.

(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, Pauly, & McMorrow, 2012).

Our review additionally shows that preferences for formal care impact LTCI uptake.[9] 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 insurers decreases LTCI uptake. Such a trust relationship may be especially important as LTCI provides coverage against risks that are often in the far future. Furthermore, the fact that LTCI may only pay out in the distant future, depending on uncertain LTC needs, may trigger nonstandard time preferences or state-dependent utility preferences. Nonetheless, we found no empirical evidence about the impact of time preferences. Only one study has highlighted that people who are prone to procrastinate are less likely to own LTCI (Brown & Previtero, 2014). Finally, most evidence for the impact of state-dependent utility remains indirect. For example, using the HRS, Finkelstein Luttmer, & Notowidigdo (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 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 economically expected behavior. Our review shows that those who are aware of LTC risks and who are financially literate purchase more insurance than those who do not. Moreover, Lin & Prince (2016) show that wealthier individuals are also better able to make use of sponsored LTCI plans, indicating that socio-economic status characteristics may to some extent reflect such ability.

From our review it also 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

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9   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.

causes for low uptake. First, 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 as these are relatively healthy. Second, as most social benefit schemes are means-tested, crowding out should theoretically take place predominantly among individuals with low income and assets (Brown & Finkelstein, 2008). This is also what is observed empirically (Brown, Coe, et al., 2007) and works to increase relative uptake among wealthier individuals.

Third, it has been shown that preferences for insurance differ and are an important determinant of LTCI uptake (Browne & 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 individuals[10] (Finkelstein & 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.

5.2 Uptake of annuities

Table 5 provides an overview of all 44 empirical studies on annuity uptake decisions that are included. Clearly, the studies included are more diverse than those analyzing LTCI decisions. Data sets 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: 4 studies are graded 'B', 29 'C' and 11 'D'. Moreover, sample restrictions concerning age are generally much more inclusive than for LTCI, as they comprise all adult age groups.

5.2.1 Individual characteristics

As to gender and age, uptake patterns displayed in Table 6 are broadly similar to those of LTCI. Somewhat more women than men seem to opt for annuities. 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. There is no clear pattern in the effects summarized in Table 6, and the two studies analyzing squared age effects retrieve

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10 As well as individuals who use preventive health services and individuals who always wear seatbelts (Cutler et al., 2008; Finkelstein & McGarry, 2006).

Table 5: Overview of included studies on annuity uptake

Authors	#	Dataset	Country	N	Restrictions
Agnew, Anderson, Gerlach, & Szykman (2008)	1	Experiment	US, VA	845 ind.	18 – 89 years old nonstudents
Ai 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, Previtero, & 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, & Zeldes (2014)	6	Survey	US	5,130 ind.	50 – 75 years old
Bockweg, Ponds, Steenbeek, & Vonken (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 with a DC plan
Brown, Kapteyn, Luttmer, Mitchell, & Samek (2017)	9	Survey	US	4,549 ind.	over 18 years old
Brown, Kapteyn, Luttmer, & Mitchell (2017)	10	Survey	US	2,112 ind.	over 18 years old
Brown, Kling, Mullainathan, & Wrobel (2013)	11	Survey	US	4,055 ind.	over 50 years old
Brown & Previtero (2014)	12	Administrative dataset	US	27,231 ind.	retired between 2002 and 2008
Bütler, Staubli, & Zito (2013)	13	Administrative dataset	Switzerland	15,312 ind.	over 60 year old men retired between 2001 and 2005
Bütler & Teppa (2007)	14	Administrative dataset	Switzerland	4,544 ind.	retired between 1996 and 2006
Cannon, Tonks, & Yuille (2016)	15	ABI QLB and QPA Surveys	UK	27 quarters	n.a.
Cappelletti, Guazzarotti, & Tommasino (2013)	16	SHWI (2008 wave)	Italy	4,750 ind.	15 – 65
Chalmers & Reuter (2012)	17	Administrative dataset	US, OR	31,809 ind.	public employees retired between 1990 and 2002
Charupat & Milevsky (2001)	18	Data on annuity quotes and mortality	Canada	n.a.	n.a.
Chou, Inkmann, Van Kippersluis, & Chan (2016)	19	Survey	Hong Kong	1,066 ind.	40 – 64 years old and working full-time
Clark, Morrill, & Vanderweide (2014)	20	Administrative dataset	US, NC	46,913 ind.	under 50 years old and terminated plan in 2007 or 2008
Cutler et al. (2008)[a]	21	AHEAD (wave 2)	US	7,183 ind.	65 – 90 years old

Authors	#	Dataset	Country	N	Restrictions
Doyle, Mitchell, & Piggott (2004)	22	Data on mortality, annuity payments and interest rates	Singapore and Australia	n.a.	n.a.
Finkelstein & Poterba (2002)	23	Data on mortality, annuity payments and interest rates	UK	n.a.	n.a.
Friedman & Warshawsky (1990)	24	Data on mortality and annuity payments	US	n.a.	n.a.
Guillemette, Martin, Cummings, & James (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 & Panis (2006)	27	HRS (wave 1 – 5)	US	3,651 ind.	over 50 years old and retired between 1992 and 2000
Hurwitz & Sade (2017)	28	Administrative dataset	Israel	1,556 ind.	retired between 2009 and 2013 with balance > 500K NIS
Inkmann, Lopes, & Michaelides (2011)	29	ELSA (wave 1)	UK, England	5,233 ind.	over 50 years old
Knoller (2016)	30	Experiment	Germany	140 ind.	students
Knoller, Kraut, & Schoenmaekers (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, D'Agostino, Pagliuca, & Pratesi (2017)	34	Survey	Italy	7,840 ind.	25 – 35 years old and without private pension
Payne, Sagara, Shu, Appelt, & Johnson (2013)	35	Survey	US	514 ind.	45 – 65 years old
Pfarr & Schneider (2013)	36	SAVE (wave 2005 – 2009)	Germany	5,242 ind.	under 65 years old and working, married and eligible for Riester pensions
Previtero (2014)	37	Administrative dataset	US	103,516 ind.	retired between 2002 and 2008
Schooley-Pettis & Worden (2013)	38	Survey	US	987 ind.	n.a.
Schreiber & Weber (2016)	39	Survey	Germany	3,077 ind.	18 – 86 years old
Shu, Zeithammer, & Payne (2018)	40	Survey	US	1,020 ind.	40 – 65 years old
Teppa (2011)	41	DNB Household Survey (2005)	Netherlands	816 ind.	16 – 65
Van der Cruijsen & 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 & Nick (2013)	44	SAVE (wave 2010)	Germany	1,432 ind.	working and eligible for Riester pensions

a Also analyzes LTCI uptake.

Table 6: Overview of findings by studies on individual factors associated with annuity uptake

Factor	Negative effect		No effect		Positive effect		Total
	#	%	#	%	#	%	#
Being female	4	17%	12	52%	7	30%	23
Age	8	36%	7	32%	7	32%	22
Socio-economic status							
Education	0	0%	14	82%	3	18%	17
Income	1	7%	9	64%	4	29%	14
Home ownership	0	0%	4	100%	0	0%	4
Wealth	1	7%	5	33%	9	60%	15
Family							
Number of children[a]	1	8%	12	92%	0	0%	13
Married[b]	2	12%	15	88%	0	0%	17
Bequest motive	1	14%	5	71%	1	14%	7
Understanding							
Financial literacy[c]	2	18%	5	45%	4	36%	11
Cognition	0	0%	0	0%	2	100%	2
Awareness of longevity risk	0	0%	0	0%	2	100%	2
Risk preference							
Risk aversion	3	27%	5	45%	3	27%	11
Stock market participation	1	17%	3	50%	2	33%	6
Subjective risk							
Subjective health	0	0%	6	67%	3	33%	9
Subjective longevity	1	8%	7	58%	4	33%	12
Objective risk (longevity)[d]	0	0%	2	50%	2	50%	4
Patience	0	0%	0	0%	4	100%	4
Trust insurer	0	0%	1	50%	1	50%	2

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

b   Three studies report different directional effects for married individuals compared to individuals who are single, divorced or widowed and are counted under "no effect".

c   One study reports different directional effects for three different measures of financial literacy and is counted under "no effect".

d   One study reports different directional effects for two measures of ex-ante mortality and is counted under "no effect".

different results: one reports a positive effect of age squared (Clark et al., 2014), whereas the other finds no significant effect (Teppa, 2011).

Table 6 also shows that wealth is generally positively associated with annuity uptake. At the same time, income and annuity uptake may be somewhat positively associated, but the majority of the studies reports no significant correlation. Education and homeownership[11] are found to be of limited relevance. The low number of studies finding any effect of education is markedly different from the strong association found with LTCI uptake. These results are found both in studies measuring hypothetical uptake (stated preferences) and those measuring actual annuity uptake (revealed preferences).

As to the impact of family characteristics, Table 6 shows that most studies do not find any effect of either having children[12], being married[13] 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.

Next, Table 6 shows that financial literacy and cognition may increase annuity uptake.[14] Although there are few studies that focus on cognition, this suggests that individuals with higher financial literacy[15] are more interested in annuities than others. Using a financial advisor also seems to increase uptake (Pfarr & 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 (Shu et al., 2018; Van der Cruijsen & Jonker, 2016). This is possibly because these measures indicate financial (over)confidence, rather than actual financial literacy (Bateman et al., 2017).

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11 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).

12 One study shows a positive impact of having dependent children on annuity uptake (Bütler & Teppa, 2007).

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

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

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

Table 6 furthermore displays risk awareness as a potentially relevant factor in annuity uptake. Two studies highlight that such awareness correlates positively with annuity uptake. In addition, in an experimental setting, 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.

In addition, Table 6 highlights the potential importance of subjective and objective risk factors in annuity decisions. One third of the studies included 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. 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 also correlates positively with annuity uptake.[16] All in all, the evidence available suggests that experienced health and objective longevity are positively correlated with annuity uptake.

Finally, there is no convincing evidence that individual risk or more general real life insurance preferences are correlated with uptake decisions. First, the evidence we map in Table 6 does not show clear directional effects of risk aversion or stock market participation. Second, another indicator of risky behavior, namely smoking, seems to be uncorrelated with annuity uptake (Guillemette et al., 2016; Hurwitz & Sade, 2017). Third, even though some studies find a positive relationship between annuity uptake and health insurance ownership (Hurd & Panis, 2006) or LTCI ownership (Pfarr & Schneider, 2013), while others do not (Chou et al., 2016). Additionally, several studies found patience and personal trust in the insurance company[17] to increase annuity uptake.

5.2.2 Contextual characteristics
Contextual factors that are associated with annuity uptake are summarized in Table 7. Contrary to theoretical predictions, not all evidence shows that social benefits 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,

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

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

Table 7: Overview of findings by studies on contextual factors associated with annuity uptake

Factor	Negative effect		No effect		Positive effect		Total
	#	%	#	%	#	%	#
Social benefits[a]	1	33%	2	67%	0	0%	3
Tax incentives	0	0%	0	0%	3	100%	3
Annuity equivalent worth	1	17%	0	0%	5	83%	6
Return on investments	3	75%	1	25%	0	0%	4
Annuity as defaults	0	0%	1	75%	4	80%	5
Framing as investment	4	80%	1	20%	0	0%	5
Protections[b]	0	0%	1	20%	4	80%	5

a   One study reports different directional effects of different social benefit schemes and is counted under "no effect".

b   One study reports a positive effect of period guarantees and a negative effect of inflation protection and is counted under "no effect".

thus offering basic financial security for the majority of the population (Schreiber & 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.[18] Second, tax incentives can also increase annuity uptake as shown in Table 7.[19]

The impact of annuity-equivalent wealth is also positively associated with uptake, as shown in Table 7.[20] 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). Similarly, the relative value of annuities can impact uptake. Table 7 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).

18 Procrastination decreases uptake (Brown & Previtero, 2014), whereas two studies find that simplicity of the product can increase uptake (Brown, Kapteyn, Luttmer, Mitchell, et al., 2017) or has no effect (Bockweg et al., 2016).

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

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

In addition, Table 7 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, Kling, Mullainathan, & Wrobel, 2008). Consequently, it seems that annuities with additional protections – such as period guarantees, principal protections, or inflation coverage – can increase uptake. In line with this, framing annuities in terms of lack of flexibility and control may significantly reduce uptake (Beshears et al., 2014). Other framing aspects may also be of importance as it has been suggested that using a "live to" (rather than "die by") frame (Payne et al., 2013) increases uptake. Finally, framing a specific annuity goal may (Knoller, 2016) or may not (Brown et al., 2013) increase uptake.

5.2.3 Why is annuity uptake so low?

From the results of Table 6 and Table 7 we infer the same explanations for low uptake of annuities as those inferred earlier for LTCI: (i) adverse selection; (ii) crowding out by social benefits; (iii) individual preferences that differ from those assumed in standard economic models of consumer behavior; and (iv) financial illiteracy.

(i) 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).

(ii) As shown in Table 7, 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 take place.

In addition, other investments have theoretically been proposed to substitute for annuity uptake (Hainaut & 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.

(iii) Nonstandard preferences may also explain lower than expected annuity demand. However, results from empirical studies deviate from theoretical predictions. 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. We can only confirm that higher levels of patience are associated with higher levels of uptake.

(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. Moreover, uptake decisions seem to be guided by contextual defaults and framing rather than by expected utility maximization. Finally, trust in insurance companies increases annuity uptake and lack thereof may thus contribute to low uptake levels.

From our review it follows that uptake of annuities differs across different sub-groups of the population, similar to 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 potentially 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; and/or (c) be better able to judge the value of those products.

6. Discussion: will an integrated product increase uptake?

Up to this point, we have separately analyzed uptake of LTCI and of annuities without integrating our results. However, in doing so we have left unanswered a pivotal question: could the introduction of integrated products increase insurance uptake? Integrated products are often suggested as a potential solution for low uptake levels (e.g., Eling & Ghavibazoo, 2019). Specifically, it is argued that – because LTC and longevity risks are likely to be negatively correlated – integrated products mitigate adverse selection effects and as such could expand the market to also include individuals who are currently rejected by underwriters (Brown & Warshawsky, 2013; Murtaugh et al., 2001). Moreover, because of this, integrated products could be made available at lower prices and hence appeal to a broader public.

The results of our review show that individuals with higher subjective LTC risk are indeed more likely to purchase LTCI. Similarly, individuals with higher objective longevity risk are more likely to purchase annuities. Yet we find no evidence that individuals with higher subjective LTC (objective longevity) risk are also less likely to purchase annuities (LTCI) or that an integrated product would appeal to a broader public by simultaneously pooling these two risks. Consequently, we analyzed other sources of adverse selection. Murtaugh et al. (2001) and Brown & Warshawsky (2013) use ADL impairments, as well as subjective health, illness history, and cognitive capacity to calculate LTC risk. Our results, however, show no correlation between ADL impairments or illness history and LTCI uptake. Rather, we find that subjectively healthier individuals purchase more – not less – LTCI than subjectively less healthy individuals. For annuities, our results indicate that uptake is highest among those with higher subjective health and higher longevity, which is in line with theoretical assumptions.

Altogether, our findings imply that product integration is unlikely to expand the market through limitation of adverse selection. Rather, uptake of an integrated product will likely continue to be concentrated among subjectively healthy individuals, as shown in Table 8. That is to say, if subjectively healthy individuals indeed face low LTC risks (and high longevity risks), then people are currently advantageously selecting into the LTC market based on subjective health. An integrated product is unlikely to change this. On the other hand, if subjectively healthy individuals also face high LTC risks, then an integrated product will likely aggravate this adverse selection.

Moreover, even if an integrated product would manage to limit the underwriting that is needed to counter adverse selection, it is unclear whether uptake would increase significantly. Our results show that uptake of both LTCI and annuities is not

Table 8: Explanations for low uptake of LTCI and annuities and implications for LCAs

	LTCI	Annuity	LCAs
Adverse selection	• Individuals with subjectively better health may take out more LTCI • Individuals with higher subjective LTC risks take out more LTCI • Individuals with objectively worse health do not take out more LTCI	• Individuals with subjectively better health may take out more annuities • Individuals with higher subjective longevity risks may take out more annuities • Individuals with objectively higher longevity risks take out more annuities	• Individuals with subjectively better health will likely take out more LCAs
Substitution	• Is substituted by social benefits that provide a safety net only • May be substituted by informal care availability	• Is substituted by social benefits that provide a safety net only • Is not substituted by intra-family risk pooling	• Will be substituted by social benefits that provide a safety net only
Nonstandard preferences	• Trust in insurers increases uptake • Risk aversion has no impact on uptake	• Trust in insurers increases uptake • Risk aversion has no impact on uptake	• Trust in insurers will increase uptake • Risk aversion will have no impact on uptake
Limited rationality	• Financial literacy increases uptake • Risk awareness increases uptake	• Financial literacy increases uptake • Risk awareness increases uptake	• Financial literacy will increase uptake • Risk awareness will increase uptake

only lowered by adverse selection, but also by substitution, nonstandard preferences, and limited rationality. In Table 8 we summarize which specific aspects limit uptake for both LTCI and annuities. Clearly, there is overlap in these limitations that will not be solved by an integrated product. Uptake of both LTCI and annuities is higher for individuals with trust in insurers, higher financial literacy, and higher risk awareness. An integrated product is thus still unlikely to appeal to individuals with low trust in insurers, low financial literacy, and low risk awareness. Moreover, an integrated product may even be more complex than the two separate products on the market now, which may even reduce uptake among those with low financial literacy.

As integrated products such as those proposed by Murtaugh et al. (2001) are not available in the market, there is little direct evidence on their attractiveness. Combined products, meaning annuities with LTC riders, seem to perform reasonably well (National Association of Insurance Commissioners, 2016), but it is unclear whether this signifies an expanding market or a shift from traditional annuities to annuities with LTC riders. Currently, only one study has directly analyzed demand for LCAs empirically (Wu et al., 2018). This study finds no evidence of selection effects in purchase decisions for integrated products and additionally highlights – in line with

our expectations – that uptake is impacted by risk awareness as well as by ease of financial knowledge acquisition.

Based on indirect evidence from LTCI and annuities uptake, we conclude that an integrated product is unlikely to expand the market substantially. Uptake of an integrated product is likely to be impacted not only by adverse selection, but also by substitution, nonstandard preferences, and limited rationality. Moreover, all these explanations currently seem to drive a concentration of uptake among healthy individuals with higher wealth, making it difficult to expand the market for LTCI and longevity insurance products to a broader population.

7. 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 adverse selection, substitution, nonstandard preferences, and limited rationality. Moreover, these factors may also explain why uptake is concentrated among individuals with high wealth and high 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 will be worth analyzing to what extent our explanations for low uptake can indeed explain uptake concentrations among individuals with good subjective health and high wealth. The fact that uptake of private insurance is unequally distributed also has important consequences for policymakers. Insofar 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, longevity and financial capabilities and may warrant policy interventions.

If the goal is to increase insurance uptake on private LTCI or annuity markets, policymakers 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 can be achieved not only by policies that increase financial literacy and thus lead to a better understanding of LTCI and annuity products, but also by making insurance policies easier to comprehend. Second, risk awareness increases insurance uptake; policymakers and insurers could thus focus on raising awareness of LTC and longevity risks. Particularly, governments should be clear as to what social benefits do and do not reimburse and as to what contribution is expected from citizens themselves. 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 payout of fair claims may help to increase uptake. Fourth, evidence on the importance of perceptions, framing, and defaults suggests that these may provide effective means for increase of insurance uptake. As such, offering product features that guarantee predetermined payouts when the insured risk does not fully materialize may prove particularly effective.

Our research also offers important insights for insurers in countries where private LTCI is currently not available, such as the Netherlands. We show that there may well be market potential when insurers cater to country-specific demand-side traits of substitution and nonstandard preferences. In the case of the Netherlands, substitution by formal care arrangements may seem particularly difficult to overcome because of its extensive public long-term care scheme. Although nursing home care is indeed comprehensively insured through public income-adjusted insurance, home care is not. The eligibility for and scope of home care entitlements is determined by local authorities, and future reimbursements are far less certain than under a public insurance scheme. This offers ample opportunities for a home care insurance product, particularly as a large share of the Dutch population is worried about elderly care (The Netherlands Institute for Social Research, 2019). Further research is needed to examine which (nonstandard) preferences govern demand for such a product in the Netherlands.

Additionally, insurers should be able to adjust to more generic factors of adverse selection and limited rationality. We show that integration of LTCI and annuity products does not necessarily limit adverse selection more effectively. Hence, annuity providers may find it easier to develop new LTCI products separately, without negative adverse selection effects. Top-up products similar to American LTCI riders may, however, be more marketable in two ways. First, riders may need less marketing because they can be sold as a top-up to immediate annuities that are already on the market. Second, riders can be designed and marketed to advance benefits and as such ensure annuity payments.

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Appendices

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 ltci):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 2009 Flow Diagram

Identification

Records identified through database searching (n = 6,175)	Additional records identified through Google Scholar (n = 400)

Records after duplicates removed (n = 2,230)

Screening

Records screened (n = 3,945)	Records excluded (n = 3,604)

Eligibility

Full-text articles assessed for eligibility (n = 341)

Full-text articles excluded, with reasons (n = 204)
Not explicitly on LTCI or annuities (n = 1)
Not on insurance demand   (n = 43)
No factors identified   (n = 52)
Not empirical nor theoretical   (n = 50)
Not on high-income countries   (n = 3)
Not peer-reviewed   (n = 26)
Double   (n = 6)
Not found   (n = 5)
Quality   (n = 18)

Included

Studies included in synthesis (n = 137)

Studies on LTCI (n = 64) Empirical (n = 50) Theoretical (n = 14)	Studies on LA (n = 66) Empirical (n = 28) Theoretical (n = 38)	Studies on both (n = 7) Empirical (n = 1) Theoretical (n = 6)

Additional

From additional sources (n = 12) Empirical (n = 2ª + 7ᵇ) Theoretical (n = 3ᵇ)	From additional sources (n = 33) Empirical (n = 6ª + 9ᵇ) Theoretical (n = 14ª + 4ᵇ)	From additional sources (n = 3) Empirical (n = 1ᵇ) Theoretical (n = 2ᵇ)

[a]from snowballing reference lists, [b]from working paper search, [c]from experts.

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

Table 9: Overview of findings by studies on individual factors associated with annuity uptake

Factor	Negative effect	No effect	Positive effect
Being female	3 • Brau & Bruni (2008) • Swamy (2004) • Stevenson, Frank, & Tau (2009)	20 • Ameriks, Briggs, Caplin, Shapiro, & Tonetti (2018) • Brau, Bruni, & Pinna (2010) • Caro, Porell, & Kwan (2011) • Costa-Font & Font (2009) • Costa-Font & Rovira-Forns (2008) • Courbage & Roudaut (2008) • Cramer & Jensen (2006) • Friedberg, Hou, Sun, & Webb (2017) • Gousia (2016) • Gottlieb & Mitchell (2015) • He & Chou (2018) • Jiménez-Martín, Labeaga-Azcona, & Vilaplana-Prieto (2016) • Kennedy, Gimm, & Glazier (2016) • McGarry, Temkin-Greener, & Li (2014) • Mellor (2000) • Mellor (2001) • Schaber & Stum (2007) • Sloan & Norton (1997) • Stum (2008) • Wu, Bateman, Stevens, & Thorp (2017)	13 • Barnett & Stum (2013) • Bernet (2004) • Chatterjee & Fan (2017) • Konetzka & Luo (2011) • Kumar, Cohen, Bishop, & Wallack (1995) • Li & Jensen (2012) • McCall, Mangle, Bauer, & Knickman (1998) • McGarry, Temkin-Greener, Chapman, Grabowski, & Li (2016) • McGarry, Temkin-Greener, Grabowski, Chapman, & Li (2018) • McNamara & Lee (2004) • Pinquet, Guillén, & Ayuso (2011) • Unruh, Stevenson, Frank, Cohen, & Grabowski (2016) • Van Houtven, Coe, & Konetzka (2015)
Age	8 • Brau & Bruni (2008) • Brau et al. (2010) • Costa-Font & Font (2009) • Friedberg et al. (2017) • He & Chou (2018) • Konetzka & Luo (2011) • Kumar et al. (1995) • Swamy (2004)	18 • Ameriks et al. (2018) • Caro et al. (2011) • Chatterjee & Fan (2017) • Courtemanche & He (2009) • Gottlieb & Mitchell (2015) • Jiménez-Martín et al. (2016) • Li & Jensen (2012) • McGarry et al. (2014) • McGarry et al. (2016) • McNamara & Lee (2004) • Mellor (2001) • Sloan & Norton (1997)[a] • Stevenson et al. (2009) • Stum (2008) • Unruh et al. (2016) • Van Houtven et al. (2015)[b] • Wu et al. (2017) • Zhou-Richter, Browne, & Gründl (2010)	11 • Barnett & Stum (2013) • Bernet (2004) • Courbage & Roudaut (2008) • Doerpinghaus & Gustavson (2002) • Gousia (2016) • Kennedy et al. (2016) • McCall et al. (1998) • McGarry et al. (2018) • Mellor (2000) • Pincus, Hopewood, & Mills (2017) • Schaber & Stum (2007)

Factor	Negative effect	No effect	Positive effect
Education	2 • Gousia (2016) • Kumar et al. (1995)	9 • Ameriks et al. (2018) • Barnett & Stum (2013) • Brau et al. (2010) • Costa-Font & Rovira-Forns (2008) • Courbage & Roudaut (2008) • Friedberg et al. (2017) • Li & Jensen (2012) • McGarry et al. (2018) • Swamy (2004)	18 • Bernet (2004) • Brau & Bruni (2008) • Caro et al. (2011) • Chatterjee & Fan (2017) • Cramer & Jensen (2006) • He & Chou (2018) • Jiménez-Martín et al. (2016) • Gottlieb & Mitchell (2015) • Konetzka & Luo (2011) • McCall et al. (1998) • McGarry et al. (2014) • McGarry et al. (2016) • McNamara & Lee (2004) • Mellor (2000) • Mellor (2001) • Sloan & Norton (1997) • Unruh et al. (2016) • Van Houtven et al. (2015)
Income	0	14 • Ameriks et al. (2018) • Browne & Zhou-Richter (2014) • Costa-Font & Font (2009) • Courbage & Roudaut (2008) • Courtemanche & He (2009) • Doerpinghaus & Gustavson (2002) • Friedberg et al. (2017) • Li & Jensen (2012) • McCall et al. (1998) • Sloan & Norton (1997) • Stevenson et al. (2009) • Stum (2008) • Swamy (2004) • Unruh et al. (2016)	21 • Barnett & Stum (2013) • Bernet (2004) • Brau & Bruni (2008) • Brau et al. (2010) • Caro et al. (2011) • Chatterjee & Fan (2017) • Costa-Font & Rovira-Forns (2008) • Cramer & Jensen (2006) • Jiménez-Martín et al. (2016) • Kennedy et al. (2016) • Konetzka & Luo (2011) • Kumar et al. (1995) • McGarry et al. (2014) • McGarry et al. (2016) • McNamara & Lee (2004) • Mellor (2000) • Mellor (2001) • Nixon (2014) • Schaber & Stum (2007) • Van Houtven et al. (2015) • Zhou-Richter et al. (2010)
Home equity	2 • Boyer, De Donder, Fluet, Leroux, & Michaud (2017) • Costa-Font & Rovira-Forns (2008)	2 • Stevenson et al. (2009) • Wu et al. (2017)	0

Factor	Negative effect	No effect	Positive effect
Wealth	1 • Barnett & Stum (2013)	10 • Ameriks et al. (2018) • Costa-Font & Rovira-Forns (2008) • Courtemanche & He (2009) • Kumar et al. (1995) • Lin & Prince (2013) • McGarry et al. (2016) • Mellor (2000) • Schaber & Stum (2007) • Sloan & Norton (1997)[a] • Stum (2008)	15 • Bernet (2004) • Caro et al. (2011) • Chatterjee & Fan (2017) • Finkelstein & McGarry (2006) • Friedberg et al. (2017) • Gousia (2016) • He & Chou (2018) • Jiménez-Martín et al. (2016) • Konetzka & Luo (2011) • McCall et al. (1998) • McGarry et al. (2014) • McGarry et al. (2018) • McNamara & Lee (2004) • Mellor (2001) • Unruh et al. (2016) • Van Houtven et al. (2015)
Number of children	7 • Brau & Bruni (2008)[c] • Cramer & Jensen (2006) • Gousia (2016) • Jiménez-Martín et al. (2016)[d] • McGarry et al. (2016) • McGarry et al. (2018) • Schaber & Stum (2007)[c]	13 • Barnett & Stum (2013)[d] • Browne & Zhou-Richter (2014) • Caro et al. (2011) • Costa-Font & Font (2009)[c] • Costa-Font & Rovira-Forns (2008)[c] • Friedberg et al. (2017)[d] • Konetzka & Luo (2011) • McGarry et al. (2014) • Mellor (2000) • Sloan & Norton (1997) • Van Houtven et al. (2015) • Wu et al. (2017) • Zhou-Richter et al. (2010)	1 • Courbage & Roudaut (2008)
Married	3 • Brau & Bruni (2008)[c] • McNamara & Lee (2004) • Schaber & Stum (2007)[c]	24 • Browne & Zhou-Richter (2014) • Chatterjee & Fan (2017) • Costa-Font & Font (2009)[c] • Costa-Font & Rovira-Forns (2008)[c] • Courbage & Roudaut (2008)[d] • Courtemanche & He (2009) • Friedberg et al. (2017) • Gousia (2016)[d] • He & Chou (2018) • Jiménez-Martín et al. (2016) • Konetzka & Luo (2011) • Li & Jensen (2012)[e] • McCall et al. (1998) • McGarry et al. (2014) • McGarry et al. (2016) • McGarry et al. (2018) • Mellor (2000) • Mellor (2001) • Sloan & Norton (1997) • Stum (2008) • Swamy (2004) • Unruh et al. (2016) • Wu et al. (2017) • Zhou-Richter et al. (2010)	4 • Bernet (2004) • Gottlieb & Mitchell (2015) • Kumar et al. (1995) • Van Houtven et al. (2015)

Factor	Negative effect	No effect	Positive effect
Bequest motive	0	4 • He & Chou (2018) • Schaber & Stum (2007) • Sloan & Norton (1997) • Stum (2008)	3 • Boyer et al. (2017) • Brown, Goda, & McGarry (2012) • Chatterjee & Fan (2017)
Financial literacy	1 • Boyer et al. (2017)	0	5 • Gousia (2016) • He & Chou (2018) • McGarry et al. (2016) • McGarry et al. (2018) • Stum (2008)
System knowledge	0	4 • Boyer et al. (2017) • Schaber & Stum (2007) • Swamy (2004) • Unruh et al. (2016)	1 • Kitajima (1999)
Cognition	0	3 • Gottlieb & Mitchell (2015) • McGarry et al. (2016) • Sloan & Norton (1997)	1 • Friedberg et al. (2017)
Awareness	0	2 • Barnett & Stum (2013) • Browne & Zhou-Richter (2014)	5 • Boyer et al. (2017) • Schaber & Stum (2007) • Stum (2008) • Swamy (2004) • Zhou-Richter et al. (2010)
LTC experience	2 • Kitajima (1999) • Kumar et al. (1995)	8 • Barnett & Stum (2013) • Coe, Skira, & Van Houtven (2015)[f] • Cramer & Jensen (2006) • Li & Jensen (2012)[f] • Schaber & Stum (2007) • Swamy (2004) • Unruh et al. (2016)[f] • Wu et al. (2017)	8 • Brau & Bruni (2008) • Courbage & Roudaut (2008) • Jiménez-Martín et al. (2016) • Kennedy et al. (2016) • Konetzka & Luo (2011) • McCall et al. (1998) • Stum (2008) • Tennyson & Yang (2014)
Risk aversion	2 • Boyer et al. (2017) • Gousia (2016)	3 • Costa-Font & Rovira-Forns (2008) • Gottlieb & Mitchell (2015) • Sloan & Norton (1997)	2 • Chatterjee & Fan (2017) • Stum (2008)
Subjective health	2 • Li & Jensen (2012) • Stum (2008)	18 • Ameriks et al. (2018) • Barnett & Stum (2013) • Brau et al. (2010) • Browne & Zhou-Richter (2014) • Caro et al. (2011) • Chatterjee & Fan (2017) • Costa-Font & Font (2009) • Courbage & Roudaut (2008) • Courtemanche & He (2009) • Friedberg et al. (2017) • Gottlieb & Mitchell (2015) • Gousia (2016) • Konetzka & Luo (2011) • McGarry et al. (2016) • McGarry et al. (2018) • Mellor (2000) • Schaber & Stum (2007) • Sloan & Norton (1997)[a]	10 • Bernet (2004) • Brau & Bruni (2008) • Costa-Font & Rovira-Forns (2008) • Cramer & Jensen (2006) • McCall et al. (1998) • McGarry et al. (2014) • McNamara & Lee (2004) • Mellor (2001) • Unruh et al. (2016) • Van Houtven et al. (2015)

Factor	Negative effect	No effect	Positive effect
Subjective LTC risk	0	5 • Ameriks et al. (2018) • Costa-Font & Font (2009)[g] • Friedberg et al. (2017) • Kumar et al. (1995)[h] • Wu et al. (2017)[h]	14 • Brown et al. (2012) • Caro et al. (2011) • Chatterjee & Fan (2017) • Costa-Font & Rovira-Forns (2008) • Finkelstein & McGarry (2006) • Gottlieb & Mitchell (2015) • He & Chou (2018) • Kitajima (1999) • McGarry et al. (2016) • McGarry et al. (2018) • Schaber & Stum **(**2007) • Sloan & Norton (1997) • Swamy (2004) • Unruh et al. (2016)
Subjective longevity	0	6 • Caro et al. (2011) • Costa-Font & Font (2009)[g] • Costa-Font & Rovira-Forns (2008) • Cramer & Jensen (2006) • Sloan & Norton (1997) • Wu et al. (2017)	0
ADL impair- ments	1 • Konetzka & Luo (2011)	14 • Ameriks et al. (2018) • Bernet (2004) • Caro et al. (2011) • Chatterjee & Fan (2017) • Courtemanche & He (2009) • Friedberg et al. (2017) • Gottlieb & Mitchell (2015) • Li & Jensen (2012) • McCall et al. (1998) • McGarry et al. (2016) • McGarry et al. (2018) • Mellor (2000) • Mellor (2001) • Sloan & Norton (1997)	3 • Courbage & Roudaut (2008) • Kennedy et al. (2016) • Nixon (2014)
Preference for formal care	0	0	3 • Boyer et al. (2017) • Brown et al. (2012) • He & Chou (2018)
Trust insurer	0	0	2 • Brown et al. (2012) • Curry, Robison, Shugrue, Keenan, & Kapp (2009)

a   Reports different directional effects in equivalent analyses and is therefore counted under "no effect".

b   Reports two different age effects and is therefore counted under "no effect".

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

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

e   Reports different directional effects for married individuals compared to individuals who are single, divorced or widowed and is therefore counted under "no effect".

f   Reports different directional effects for different proxies of LTC experience.

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

h   Reports different directional effects for home care and nursing home expectations and is therefore counted under "no effect".

Table 10: Overview of findings by studies on individual factors associated with LTCI uptake

Factor	Negative effect #	No effect #	Positive effect #
Social benefits	4 • Brown, Coe, & Finkelstein (2007) • Doerpinghaus & Gustavson (2002) • Jiménez-Martín et al. (2016) • Konetzka & Luo (2011)	6 • He & Chou (2018) • Kumar et al. (1995)[a] • Li & Jensen (2012) • McGarry et al. (2018) • Sloan & Norton (1997)[b] • Stevenson et al. (2009)[a]	0
Tax incentive	0	5 • Cornell & Grabowski (2018) • McGarry et al. (2018) • Nixon (2014) • Stevenson et al. (2009)[c] • Stum (2008)	4 • Cramer & Jensen (2006) • Courtemanche & He (2009) • Goda (2011) • Jiménez-Martín et al. (2016)
Informal care availability	4 • Bernet (2004) • Brown et al. (2012) • McCall et al. (1998) • McGarry et al. (2018)	7 • Ameriks et al. (2018) • He & Chou (2018) • Schaber & Stum (2007) • McGarry et al. (2016) • Mellor (2001) • Stum (2008) • Wu et al. (2017)	2 • Boyer et al. (2017) • Coe et al. (2015)

a   Reports different directional effect of various measures of social benefit generosity.

b   Reports different directional effects in equivalent analyses and is therefore counted under "no effect".

c   Reports different directional effects of tax deductions and tax credits and is therefore counted under "no effect".

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

Table 11: Overview of findings per study on individual factors associated with annuity uptake

Factor	Negative effect	No effect	Positive effect
Being female	4 • Bütler & Teppa (2007) • Inkmann, Lopes, & Michaelides (2011) • Nosi, D'Agostino, Pagliuca, & Pratesi (2017) • Teppa (2011)	12 • Bateman et al. (2017) • Beshears, Choi, Laibson, Madrian, & Zeldes (2014) • Bockweg, Ponds, Steenbeek, & Vonken (2016) • Chou, Inkmann, Van Kippersluis, & Chan (2016) • Cappelletti, Guazzarotti, & Tommasino (2013) • Hagen (2015)[a] • Hurd & Panis (2006) • Hurwitz & Sade (2017) • Schreiber & Weber (2016) • Pfarr & Schneider (2013) • Shu, Zeithammer, & Payne (2018) • Ziegelmeyer & Nick (2013)	7 • Benartzi, Previtero, & Thaler (2011) • Brown & Previtero (2014) • Chalmers & Reuter (2012) • Clark, Morrill, & Vanderweide (2014) • Guillemette, Martin, Cummings, & James (2016) • Lee (2016) • Previtero (2014)
Age	8 • Bernheim (1991) • Brown, Kapteyn, Luttmer, & Mitchell (2017) • Clark et al. (2014) • Guillemette et al. (2016) • Hurd & Panis (2006) • Hurwitz & Sade (2017) • Schooley−Pettis & Worden (2013) • Schreiber & Weber (2016)	7 • Beshears et al. (2014) • Inkmann et al. (2011) • Pfarr & Schneider (2013) • Previtero (2014)[a] • Shu et al. (2018) • Teppa (2011) • Ziegelmeyer & Nick (2013)	7 • Benartzi et al. (2011) • Bockweg et al. (2016) • Brown & Previtero (2014) • Cappelletti et al. (2013) • Chou et al. (2016) • Lee (2016) • Van der Cruijsen & Jonker (2016)
Education	0	14 • Beshears et al. (2014) • Brown (2001) • Cappelletti et al. (2013) • Chou et al. (2016) • Guillemette et al. (2016 • Nosi et al. (2017) • Hagen (2015) • Hurd & Panis (2006) • Pfarr & Schneider (2013) • Previtero (2014)[a] • Schooley−Pettis & Worden (2013) • Schreiber & Weber (2016) • Van der Cruijsen & Jonker (2016) • Ziegelmeyer & Nick (2013)	3 • Bateman et al. (2017) • Brown, Kapteyn, Luttmer, & Mitchell (2017) • Inkmann et al. (2011)

Factor	Negative effect	No effect	Positive effect
Income	1 • Previtero (2014)	9 • Bockweg et al. (2016) • Cappelletti et al. (2013) • Chou et al. (2016) • Guillemette et al. (2016) • Nosi et al. (2017) • Schreiber & Weber (2016) • Shu et al. (2018) • Van der Cruijsen & Jonker (2016) • Ziegelmeyer & Nick (2013)	4 • Chalmers & Reuter (2012) • Clark et al. (2014) • Hagen (2015) • Pfarr & Schneide (2013)
Home ownership	0	4 • Beshears et al. (2014) • Pfarr & Schneider (2013) • Van der Cruijsen & Jonker (2016) • Ziegelmeyer & Nick (2013)	0
Wealth	1 • Brown (2001)	5 • Bateman et al. (2017) • Chou et al. (2016) • Guillemette et al. (2016) • Shu et al. (2018) • Van der Cruijsen & Jonker (2016)	9 • Bernheim (1991) • Bockweg et al. (2016) • Bütler, Staubli, & Zito (2013) • Bütler & Teppa (2007) • Cappelletti et al. (2013) • Hurd & Panis (2006) • Inkmann et al. (2011) • Knoller, Kraut, & Schoenmaekers (2016) • Ziegelmeyer & Nick (2013)
Children	1 • Schreiber & Weber (2016)	12 • Bernheim (1991)[b] • Beshears et al. (2014) • Bockweg et al. (2016) • Bütler & Teppa (2007) • Cappelletti et al. (2013) • Chou et al. (2016) • Hagen (2015)[b] • Inkmann et al. (2011) • Pfarr & Schneider (2013) • Shu et al. (2018)[b] • Van der Cruijsen & Jonker (2016)b • Ziegelmeyer & Nick (2013)	0
Married	2 • Brown (2001) • Inkmann et al. (2011)	15 • Bateman et al. (2017) • Bernheim (1991)[c] • Beshears et al. (2014) • Bockweg et al. (2016) • Bütler & Teppa (2007)[c] • Cappelletti et al. (2013) • Chou et al. (2016)[c] • Guillemette et al. (2016) • Hagen (2015)[a] • Hurwitz & Sade (2017) • Pfarr & Schneider (2013) • Schooley–Pettis & Worden (2013) • Schreiber & Weber (2016) • Shu et al. (2018) • Ziegelmeyer & Nick (2013)	0

Factor	Negative effect	No effect	Positive effect
Bequest motive	1 • Bateman et al. (2017)	5 • Brown (2001) • Schooley-Pettis & Worden (2013) • Shu et al. (2018) • Teppa (2011) • Van der Cruijsen & Jonker (2016)	1 • Chou et al. (2016)
Financial literacy	2 • Agnew, Anderson, Gerlach, & Szykman (2008) • Chou et al. (2016)	5 • Bateman et al. (2017) • Bockweg et al. (2016) • Cappelletti et al. (2013)[d] • Knoller (2016) • Shu et al. (2018)	4 • Ai, Brockett, Golden, & Zhu (2017) • Brown, Kapteyn, Luttmer, & Mitchell (2017) • Schreiber & Weber (2016) • Ziegelmeyer & Nick (2013)
Cognition	0	0	2 • Brown, Kapteyn, Luttmer, & Mitchell (2017) • Brown, Kapteyn, Luttmer, Mitchell, et al. (2017)
Awareness	0	0	2 • Ai et al. (2017) • Brown, Kapteyn, Luttmer, Mitchell, & Samek (2017)
Risk aversion	3 • Guillemette et al. (2016) • Knoller (2016) • Shu et al. (2018)	5 • Agnew et al. (2008)[a] • Cappelletti et al. (2013) • Chou et al. (2016) • Pfarr & Schneider (2013) • Schreiber & Weber (2016)	3 • Bockweg et al. (2016) • Schooley-Pettis & Worden (2013) • Van der Cruijsen & Jonker (2016)
Stock market participation	1 • Cappelletti et al. (2013)	3 • Chou et al. (2016) • Guillemette et al. (2016) • Inkmann et al. (2011)	2 • Bockweg et al. (2016) • Pfarr & Schneider (2013)
Subjective health	0	6 • Cappelletti et al. (2013) • Chou et al. (2016) • Schooley-Pettis & Worden (2013) • Shu et al. (2018) • Van der Cruijsen & Jonker (2016) • Wuppermann (2017)	3 • Bockweg et al. (2016) • Brown (2001) • Hurd & Panis (2006)
Subjective longevity	1 • Chou et al. (2016)	7 • Bateman et al. (2017) • Bockweg et al. (2016) • Brown (2001) • Hurd & Panis (2006) • Inkmann et al. (2011) • Pfarr & Schneider (2013) • Shu et al. (2018)	4 • Payne, Sagara, Shu, Appelt, & Johnson (2013) • Schreiber & Weber (2016) • Teppa (2011) • Van der Cruijsen & Jonker (2016)
Objective longevity	0	2 • Hurwitz & Sade (2017)[ef] • Wuppermann (2017)[g]	2 • Chalmers & Reuter (2012)[g] • Lee (2016)[e]

Factor	Negative effect	No effect	Positive effect
Patience	0	0	4 • Bockweg et al. (2016) • Brown (2001) • Cappelletti et al. (2013) • Van der Cruijsen & Jonker (2016)
Trust insurer	0	1 • Bockweg et al. (2016)	1 • Van der Cruijsen & Jonker (2016)

a   Reports different directional effects in equivalent analyses and is therefore counted under "no effect".

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

c   Reports directional effects for married individuals compared to individuals who are single, divorced or widowed and is therefore counted under "no effect".

d   Reports different directional effects for three different measures of financial literacy and is therefore counted under "no effect".

e   Reports ex-ante mortality.

f   Reports different directional effects for two measures of ex-ante mortality and is therefore counted under "no effect".

g   Reports ex-post mortality.

Table 12: Overview of findings by studies on contextual factors associated with annuity uptake

Factor	Negative effect	No effect	Positive effect
Social benefits	1 • Bernheim (1991)	2 • Chou et al. (2016)[a] • Schreiber & Weber (2016)	0
Tax incentive	0	0	3 • Hagen (2015) • Lee (2016) • Pfarr & Schneider (2013)
Annuity equivalent worth	1 • Chalmers & Reuter (2012)	0	5 • Brown (2001) • Bütler et al. (2013) • Bütler & Teppa (2007) • Clark et al. (2014)[b] • Lee (2016)
Return on investments	3 • Brown & Previtero (2014) • Chalmers & Reuter (2012) • Previtero (2014)	1 • Lee (2016)	0
Annuity as default	0	1 • Agnew et al. (2008)	4 • Bateman et al. (2017) • Bockweg et al. (2016) • Bütler et al. (2013) • Bütler & Teppa (2007)
Framing as investment	4 • Benartzi et al. (2011) • Bockweg et al. (2016)[c] • Brown, Kling, Mullainathan, & Wrobel (2013) • Guillemette et al. (2016)	1 • Beshears et al. (2014)	0
Protections	0	1 • Chou et al. (2016)[f]	4 • Brown et al. (2013)[d] • Knoller (2016)[d] • Knoller et al. (2016)[d] • Lee (2016)[e]

a   Reports different directional effects for different social benefit schemes and is therefore counted under "no effect".

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

c   Reports a negative effect of framing annuities as investment with potential loss, but not for framing annuities as investment with potential gain.

d   Reports the effect of principal protection or guarantees.

e   Reports the effect of fixed interest rates.

f   Reports a positive effect of period guarantees and a negative effect of inflation protection and is therefore counted under "no effect".

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