ON THE VALUATION OF INVESTMENT GUARANTEES IN UNIT-LINKED LIFE INSURANCE: A BEHAVIORAL PERSPECTIVE

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ABSTRACT

Interest rate guarantees in unit-linked life insurance products ensure that at contract maturity, at least a minimum guaranteed amount is paid, even if the mutual fund falls below the guaranteed level. Strongly depending on the riskiness of the underlying mutual fund, these guarantees can be of substantial value. However, while insurer pricing is based on the replication of cash flows, customers are more likely to base their decisions on individual preferences. The aim of this paper is to contrast minimum prices for guarantees in unit-linked life insurance policies based on customers' subjective willingness to pay with a financial pricing approach, an investigation that has not been undertaken to date. To do so, we use an online questionnaire survey as well as calculate reservation prices using option pricing theory. Our findings reveal that even though the majority of the participants in the online questionnaire are employed in the field of insurance, subjective prices are very difficult to derive and are significantly lower on average than the prices obtained using a financial pricing model. However, there is still a considerable portion of participants willing to pay a substantially higher price.

Keywords: Behavioral Insurance, Investment Guarantees, Unit-linked Life Insurance, Willingness to Pay, Empirical Survey

1. INTRODUCTION

Attractive pension product design is becoming increasingly important, in part due to demographic change (i.e., the aging of the population) in many countries. In this respect, knowing customer perceptions and preferences as to

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product characteristics is crucial for product development. Unit-linked life insurance policies, in particular, are often offered with different types of investment guarantees, typically ensuring that at least a minimum amount is paid, even if the mutual fund value falls below a specific guaranteed level. These guarantees can be of substantial value since—depending on the riskiness of the underlying fund—costly risk management measures must be undertaken to secure the guarantees promised to the customers. Thus, the question arises as to whether customers' maximum willingness to pay (WTP) actually exceeds the minimum premium necessary for the insurer to buy adequate risk management measures. The aim of this paper is to broaden the traditional viewpoint of risk valuation of investment guarantees in unit-linked life insurance products and to investigate the impact of product design and customer characteristics on policyholder WTP. This will be done by focusing on a behavioural economics approach and by comparing the results from an empirical survey with those of a financial valuation approach. In general, behavioural economics provides a more realistic psychological foundation for economic analyses and thus allows increasing the explanatory power of economics in providing new theoretical insights and for deriving fundamental policy implications.

Research in the field of behavioural economics examines irrational phenomena in decision making and has discovered various anomalies in respect to expected utility theory (e.g., the use of heuristics, biases), which have led to the development of new theoretical models, such as prospect theory (Kahneman and Tversky, 1979), cumulative prospect theory (Tversky and Kahneman, 1992), and the model of intertemporal choice (Loewenstein and Prelec, 1992).

Experimental analyses of insurance demand build on and complement important previous empirical studies on behavioural economics. Wakker, Thaler, and Tversky (1997) use prospect theory, developed by Kahneman and Tversky (1979), to explain experimental data on the demand for probabilistic insurance. A probabilistic insurance policy indemnifies the policyholder with a probability of strictly less than one to account for insurer default risk. Other

recent experimental research on demand for insurance under default risk includes Albrecht and Maurer (2000), Zimmer, Gründl, and Schade (2008), and Zimmer, Schade, and Gründl (2009), who show that awareness of even a very small positive probability of insolvency drastically reduces customer WTP.

Gatzert, Holzmüller, and Schmeiser (2009) contrast prices for participating life insurance contracts determined via financial theory with prices determined via expected utility theory, thus aiming to combine policyholder and insurer perspectives. Except for this study, previous literature on behavioural insurance has chiefly focused on the impact of insurance company insolvency risk on customer WTP. We extend this research by investigating customer WTP to prevent their maturity payoff from falling below a fixed guarantee level. In addition, we contrast these results with the actual reservation premium that, from the insurer perspective, is necessary to acquire adequate risk management measures that will ensure the investment guarantee. To the best of our knowledge, the gap between the value of guarantees in unit-linked life insurance based on duplication of cash flow (from the insurer perspective) and the empirically identified value of guarantees from the policyholder perspective is studied for the first time in this paper. The present analysis is a first step in discovering the determinants of customer WTP for investment guarantees in unit-linked life insurance contracts. Based on research (e.g., Wakker, Thaler, and Tversky, 1997; Zimmer, Gründl, and Schade, 2008; Zimmer, Schade, and Gründl, 2009) examining WTP for insurance products with default probability, we try to reduce making people sensitive to the problem of default risk, as it can be assumed that many customers may not consider default risk in their insurance purchase decisions at all. Thus, we assume that asking WTP for an investment guarantee will be more uncommitted and realistic out of a practitioner's point of view. This means that participants will have the possibility to choose or to refuse the guarantee, as insurance products are seen as product bundles, where it is possible to buy an additional guarantee or not.

We provide an experimental framework that combines the insurer and policyholder viewpoints in the context of unit-life insurance contracts with an embedded investment guarantee. In a first step, we calculate the fair price of an investment guarantees in a unit-linked insurance contract, which is the minimum premium the insurance company needs to charge in order to secure the guarantee with risk management measures. In a second step, we conduct an experimental study based on a comprehensive survey to identify policy-holder WTP for investment guarantees and their price perception for same. We take into account various customer characteristics, including gender, age, financial background knowledge, and individual degree of risk perception. In the experimental design, customer WTP for guarantees might exceed or fall below the insurer's calculated minimum premium. However, it will likely be difficult to directly state individual WTP due to the absence of a reference point.

The remainder of the paper is organized as follows. In Section 2, the unit-linked life insurance contract design with minimum interest rate guarantee is introduced and evaluated from the insurer perspective using risk-neutral valuation. Section 3 presents the customer perspective, along with survey design and empirical results on WTP for guarantees from the customer perspective using descriptive statistics and different statistical tests. Section 4 derives policy implications based on the empirical findings and Section 5 provides a summary and an outlook for future research fields.

2. Risk-Neutral Valuation of Investment Guarantees in Unit-Linked life Insurance products

Unit-linked life insurance contracts typically contain a savings policy and a death benefit that is paid out if the policyholder dies during the term of the contract. In respect to the savings part of the contract, one common form of underlying is a mutual fund with an embedded investment guarantee. A single up-front premium paid by the policyholder for a unit-linked life insurance contract can be split into two parts: the premium P^d for the death benefit and P for the savings policy. In the following, we focus on the value of

investment guarantees in unit-linked life policies only and study this value from the both the insurer and the customer perspective. Thus death benefits or transaction costs are not included in the model but the focus is solely on the savings part of the product. To simplify our questionnaire (described in detail in Section 3), mortality risk (i.e., the chance that the policyholder will die before the contract matures), the possibility of early option exercise (e.g., surrendering the contract), and the use of a paid-up option are not included in the model framework.

Design and modelling of the underlying mutual funds

To determine a risk-adequate price for investment guarantees included in unit-linked life insurance contracts, we use the following model framework (see, e.g., Gatzert and Schmeiser, 2009; Lachance and Mitchell, 2003). At time $t = 0$, the policyholder pays a single up-front premium P that is invested in a traded mutual fund with a contract term of T years. The unit price of the mutual fund at time t is denoted by S_t and its development is described by a geometric Brownian motion with fixed average rate of return and standard deviation during the policy term. Hence, under the objective measure $\mathbb{P}$, it can be described by the following stochastic differential equation,

$$dS_t = S_t\left(\mu dt + \sigma dW_t\right),$$

with $S_0 = S(0)$, a constant drift μ, volatility σ, and a standard $\mathbb{P}$-Brownian motion $\left(W_t\right)$, $0 \le t \le T$, on a probability space $(\Omega, \mathcal{F}, \mathbb{P})$. In addition, $(\mathcal{F}_t)$, $0 \le t \le T$, denotes the filtration generated by the Brownian motion. The solution of the stochastic differential equation is given by (see, e.g., Björk, 2004)

$$\begin{aligned} S_t &= S_{t-1} \cdot e^{\left(\mu-\sigma^2/2\right)+\sigma\left(W_t-W_{t-1}\right)} \\ &= S_{t-1} \cdot e^{\left(\mu-\sigma^2/2\right)+\sigma Z_t} = S_{t-1} \cdot R_t, \end{aligned}$$

where Z_t are independent standard normally distributed random variables. Hence, the continuous one-period return $r_t = \ln\left(R_t\right)$ is normally distributed with an expected value of $\mu - \sigma^2/2$ and standard deviation σ.

Mutual fund payoff with embedded investment guarantee

At maturity, the stochastic value of the investment in T, F_T, is given by the number of acquired units at $t = 0$ $\left(P / S_0\right)$ times the value of a unit in T $\left(S_T\right)$

$$F_T = P \cdot \frac{S_T}{S_0}.$$

The payoff depends on the fund's development over time and thus on future financial market conditions. Therefore, the terminal investment value can fall below the initially paid premium P. To prevent such a default situation for the policyholder, unit-linked life insurance contracts are often offered with a minimum interest rate guarantee g on the premium, providing a minimum payment of

$$G_T = P \cdot \exp\left(g \cdot T\right).$$

In the presence of an investment guarantee, the customer's terminal payoff is the greater of the guaranteed payment and the value of the investment in the underlying fund

$$L_T = \max\left(F_T, G_T\right) = F_T + \max\left(G_T - F_T, 0\right). \quad (1)$$

Thus, the payoff to the investor in T, L_T, can be written as the value of the underlying assets plus a put option on this value with strike G_T.

Valuation of investment guarantee from insurer perspective

The value of the investment guarantee from the insurer perspective is derived by using the concept of risk-neutral valuation. The cost of the guarantee is the minimum amount an insurer needs to charge at time $t = 0$, in addition to the premium that is invested in the mutual fund, to be able to invest in risk management measures such as hedging strategies, equity capital, or reinsurance that will ensure the guarantee provided to the policyholder.

Under the unique equivalent martingale measure $\mathbb{Q}$ (see Harrison and Kreps, 1979), the drift of the mutual fund unit price process changes to the riskless rate of return r

$$dS_t = S_t\left(rdt + \sigma dW_t^{\mathbb{Q}}\right),$$

where $W^{\mathbb{Q}}$ is a standard $\mathbb{Q}$-Brownian motion. The value of the investment guarantee Π_0 at time $t = 0$ is then given as the difference between the expected present value of the contract's payoff under the risk-neutral measure $\mathbb{Q}$ and the present value of the premiums paid, discounted with the riskless interest rate r. According to Equation (1), this implies that the cost of the investment guarantee is the price of a European put option value on the mutual fund at maturity with strike G_T. Using the Black and Scholes option pricing formula, one obtains

$$\begin{aligned}\Pi_0^G &= e^{-rT}\cdot E^{\mathbb{Q}}\left(\max\left(G_T - F_T, 0\right)\right)\\ &= G_T\cdot e^{-rT}\cdot N\left(-d_2\right) - P\cdot N\left(-d_1\right)\end{aligned} \tag{2}$$

where

$$d_1 = \frac{\ln\left(\frac{P}{G_T}\right) + \left(r + \frac{\sigma^2}{2}\right)\cdot T}{\sigma\cdot\sqrt{T}},\ d_2 = d_1 - \sigma\cdot\sqrt{T}\ .$$

The cost of the guarantee calculated in Equation (2) represents a lower limit to the actual price, since no transaction costs are included.

3. The Value of Investment Guarantees from the Customer Perspective

Prospect theory: A short overview

The value of guarantees in unit-linked life insurance contracts may differ depending on the perspective from which they are viewed. On the one hand, an insurer is generally able to calculate the appropriate premium for investment guarantees assuming a duplication of the cash flows, such as risk-neutral valuation and other premium principles, all based on the assumption of an efficient capital market. Customers, on the other hand, are not necessarily able to replicate cash flows or claims to the same extent as the insurer and may thus assess the value of investment guarantees based on preferences. In addition, it may not be appropriate to assume a "homo oeconomicus" when it comes to subjective WTP. Thus, customer WTP may be quite different from what financial theory suggests. To elicit customer WTP, we conduct an experimental study, explained below.

People use different mental models when making decision, especially in respect to risky or probabilistic choices, and these mental models are often inconsistent with the basic principles of expected utility theory (for an overview, see, e.g., Camerer and Loewenstein, 2003). Based on these findings, Kahneman and Tversky (1979) began to contradict expected utility theory with prospect theory in their work. Many biases and heuristics have been examined since this theoretical breakthrough (Tversky and Kahneman, 1974). The purchase of insurance contracts in particular leads to a substantial amount of irrational behaviour. The mental models believed to be in play during insurance purchase decisions include the following:

- anchoring, i.e., the adjustment on an initial value (Tversky and Kahneman, 1974);
- an availability bias, i.e., the evaluation depends on how easily something comes to mind (Tversky and Kahneman, 1973);

- a certainty effect, i.e., the overweighting of certain outcomes relative to probable outcomes (Allais, 1953; Tversky and Wakker, 1995);
- framing, i.e., reliance on how information is presented (Tversky and Kahneman, 1981, 1986; Kahneman and Tversky, 1984);
- loss aversion, i.e., losses loom larger than corresponding gains (Tversky and Kahneman, 1991);
- mental accounting, i.e., the dividing of current and future assets into separate, non-transferable portions (Thaler, 1999);
- wishful thinking, and overconfidence, e.g., by overestimating own knowledge and ability to control events, while underestimating risks (Barberis and Thaler, 2005);
- risk perception (Slovic, 1972; Slovic et al., 1977) or an overestimation of probabilities (Johnson et al., 1993).

Furthermore, according to Kahneman and Tversky (1979) and Tversky and Kahneman (1991, 1992), every individual has a personal reference point through which the value function passes (see Figure 1). In prospect theory, Kahneman and Tversky distinguish between two phases of the decision-making process. In the first phase, the editing phase, the offered prospects are analyzed and simplified on the basis of heuristics and biases. One of the major operations of this phase is the so-called coding, meaning that the individual defines alternative outcomes as either gains or losses relative to some reference point. The reference point and its location, and thus the consequent coding of outcomes as gains or losses, are suggested or implied by how the problem is stated and are largely determined by the objective status quo (e.g., current assets). However, they are also affected by the decision maker's expectations or social comparisons. Based on this first phase of the decision-making process, the value function (denoted with v in Figure 1) can be generated, which will be accomplished in the second phase, the evaluation phase.

As Figure 1 shows, this value function v is concave for $x > 0$ ($v''(x) < 0$), convex for $x < 0$ ($v''(x) > 0$), steeper for losses than for gains, and steepest at the reference point (hence, $v'(x) < v'(-x)$ for $x \geq 0$). In that phase, the decision

maker appraises the edited prospects and chooses the one with the highest value. The decision will be made according to this value function and reference point. Thus, the reference point serves as a boundary when evaluating outcomes, distinguishing gains from losses, whereas the location of the reference point is individually defined during the editing phase.

Accordingly, if individuals are not able to define a reference point, they will find it difficult to make an evaluation and, thus, stating their WTP will be difficult as well. Thus, one interesting aspect of behavioural insurance that we are interested in investigating in our survey is whether there is a reference point that customers can rely on when evaluating their individual WTP for different types of guarantees.

Design of the survey

The aim of the study is to compare objective and subjective prices for guarantees that are included in unit-linked life insurance products. To elicit the subjective WTP and the presence of a reference point, we used a computer-based questionnaire comprised of direct open-response questions, a section containing choice options, and questions as to age, gender, or knowledge about insurance. An overview of methods for measuring consumer WTP can be found in Diller (2000) and Völckner (2005, 2006). We assume that answers to direct questions about WTP will be a good indication as to whether there are individual reference points for guarantees embedded in insurance. If there is a reference point, it should be easy for the respondent to state his or her WTP, which should then be dispersed more or less around the calculated price (except, of course, for those with no WTP). On the contrary, however, if respondents do not have reference points, WTP will be broadly dispersed and it will be difficult for participants to state their WTP with sufficient precision.

Pre-tests were conducted to test the understandability and the length of the questionnaire, as well as to identify possible biases or heuristics. The pre-tests comprised 18 stepwise conducted open-ended and semi-structured interviews with insurance- and non-insurance-related probands from the University of St.

Gallen during April 7, 2009 to April, 21st, 2009, as well a pilot study with 60 master-students of the University of St. Gallen on April 29, 2009. The questionnaire was revised accordingly and possible biases eliminated or controlled for as much as possible.[1]

Empirical study: Input data

The unit-linked product studied in the survey is based on a mutual fund that invests in the money market and in stocks. The input data for the mutual fund were estimated from the Swiss market indices, with resulting input parameters as shown in Table 1.

In the survey, we compared the case of a "medium-risk" mutual fund that invests 50% in the money market and 50% in stocks with a "high-risk" mutual fund that invests 100% in stocks. The medium-risk fund has an expected return of 4.061% and a volatility $\sigma = 8.610\%$; the high-risk fund has an expected return of 5.975% and a volatility of $\sigma = 17.220\%$.

In addition to distinguishing between a medium- and a high-risk fund, we further compare three products in the survey: a unit-linked policy without guarantee and two products with guarantees, including a money-back guarantee and a minimum interest rate of 2% on the initial nominal premium ($g = 0\%$ and $g = 2\%$). Guarantee costs for all three products are calculated based on the Black and Scholes option pricing formula given in Equation (2).

Sample and survey procedure

Due to the complexity of investment products and the survey method (directly asking about WTP), we chose a sampling by mainly focusing on participants having some relation to insurance or finance. We assume that persons with

[1] Biases that were eliminated or controlled included, for example, (a) the availability bias—dealt with by concentrating on an insurance- or finance-related sample, (b) framing effects, risk perception, and overestimation of probabilities—dealt with by using graphical, verbal, and numerical illustrations of the probabilities (see Figure 3), and (c) anchoring—dealt with by the order of the questions.

insurance or finance background are more capable of stating WTP for guarantees directly as these people are more likely to have reference point in this regard. The desired sample was achieved by conducting the survey among persons in the contact database of the Institute of Insurance Economics at the University of St. Gallen, who are thus mainly working in the financial services industry or in the insurance and finance departments of universities. There are 2,500 individuals in the contact database. The link to the online questionnaire was sent to each of these individuals via a personal email invitation that contained a unique anonymous login code. Each individual choosing to participate could answer the questionnaire only once. Participants took part in the survey individually. Once a respondent chose to participate, the goal of the survey was explained and standardized instructions were given without interaction or inducements. Participants could pause the survey, but could go neither forward nor back. No new question was posed until the current one was answered. After a two-week period from May 20, 2009 to June 2nd, 2009, 375 persons had completed the survey, a completion rate of 14.5%.

The survey was divided into three parts. To achieve some understanding of how customer characteristics—particularly their knowledge about financial and insurance products—impact WTP, in the first part, we collected information on gender, age, job, education, attitude toward risk, stock ownership, knowledge about guarantees in life insurance products, and previous purchase of pension or life insurance products (see Figure 2).

To compare theoretical guarantee costs with the price customers are willing to pay, in the second part of the survey we directly asked the participants their WTP for an additional investment guarantee that would protect them from default at various levels (g = 0%, 2%), explaining that the cost of the guarantee would have to be paid in addition to the initial up-front premium invested in the mutual fund (the initial premium was given by P = CHF 10,000, contract term = 10 years; see Figures 3 and 4). The aim was to investigate to what extent participants who already have some knowledge about insurance or finance can actually estimate a price they are willing to pay for such a risk management product. To avoid framing effects due to how the

payoff was represented (verbally, numerically, graphically, positively, or negatively), we aimed to make our information about the mutual fund payoff structure as neutral as possible. To this end, participants received a graphical illustration of the terminal payoff and the probabilities accompanied by a written-out explanation (see Figure 3).

Since direct judgments of guarantee costs are difficult to assess and typically display a high degree of volatility (Völckner, 2006), in the third part of the survey (see Figure 5), we asked the participants to choose between the three products (no guarantee, money-back guarantee, and 2% minimum interest rate), giving them the guarantee prices obtained by option pricing theory. The guarantee prices are presented as absolute values payable at contract inception (at time $t = 0$) to simplify the questionnaire as much as possible, and thus, to ensure understandability of the setting by the participants. By positioning the choice question after asking for WTP, possible anchoring effects were avoided—as mentioned, participants could not change their answers to the judgment question after reading the choice questions with the calculated guarantee prices.

Empirical study: Descriptive statistics

Fifteen outliers had to be removed from the 375 responses, implying a total sample size of 360.[2] The information collected in Part 1 of the survey (customer characteristics) is set out in Table 2.

Table 2 shows that the majority of the participants are male (91%), work in the field of insurance (84%), have an education that includes knowledge about financial markets (84%), and are aware that life insurance products typically contain investment guarantees (97%). In addition, 84% have stocks in their

[2] The reasons for elimination were: (a) obviously false statements concerning WTP, possibly due to a desire to move on to the next question in the survey (e.g., 123456) and (b) disproportionate overestimation of WTP, possibly due to the question being too complex for the particular participant (e.g., WTP twice as high as the initial premium invested in the fund).

portfolio and thus have experience with financial market volatility. Most respondents are between 30–45 years old (52%) and 46–65 years old (42%). Interestingly, most respondents consider themselves risk neutral (55%); 27% classify themselves as risk seeking, while only 18% are risk averse. Even though all survey participants have some connection to insurance and finance, 19% do not own a pension or life insurance product other than obligatory state pension schemes. Of those, 15% do not even plan to buy insurance. However, most participants own one or multiple contracts (81%), of which more than half are unit-linked.

To summarize, while the majority of our respondents have experience with the stock market, an educational and job profile related to insurance and finance, and consider themselves as risk neutral or even risk seeking, a substantial number have a rather critical attitude toward life and pension products.

Before conducting a more detailed analysis of the impact of these customer characteristics on their respective WTP for investment guarantees in unit-linked life policies, we first examine descriptive statistics of WTP for different product designs and contrast them with prices based on option pricing theory (OPT). Results are displayed in Table 3, including mean, median, and standard deviation of results of Part 2 of the survey for unit-linked life policies with two underlying funds—medium risk (50% money market and 50% stocks) and high risk (100% stocks)—and two levels of guarantee, a money-back guarantee (Guarantee I) and a minimum interest rate of 2% on the initial premium (Guarantee II). In addition, we varied the amount of the initial premium to CHF 50,000 (instead of CHF 10,000) and the contract term to 20 years (instead of 10 years). The theoretical minimum guarantee costs obtained using the Black-Scholes formula in Equation (2) are given in the first column of Table 3 (“OPT model”). The column “p-value” contains the results for the two-sided t-test on whether the average WTP (“mean”) significantly differs from the insurer’s minimum OPT price.

The results demonstrate that, on average, default probabilities were significantly overestimated. In the case of a medium-risk fund, for instance,

the actual default probability given the input parameters in Table 1 is 7%, while the subjective default probability estimated by the respondents is around 20%—substantially higher. Despite this judgment, the respondents' WTP to prevent this default by purchasing an additional guarantee (e.g., money-back guarantee—Guarantee I) is significantly lower than the minimum price the insurer would be expected to charge given the input parameters.

Taking Guarantee I and the underlying high-risk fund as an example, we find that the subjective WTP of CHF 401 is almost 65% lower than the theoretically calculated guarantee cost of CHF 1,117. Similar results are observed for all product designs in Table 3, with the exception of Guarantee I for the longer contract term of 20 years, in which case the subjective price is almost equal to the OPT reservation price.

Table 3 also provides information on whether the subsample with a positive WTP has a significantly lower price perception compared to the total sample (right columns). The results show that between 10% and 37% of the participants (depending on the product design) are not willing to pay a positive amount for an additional guarantee. Furthermore, in this subsample, WTP is no longer clear-cut. For instance, in the case of a medium-risk fund with Guarantee I, subjective WTP is almost the same as the theoretical price, but in the case of a contract term of 20 years, the WTP of CHF 326 on average significantly *exceeds* the price calculated using the OPT model (CHF 204). All other product designs, however, show a subjective WTP that is significantly less than the OPT model price.

Further analysis shows that WTP is significantly higher when increasing the guarantee (from a money-back guarantee to a 2% guaranteed interest rate) and when switching from a medium-risk fund to a high-risk fund (using a one-sample t-test). Furthermore, we observe that in every case there are more people with a positive WTP for Guarantee II than there are for Guarantee I. In other words, fewer people are willing to pay anything for Guarantee I. Nevertheless, the WTP of those who are willing to pay for Guarantee I (except in the case of the high-risk fund) is always closer to the OPT model price than

the WTP of those willing to pay for Guarantee II. This means that a money-back guarantee is less in demand, but that when it is wanted, customers are fairly willing to pay the OPT model price. The nature of the product also seems to have an impact on WTP. Most people with a positive WTP are found for the product investing in a high-risk fund and for the product investing in a medium-risk fund with an initial premium of CHF 50,000. The product investing in a medium-risk fund with a contract term of 20 years appears to less attractive when it comes to WTP for a guarantee.

However, additional analysis reveals that there is still a considerable number of people who is willing to pay more than the minimum OPT model price as illustrated in Table 4. Interestingly, the results demonstrate a shift of participants' preferences. Looking at the subsample with a positive WTP (Table 3, right columns), there are more participants who prefer Guarantee II to Guarantee I for every product design, i.e., more people are willing to pay a positive price for Guarantee II compared to Guarantee I. However, when looking at the subsample with a WTP exceeding the OPT price, we observe that for every product design, there are always more participants with a WTP that exceeds the insurer's OPT price for Guarantee I compared to Guarantee II. Thus, the price plays an important role in the decision making process of buying (or not buying) additional guarantees, a finding as we will see again in Part 3 of the survey, where the participants have to choose between the different products for given OPT prices.

As the WTP of a number of people is only marginally below the OPT price, the right columns of Table 4 additionally include the average WTP of people whose WTP is 5% lower than the OPT price (last column). The respective OPT prices are given in the second column ("OPT model - 5%"). Depending on the product design, the results show that between 6% and 28% of the participants are willing to pay sufficient or more than the guarantee would cost. Decreasing the OPT price by 5%, between 6% and 32% would do so. Certainly, the price for the guarantees obtained with the OPT model is only a lower bound to the real-world price since there are, e.g., no transaction costs included and thus, the 5% less off of the OPT price may be hardly realizable

for the product provider. In addition, time effects have to be considered since historical volatility is recently very high and leads to higher guarantee cost.

Looking at the high standard deviations, we find that for the subsample with a WTP higher than the OPT prices, stating the WTP will be difficult, too. Furthermore, one has to question whether they are indeed willing to pay these prices in reality, especially those with an extraordinary high WTP.

In order to more closely analyze our findings, Table 5 provides the customer characteristics of the subsample with a WTP that exceeds the OPT price. The different subsamples for every type of product design are similar to the main sample: The majority is male, between 30 and 45 years old, works in the insurance area, had an education that involves knowledge about financial markets, owns stocks, knows about investment guarantees in life insurance, and owns multiple life insurance contracts. However, we can still observe certain shifts. For three product designs (Guarantee II for the medium-risk fund, Guarantee I for the high-risk fund, and Guarantee II for the medium-risk fund with a contract term of 20 years), the majority is risk seeking instead of risk neutral. Additionally, the number of risk averse people willing to pay more than the OPT price increased, e.g., for products with a higher initial premium (CHF 50,000 instead of CHF 10,000). Whereas most participants of the main sample own at least one unit-linked product, the majority of all different subsamples (except for Guarantee II for the medium-risk fund with a contract term of 20 years) possesses no unit-linked life insurance product.

To obtain a more comprehensive picture of customer preferences, Part 3 of the survey asked participants to choose between three unit-linked products, given OPT guarantee prices (see also the first column, “OPT model,” of Table 3). Results are displayed in Table 6. Consistent with the results from Table 3, we find that a majority of the participants chose Product A without any additional guarantee (44% medium-risk fund/44% high-risk fund). However, there was still a substantial proportion—more than half—who were willing to purchase an additional guarantee. Overall, more persons prefer the money-back guarantee over the 2% minimum interest rate guarantee. The results do not

substantially differ when comparing the results for the underlying medium- and the high-risk fund. However, while Table 3 shows that demand is, generally speaking, higher for Guarantee II than for Guarantee I, we see from Table 6 that many respondents prefer a product without any additional guarantees when they are confronted with the OPT model prices. As all participants were consistent with their previous statements concerning WTP, that is, no one chose a product in Part 3 that exceeded his or her WTP, we may assume that it is not the idea of a guarantee per se that discourages customers from buying one, but the price—even though the OPT price for the guarantee in our model is lower than it would currently be in reality.

In summary, this descriptive analysis clearly demonstrates the difficulty in explicitly assessing the value of an investment guarantee in a unit-linked life insurance policy. By comparing subjective guarantee values with minimum guarantee costs obtained using a theoretical option pricing model, we show that respondents, even though they all had a background in financial services with experience in financial markets, valued guarantees significantly lower than the theoretical price. In this respect, it is important to stress that the price for the guarantee obtained with the OPT model is a lower bound to the real-world price (since there are no transaction costs included, nor jumps in the stock price model, nor model risk in general, etc.). Thus, even though a direct judgment of the value of a guarantee is highly complex and difficult for the participants—even in this fairly knowledgeable sample—the empirical findings still allow the tentative conclusion that the true value of investment guarantees may not be fully acknowledged by customers. However, when providing the theoretical prices and then asking participants to choose between unit-linked products with different guarantee levels for the given price, a large number of them would still select a guarantee, even though more than 40% consistently chose the product without an additional guarantee. The results of the choice option are certainly influenced by the presentation of the OPT prices (see Figure 5). Giving the participants absolute values of the costs and the premium, and thus the demanded transparency and cost overview, leads to a different price perception than giving, e.g., monthly calculated payments

(small vs. big numbers) or relative costs (under-/overestimation of probabilities).

Empirical study: Further analysis of relationships

To provide further insight into the relationship between customer characteristics and WTP, Table 7 displays respective correlations (see Figure 2 for coding). Aside from some insight into the estimation, customer characteristics appear to play only a minor role in assessing subjective WTP and estimating default probabilities. However, we do find that females have a lower WTP for guarantees, which is found to be significant for Guarantee I of the medium-risk fund and Guarantee II of the high-risk fund.

Older people are willing to pay more (except for Guarantee II medium risk) and have a higher subjective estimate of default probabilities. A significant relation of this is found for the default probability of the high-risk fund. As expected, persons who see themselves as risk seeking tend to have a lower WTP. Other characteristics with significant relation were persons having a job in an area other than insurance or finance, who tend to more greatly underestimate the default probability for the high-risk fund compared to persons working in insurance or financial services.

At the same time, these people have a higher WTP for investment guarantees (except for Guarantee I high-risk fund). Persons without an education in financial markets estimate the default probability as significantly higher than do persons who do have such an education. Those who do not own any stocks tend to underestimate the default probabilities for the medium-risk fund compared to those who hold stocks.

Participants owning one or more life or pension products are willing to pay less compared to those without life insurance products, even though their subjective default probability for the high-risk fund is slightly higher. Persons with more than one life or pension product have a lower WTP for both types of guarantees and both fund types. Similar results are observed for the fund

with an initial premium of CHF 50,000, for the fund with a contract term of 20 years, and for the choice-options (see Table 8).

The above findings are confirmed by an ANOVA analysis between customer characteristics and WTP, as shown in Table 9. The table reveals that customer characteristics have no significant effect on levels of WTP, except of the characteristic "gender", neither do they reveal a significant trend. Only "gender" shows significant differences in respect to the WTP of men and women. For all types of guarantees, we observe the trend that male persons are willing to pay considerably more than females. This proves significant for Guarantee I for the medium risk fund (with an initial up-front premium of CHF 10,000) on a 99% level and for Guarantee I and II for the medium risk fund with an initial up-front premium of CHF 50,000, both on a 99.5% level. In all three cases, women are on average willing to pay more than 50% less than men. However, the average WTP of men is still too small to cover the minimum guarantee costs calculated using option pricing theory. Except for the customer characteristic “gender", customer characteristics do not show any significant differences between groups and thus, do not represent good predictors of WTP by group. These results indicate that even within different groups, it is difficult to state WTP and, presumably, that there is no reference point for evaluating guarantees within these different groups.

Looking at the ANOVA analysis of the subsample whose WTP exceeds the OPT price (Table 10), we can observe that the customer characteristic "job" has a significant effect on the WTP in the case of Guarantee II for the medium-risk fund. People who work in the area of insurance are willing to pay more (mean: CHF 1,952) than people employed in the financial area, but not insurance (mean: CHF 1,171), or in a different area (mean: CHF 1,783). Another significant group difference can be found for Guarantee II for the medium-risk fund with an initial up-front premium of CHF 50,000. Stock owner are willing to pay almost 25% less than non-stock owners. Interestingly, women are now willing to pay more than men for Guarantee I for the medium-risk fund with a contract term of 20 years. This finding indicates that women probably more consequently follow their reference

points than men since the OPT price is increasing with the order of the different product designs and only the last design (medium-risk fund, contract term 10 years) is decreasing again. Also, the other two significant group effects confirm the importance of the reference point. Participants working in the financial area or owning stocks, thus having a kind of reference point in mind in regard to prices of investment products or investment guarantees, default probabilities, etc., have a WTP closer to the OPT price than others. Stockowners, for instance, are willing to pay CHF 8,655 on average for the guarantee costing CHF 5,015 whereas non stockowners would pay more than twice of the OPT price. Even if the hypothetical WTP may overestimate the real WTP in some cases, these results offer valuable insight and illustrate fundamental preferences in regard to WTP for guarantees in unit-linked life insurance.

4. Discussion and Policy Implications

The results of our empirical study show that participants are on average not willing to pay the minimum premium necessary to secure the guarantees in insurance products. This is true, even though the cost of the guarantee in our model can in general be considered to represent a lower bound to the "true" costs due to the underlying assumptions (no inclusion of, e.g., jumps in the underlying asset process, stochastic volatility, transaction costs). Thus, the market price might even be higher. Nevertheless, we found that people are generally positively disposed toward guarantees, especially in the case of high-risk products or products with a higher premium volume. Additionally, for every type of guarantee, we still find a substantial portion of up to one third of the participants, who are willing to pay a price that substantially exceeds the option price. Further research could thus focus on the characteristics of this group in more detail and analyze biases as to what extent the hypothetical WTP may be overestimated or not. In addition, it would be worthwhile comparing results for WTP in a different time period when historical volatility and, thus, guarantee costs are lower. However, at the moment, customers' average maximum WTP in our sample does not suffice to cover the reservation price derived by option pricing theory.

We also expected that people would find it difficult to directly assess "true" subjective WTP for insurance-related guarantees. This expectation was confirmed when considering the considerable deviations of the stated WTP and the high number of outliers, which makes a direct assessment of "true" subjective prices for guarantees very difficult. There are several explanations for this finding. First, perhaps the most obvious reason is the complexity of the product. Specifically, even for our fairly knowledgeable sample, the products are complicated for consumers to evaluate in anything close to an objective manner. Second, most consumers have only a very low involvement regarding insurance products and very rarely engage in insurance purchase decision making, with the result that they generally do not have a reference or anchoring point available against which to judge prices (Kahneman and Tversky, 1979). Third, we conducted a survey that included direct open-response questions eliciting subjective WTP, a cognitively very demanding task, especially in the absence of a reference point. Even so, by directly asking if and how much people are willing to pay for guarantees, the survey should be a first step in discovering whether a reference point can be derived for insurance products, how well these products are understood, and to what extent subjective WTP differs from insurers' OPT prices.

Interestingly, customer characteristics, such as age, gender, or risk attitude, had no influence on these findings, as reflected in the lack of statistical significance. It thus appears that even for our sample, more than 90% of whom work in the fields of insurance or finance typical customer characteristics have only very low power in explaining WTP, customer estimates of default probabilities, and the general lack of understanding the products. This is true even for our sample, where more than 90% of participants work in the fields of insurance or finance.

Due to the selection of the sample, our findings and their implications cannot be generalized, and external validity is not entirely given. However, even though interpretations and policy implications are tentative, the present research still allows deducting of some practical implications for insurers.

First, and as pointed out earlier, the complexity of insurance products is very high, and people may not be able to fully understand these products or single elements of them, nor evaluate or compare them entirely. Consequentially, the question arises, if it is advisable and justifiable to offer rather complex products instead of offering a transparent product design that may increase customer value. Second on average, the WTP for investment guarantees does not suffice to cover the minimum reservation price. Thus, the question arises to what extent the product design considers customer preferences and, more specifically, the trade-off between the wish for high guarantees (and thus a secure payoff at maturity) and the associated costs. Certainly, life insurance products with different types of embedded guarantees may imply a unique selling proposition for insurance companies. However, the results of the study challenge the reasonability of investment guarantees in this context, especially in regard to the insufficient average WTP, if costs are communicated in a transparent way. This is important in the context of the current demand for more transparency, since our empirical study suggests that customers may often not choose the products or pay the required price when they are fully informed about absolute costs and pay-off structure. However, these results may change when altering, e.g., the presentation of the premium payment method (monthly instead of up-front; percentage of fund value instead of absolute). Third, regulatory authorities and tax subsidies generally obligate people to buy guarantees, even if customers may not be willing to voluntarily buy and pay for these guarantees. Thus, regulatory authorities should reflect requirements in regard to guarantees against the background of customers' interests. Doubtless, it is important to protect customers, and in particular to prevent elderly poverty, but on the other hand, massive regulatory frameworks may constrict market mechanisms and thus conceal cost transparency.

Hence, to summarize these tentative implications, it is to consider whether insurance companies should reassess their product designs and to conduct an in-depth analysis of customers' needs in order to ensure a sufficient WTP that exceeds the minimum reservation price. Further, regulatory authorities should readjust their frameworks, both parties towards a reduction of complexity, an increase of (cost) transparency, and a more comprehensive consideration of

customer preferences, e.g., by integration of customer surveys. However, due to the specific choice of the sample and the method, these implications can only be considered as a first indication and have to be confirmed in further research.

5. Summary and Outlook

In this paper, prices for investment guarantees for unit-linked life or pension products based on options pricing theory were compared to subjective WTP. To elicit the subjective WTP, we conducted an online questionnaire comprised of direct open-response questions and choice options. Biases and heuristics that could play a role in probabilistic or risky decision making, as gleaned from the literature, were taken into consideration. The results from the questionnaire were compared to the actual minimum premium calculated with the Black and Scholes option pricing formula. The majority of the participants had some connection to either insurance or finance, an aspect of survey design necessitated by the complexity of the products they were asked to evaluate and choose from and the subject matter of the direct open-response questions.

The results of this study show that the average WTP of customers for investment guarantees in unit-linked life insurance products is significantly lower than the minimum price the insurer would be expected to charge. However, there was still a substantial portion of participants whose WTP considerably exceeded the insurer's minimum reservation price. The assumption of the difficulty to directly state individual WTP due to the absence of a reference point for insurance products has also proved true. For both findings, customer characteristics had no influence on it, and differences between groups could hardly be observed. Our results indicate first implications, such as the reassessing of product designs by insurers, and of the regulatory framework by regulatory authorities, which have to be analyzed in detail in further analyses.

We have shown that on average, there is too little WTP for guarantees in unit-linked life insurance, no reference point to rely on, and that there is not much

of a link, if any, between customer characteristics and WTP. Thus, the way is now cleared for work on determining indirect WTP and why subjective prices are so low on average and still high for a considerable portion of the sample. Thus the data from this study constitute a first step in examining the contrast between minimum prices for guarantees in unit-linked life insurance policies based on a financial pricing approach and the subjective WTP of customers. However, it difficult to examine the "real" willingness of consumers, especially since insurance products are perceived as product bundles, comprised of several items, including price, service, image, etc. Thus, there is a discrepancy between real and hypothetical WTP. The next step is to replicate and extend this study by investigating these dimensions for buying insurance, measuring their extent, and analyzing indirect WTP for guarantees by conducting a conjoint analysis on a panel representing, for example, the Swiss population.

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APPENDIX

Figure 1: Value function of prospect theory (Kahneman and Tversky, 1979)

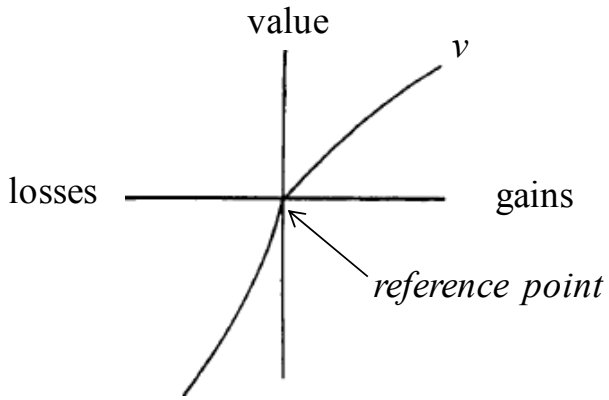


Figure 2: Design of the survey[3]—Part 1: customer characteristics

1. Gender
Male *(1)*
Female *(2)*

2. Age
18–29 years *(1)*
30–45 years *(2)*
46–65 years *(3)*
Over 65 years *(4)*

3. Job
I work in the area of insurance *(1)*
I work in the area of financial services, but not in insurance *(2)*
I work in a different area *(3)*

4. Did you complete or are you completing an education, which involves knowledge about financial markets?
Yes *(1)*
No *(2)*

5. How would you describe your risk behavior?
Risk averse *(1)*
Risk neutral *(2)*
Risk seeking *(3)*

6. Do you own stocks?
Yes *(1)*
No *(2)*

7. Do you know that life insurances generally contain investment guaranties (particularly in the form of minimum interest rate promises)?
Yes *(1)*
No *(2)*

8a. Do you own a pension or life insurance product (e.g. pension fund or life insurance)?
No, and signing a contract is not planned either *(1)*
No, but signing a contract is planned *(2)*
Yes, I own one contract *(3)*
Yes, I own multiple contracts *(4)*

8b. *(Only if you answered Question 8a with "Yes")*: Is there a unit-linked life insurance product amongst them?
☐ Yes, one *(1)*
☐ Yes, multiple *(2)*
☐ No *(3)*
☐ I don't know *(4)*

Note: Italic numbers in parentheses display coding scheme.

[3] The survey has originally been conducted in German. The Appendix contains a translation.

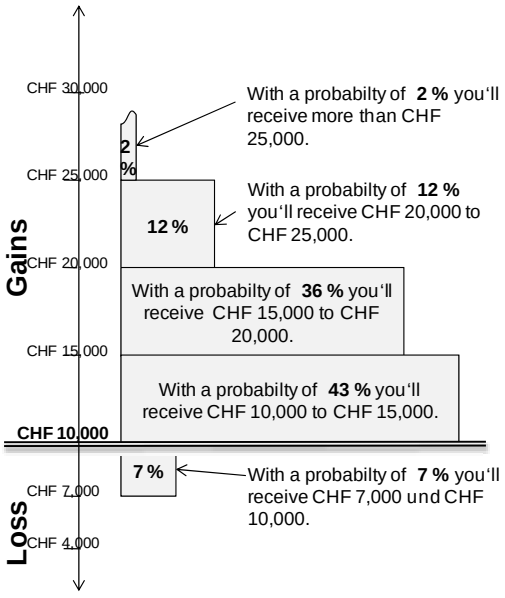
Figure 3: Design of the survey Part 2: description of unit-linked product

For your retirement provision, you have the possibility to sign a unit-linked life insurance with the following contract characteristics:

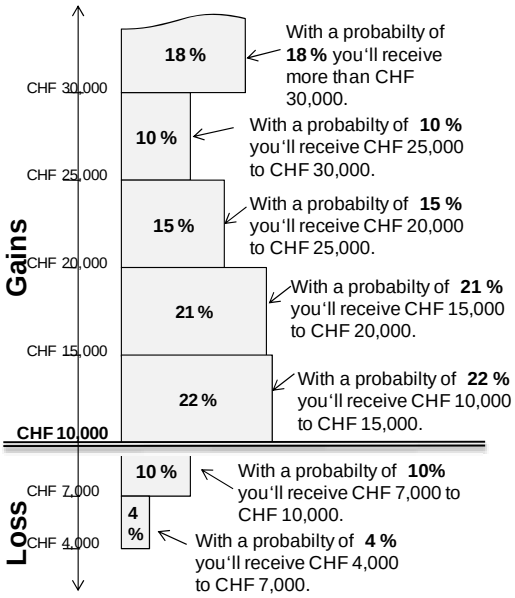
- Single premium at the signing of the contract: CHF 10,000
- Contract duration: 10 years
- Investment: the premiums will be invested in the financial markets either in a medium-risk fund (50% stocks and 50% bonds) or in a high-risk fund (100% stocks)
- Payout at maturity: worth of the fund's assets. Due to the uncertain development of the financial markets, the value of the fund and thus the payout are uncertain.

At maturity of the contract, the payout profile of the fund's assets looks as follows. As you can infer from the below graphs, due to uncertain developments in the financial markets, profits but also losses are possible. In order to protect yourself against possible losses, on the next page you have the choice between two guarantees, which you can buy additionally.

a) medium-risk fund



b) high-risk fund



Guarantee I: You receive back at least your deposited premium, i.e., a guaranteed payout of CHF 10,000 or more.

Guarantee II: You receive back at least your deposited premium with an additional interest payment of 2%, i.e., a guaranteed payout of CHF 12,214 or more.

Figure 4: Design of the survey—Part 2: willingness to pay

How much is your maximal willingness to pay for a given guarantee, which you have to pay in addition to the single premium of CHF 10,000
(in CHF)

- with a medium-risk fund for Guarantee I (i.e., guaranteed payout of CHF 10,000 or more)?
- with a medium-risk fund for Guarantee II (i.e., guaranteed payout of CHF 12,214 or more)?
- with a high-risk fund for Guarantee I (i.e., guaranteed payout of CHF 10,000 or more)?
- with a high-risk fund for Guarantee II (i.e., guaranteed payout of CHF 12,214 or more)?

How much is your maximal willingness to pay for the given guarantee, when you now have to pay a single premium of CHF 50,000 (instead of CHF 10,000) and it is invested in a medium-risk fund
(in CHF)

- for Guarantee I (i.e., guaranteed payout of CHF 50,000 or more)?
- for Guarantee II (i.e., guaranteed payout of CHF 61,070 or more)?

How much is your maximal willingness to pay for the given guarantee, when your contract has a duration of 20 years (instead of 10 years) (single premium = CHF 10,000; medium-risk fund)

- for Guarantee I (i.e., guaranteed payout of CHF 10,000 or more)?
- for Guarantee II (i.e., guaranteed payout of CHF 14,918 or more)?

Figure 5: Design of the survey—Part 3: choice of product

Here you have the choice between three different products, which either do not contain a guarantee (Product A) or contain guarantees in different extent (Product B and Product C). Which of the three products would you choose in each case? Mark with a cross please.

a) Your single premium is invested in the financial markets in a medium-risk fund (50% stocks and 50% bonds).
   - ☐ Product A: *(1)*
     - No guarantee
     - Payout of more or less than CHF 10,000 (depending on the evolution of financial markets)
     - No additional costs
   - ☐ Product B: *(2)*
     - Guaranteed payout of the deposited single premium (i.e., CHF 10,000 or more, 0% yield)
     - Additional costs for the guarantee: CHF 300
   - ☐ Product C: *(3)*
     - Premium returns a minimum of 2% (guaranteed payout: CHF 12,214 or more)
     - Additional costs for the guarantee: CHF 1,000

b) Your single premium is invested in the financial markets in a high risk fund (100% stocks).
   - ☐ Product A: *(1)*
     - No guarantee
     - Payout of more or less than CHF 10,000 (depending on the evolution of financial markets)
     - No additional costs
   - ☐ Product B: *(2)*
     - Guaranteed payout of the deposited single premium (i.e., CHF 10,000 or more, 0% yield)
     - Additional costs for the guarantee: CHF 1,120
   - ☐ Product C: *(3)*
     - Premium returns a minimum of 2% (guaranteed payout: CHF 12,214 or more)
     - Additional costs for the guarantee: CHF 2,060

Note: Italic numbers in parentheses display coding scheme.

Table 1: Expected value ($\mu - 0.5\sigma^2$) and standard deviation (σ) of annualized continuous returns for selected indices

Asset class	Index	$\mu - 0.5\sigma^2$	σ
Stocks (Swiss)	SMI (Total Return Index)	5.975%	17.220%
Money (Swiss Money Market)	Yield on bonds of the Swiss Confederatio (duration of 10 years; period from 1994 - 2008)	2.148%	-
Portfolios:			
50% Bonds 50% Stocks	Medium-risk fund	4.061%	8.610%
100% Stocks	High-risk fund	5.975%	17.220%

Table 2: Survey Part 1—Description of the sample (absolute frequency, percentage in parentheses)

Gender				
Male	Female	Total		
326 (91%)	34 (9%)	360 (100%)		
Age				
18–29 years	30–45 years	46–65 years	over 65 years	Total
19 (5%)	186 (52%)	152 (42%)	3 (1%)	360 (100%)
Job				
I work in the area of insurance	I work in the area of financial services, but not in insurance	I work in a different area	Total	
301 (84%)	27 (7%)	32 (9%)	360 (100%)	
Education involves knowledge about financial markets				
Yes	No	Total		
302 (84%)	58 (16%)	360 (100%)		
Attitude toward risk				
Risk averse	Risk neutral	Risk seeking	Total	
65 (18%)	198 (55%)	97 (27%)	360 (100%)	
Own stocks?				
Yes	No	Total		
302 (84%)	58 (16%)	360 (100%)		
Know about investment guarantees in life insurance?				
Yes	No	Total		
348 (97%)	12 (3%)	360 (100%)		
Own a pension or life insurance product?				
No, and signing a contract is not planned	No, but signing a contract is planned	Yes, I own one contract	Yes, I own multiple contracts	Total
56 (15%)	13 (4%)	96 (27%)	195 (54%)	360 (100%)
If yes, is there a unit-linked product among them?				
Yes, one	Yes, multiple	No	I don’t know	Total
99 (28%)	48 (13%)	143 (40%)	1 (0%)	291 (81%)

Table 3: Survey Part 2—Subjective WTP versus guarantee costs according to option pricing model (in CHF)

		All participants (n=360)				Participants with WTP > 0		
	OPT model	Mean	p-value	Median	Std	Mean	p-value	N (out of 360)
Medium-risk fund								
Default probability	7%	20%	0.00%	11%	20%			
Guarantee I	298	219	0.00%	100	314	294	84.40%	268
Guarantee II	1,003	516	0.00%	400	552	582	0.00%	319
High-risk fund								
Default probability	14%	36%	0.00%	30%	23%			
Guarantee I	1,117	401	0.00%	250	485	489	0.00%	295
Guarantee II	2,057	788	0.00%	500	858	876	0.00%	324
Premium 50,000, medium-risk fund								
Guarantee I	1,491	1,045	0.00%	500	1,375	1,330	5.77%	283
Guarantee II	5,015	2,344	0.00%	1,500	2,634	2,613	0.00%	323
Contract term 20 years, medium-risk fund								
Guarantee I	204	206	93.8%	50	384	326	0.00%	227
Guarantee II	1,363	603	0.00%	250	958	724	0.00%	300

Notes: Guarantee I = money-back guarantee; Guarantee II = 2% guaranteed interest rate on premium; default probability = probability that the maturity fund value falls below the single up-front premium; medium-risk fund = 50% money market and 50% stocks; high-risk fund = 100% stocks; p-value for two-sided t-test (with respect to the guarantee costs according to option pricing theory (OPT) model with data from Table 1); N = number of respondents with WTP > 0.

Table 4: Survey Part 2—Subjective WTP exceeding guarantee costs according to option pricing model (in CHF)

	OPT model	OPT model - 5 %	Participants with WTP > OPT price			Participants with WTP > 5% off of OPT price		
			N (out of 360)	Mean	Std	N (out of 360)	Mean	Std
Medium-risk fund								
Guarantee I	298	283	99	600	378	99	600	378
Guarantee II	1,003	953	33	1,851	578	74	1,379	573
High-risk fund								
Guarantee I	1,117	1,060	22	1,750	706	23	1,722	703
Guarantee II	2,057	1,954	21	3,179	1,363	38	2,651	1,165
Premium 50,000, medium-risk fund								
Guarantee I	1,491	1,416	96	2,828	1,531	96	2,828	1,531
Guarantee II	5,015	4,764	32	8,950	2,674	56	7,257	2,815
Contract term 20 years, medium-risk fund								
Guarantee I	204	194	91	671	533	114	576	512
Guarantee II	1,363	1,295	41	2,763	1,391	41	2,763	1,391

Notes: Guarantee I = money-back guarantee; Guarantee II = 2% guaranteed interest rate on premium; medium-risk fund = 50% money market and 50% stocks; high-risk fund = 100% stocks; N = number of respondents with WTP > 0.

Table 5: Description of the subsamples with WTP ≥ OPT price (absolute frequency, percentage in parentheses)

		All partici-pants (N=360)	Participants with WTP ≥ OPT (Subsamples)							
			Medium-risk fund		High-risk fund		Medium-risk fund; Premium: 50,000		Medium-risk fund; Contract term: 10 years	
		Total	G I	G II	G I	G II	G I	G II	G I	G II
Total		360 (100%)	99 (100%)	33 (100%)	22 (100%)	21 (100%)	96 (100%)	32 (100%)	91 (100%)	41 (100%)
Gender	Male	326 (91%)	93 (94%)	32 (97%)	22 (100%)	21 (100%)	92 (96%)	32 (100%)	87 (96%)	38 (93%)
	Female	34 (9%)	6 (6%)	1 (3%)	0 (0%)	0 (0%)	4 (4%)	0 (0%)	4 (4%)	3 (7%)
Age	18-29 years	19 (5%)	2 (2%)	1 (3%)	1 (5%)	1 (5%)	2 (2%)	1 (3%)	3 (3%)	4 (10%)
	30-45 years	186 (52%)	56 (57%)	19 (58%)	15 (68%)	14 (67%)	54 (56%)	19 (59%)	48 (53%)	24 (59%)
	46-65 years	152 (42%)	40 (40%)	13 (39%)	6 (27%)	6 (29%)	39 (41%)	12 (38%)	39 (43%)	13 (32%)
	over 65 years	3 (1%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	1 (1%)	0 (0%)
Job	Area of insurance	301 (84%)	81 (82%)	24 (73%)	18 (82%)	17 (81%)	79 (82%)	26 (81%)	74 (81%)	34 (83%)
	Area of financial services	27 (7%)	7 (7%)	3 (9%)	0 (0%)	0 (0%)	8 (8%)	0 (0%)	8 (9%)	2 (5%)
	Different area	32 (9%)	11 (11%)	3 (9%)	4 (18%)	4 (19%)	9 (9%)	6 (19%)	9 (10%)	5 (12%)
Education incl. know-ledge about fin. Markets	Yes	302 (84%)	83 (84%)	28 (85%)	20 (91%)	18 (86%)	82 (85%)	27 (84%)	73 (80%)	35 (85%)
	No	58 (16%)	16 (16%)	5 (15%)	2 (9%)	3 (14%)	14 (15%)	5 (16%)	18 (20%)	6 (15%)
Attitude toward risk	Risk averse	65 (18%)	26 (26%)	6 (18%)	6 (27%)	4 (19%)	24 (25%)	7 (22%)	22 (24%)	8 (20%)
	Risk neutral	198 (55%)	48 (49%)	13 (39%)	6 (27%)	9 (43%)	44 (46%)	13 (41%)	47 (52%)	16 (39%)
	Risk seeking	97 (27%)	25 (25%)	14 (42%)	10 (45%)	8 (38%)	28 (29%)	12 (38%)	22 (24%)	17 (41%)
Own stocks?	Yes	302 (84%)	85 (86%)	27 (82%)	19 (86%)	17 (81%)	83 (86%)	28 (88%)	77 (85%)	34 (83%)
	No	58 (16%)	14 (14%)	6 (18%)	3 (14%)	4 (19%)	13 (14%)	4 (13%)	14 (15%)	7 (17%)
Know about guarantees in life ins.?	Yes	348 (97%)	97 (98%)	31 (94%)	21 (95%)	20 (95%)	95 (99%)	30 (94%)	87 (96%)	40 (98%)
	No	12 (3%)	2 (2%)	2 (6%)	1 (5%)	1 (5%)	1 (1%)	2 (6%)	4 (4%)	1 (2%)
Own a pension or life insurance product?	No, no signing planned	56 (15%)	19 (19%)	7 (21%)	4 (18%)	4 (19%)	20 (21%)	6 (19%)	14 (15%)	7 (17%)
	No, signing planned	13 (4%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	1 (2%)
	Yes, one contract	96 (27%)	28 (28%)	9 (27%)	7 (32%)	7 (33%)	30 (31%)	9 (28%)	28 (31%)	14 (34%)
	Yes, multiple contracts	195 (54%)	52 (53%)	17 (52%)	11 (59%)	10 (48%)	46 (48%)	17 (53%)	48 (53%)	19 (46%)
If yes, is there a unit-linked product among them?	Yes, one	99 (27%)	23 (23%)	9 (27%)	5 (28%)	6 (35%)	21 (28%)	9 (35%)	26 (34%)	13 (39%)
	Yes, multiple	48 (13%)	11 (11%)	3 (9%)	3 (17%)	1 (6%)	11 (14%)	3 (12%)	11 (14%)	5 (15%)
	No	143 (40%)	46 (46%)	12 (42%)	10 (56%)	10 (59%)	44 (58%)	14 (54%)	39 (51%)	15 (45%)
	I don't know	1 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Notes: G I = money-back guarantee; G II = 2% guaranteed interest rate on premium; medium-risk fund = 50% money market and 50% stocks; high-risk fund = 100% stocks

Table 6: Survey Part 3—Choice between three unit-linked life insurance products given OPT model price; absolute frequency, percentage in parentheses

	Product A: no guarantee no additional costs	Product B: money-back guarantee CHF 300 (for medium risk) CHF 1,000 (for high risk)	Product C: 2% minimum interest rate guarantee CHF 1,120 (for medium risk) CHF 2,060 (for high risk)
Medium-risk fund	157 (44%)	124 (34%)	79 (22%)
High-risk fund	160 (44%)	117 (33%)	83 (23%)

Table 7: Correlations between customer characteristics and WTP

		Medium-risk fund			High-risk fund		
		Default proba-bility	**Guaran-tee I**	**Guaran-tee II**	**Default probability**	**Guaran-tee I**	**Guaran-tee II**
Gender	Pearson Correlation	-.038	-.093*	-.058	.044	-.063	-.088*
	Sig. (2-tailed)	.471	.079	.274	.405	.231	.097
Age	Pearson Correlation	.079	.048	-.030	.136***	.049	.021
	Sig. (2-tailed)	.132	.360	.568	.010	.354	.687
Job	Pearson Correlation	-.067	.058	.066	-.105**	-.005	.005
	Sig. (2-tailed)	.207	.270	.213	.047	.919	.930
Education	Pearson Correlation	.101*	-.005	-.004	.112**	.018	.023
	Sig. (2-tailed)	.055	.928	.943	.034	.728	.665
Attitude toward risk	Pearson Correlation	.035	-.050	-.010	.008	-.081	-.021
	Sig. (2-tailed)	.503	.340	.850	.875	.126	.692
Owning stocks	Pearson Correlation	-.095*	-.013	.048	-.049	.025	.031
	Sig. (2-tailed)	.072	.812	.364	.358	.630	.560
Knowledge about guarantees	Pearson Correlation	.031	-.043	-.008	-.013	-.056	-.033
	Sig. (2-tailed)	.562	.413	.880	.810	.287	.536
Owning a life insurance product	Pearson Correlation	.053	-.017	-.030	.122**	-.013	-.052
	Sig. (2-tailed)	.311	.754	.569	.021	.813	.324

Notes: Guarantee I = money-back guarantee; Guarantee II = 2% guaranteed interest rate on premium; default probability = probability that the maturity fund value falls below the single up-front premium; medium-risk fund = 50% money market and 50% stocks; high-risk fund = 100% stocks.

*** Correlation is significant at the 0.01 level (2-tailed).

** Correlation is significant at the 0.05 level (2-tailed).

* Correlation is significant at the 0.1 level (2-tailed).

Table 8: Correlations between customer characteristics and willingness to pay

		Premium 50,000, medium-risk fund		Contract term 20 years, medium-risk fund		Choice products A–C	
		Guarantee I	Guarantee II	Guarantee I	Guarantee II	Medium-risk fund	High-risk fund
Gender	Pearson Correlation	-.107**	-.117**	-.020	-.005	-.056	.015
	Sig. (2-tailed)	.042	.027	.705	.916	.286	.773
Age	Pearson Correlation	.031	-.034	.005	-.054	.066	.051
	Sig. (2-tailed)	.561	.520	.921	.306	.211	.335
Job	Pearson Correlation	.033	.051	.018	.023	.069	.008
	Sig. (2-tailed)	.528	.331	.727	.665	.192	.873
Education	Pearson Correlation	-.021	-.015	-.015	.005	.093*	.051
	Sig. (2-tailed)	.688	.780	.778	.919	.079	.330
Attitude toward risk	Pearson Correlation	-.049	-.024	-.079	.018	-.011	-.053
	Sig. (2-tailed)	.355	.648	.136	.731	.834	.312
Owning stocks	Pearson Correlation	-.025	-.002	-.055	.059	.064	.032
	Sig. (2-tailed)	.638	.975	.298	.263	.229	.540
Knowledge about guarantees	Pearson Correlation	-.039	-.001	-.037	.010	-.067	-.067
	Sig. (2-tailed)	.456	.982	.487	.845	.202	.205
Owning a life insurance product	Pearson Correlation	-.027	-.035	.015	-.017	-.069	-.072
	Sig. (2-tailed)	.607	.505	.771	.741	.193	.176

Notes: Guarantee I = money-back guarantee; Guarantee II = 2% guaranteed interest rate on premium; default probability = probability that the maturity fund value falls below the single up-front premium; medium-risk fund = 50% money market and 50% stocks; high-risk fund = 100% stocks.

** Correlation is significant at the 0.05 level (2-tailed).

* Correlation is significant at the 0.1 level (2-tailed).

Table 9: ANOVA between customer characteristics and WTP

			Medium-risk fund		High-risk fund		Medium-risk fund; Premium: 50,000		Medium-risk fund; Contract Term: 10	
			G I	G II	G I	G II	G I	G II	G I	G II
OPT model (in CHF)			**298**	**1003**	**1116**	**2057**	**1491**	**5015**	**204**	**1363**
Gender	mean (in CHF)	total	219	516	401	788	1,045	2,344	206	603
		male	228	526	411	813	1,093	2,444	208	605
		female	129	417	306	556	590	1,393	182	588
	F		3.100	1.200	1.438	2.774	4.148	4.951	0.143	0.010
	Sig.		0.079*	0.274	0.231	0.097	0.042**	0.027**	0.705	0.919
Age	mean (in CHF)	total	219	516	401	788	1,045	2,344	206	603
		18-29 years	106	480	225	663	530	1,924	87	775
		30-45 years	223	539	405	786	1094	2,516	227	624
		46-65 years	230	498	422	817	1058	2,210	195	562
		over 65 years	133	267	167	333	600	1,200	167	333
	F		0.963	0.389	1.170	0.471	1.079	0.742	0.844	0.404
	Sig.		0.410	0.761	0.321	0.703	0.358	0.527	0.471	0.750
Job	mean (in CHF)	total	219	516	401	788	1,045	2,344	206	603
		insurance area	213	508	408	800	1,033	2,325	199	598
		financial area	206	387	263	507	956	1,674	305	549
		different area	286	694	450	921	1,239	3,088	188	701
	F		0.814	2.438	1.285	1.866	0.386	2.169	0.995	0.213
	Sig.		0.444	0.089	0.278	0.156	0.68	0.116	0.371	0.809
Education involving knowledge about fin. markets	mean (in CHF)	total	219	516	401	788	1,045	2,344	206	603
		yes	220	517	397	780	1,058	2,361	208	601
		no	215	511	421	833	979	2,256	193	615
	F		0.008	0.005	0.121	0.187	0.161	0.078	0.080	0.010
	Sig.		0.928	0.943	0.728	0.665	0.688	0.780	0.778	0.919
Attitude toward risk	mean (in CHF)	total	219	516	401	788	1,045	2,344	206	603
		risk averse	266	559	505	890	1,280	2,726	278	617
		risk neutral	207	494	380	743	972	2,171	194	573
		risk loving	211	531	374	813	1,037	2,443	180	655
	F		0.895	0.395	1.836	0.773	1.231	1.179	1.471	0.245
	Sig.		0.410	0.674	0.161	0.463	0.293	0.309	0.231	0.782
Owning stocks	mean (in CHF)	total	219	516	401	788	1,045	2,344	206	603
		yes	221	504	395	777	1,060	2,346	215	579
		no	210	576	429	849	967	2,334	157	733
	F		0.057	0.826	0.233	0.340	0.222	0.001	1.087	1.258
	Sig.		0.812	0.364	0.630	0.560	0.638	0.975	0.298	0.263
Knowledge about guarantees	mean (in CHF)	total	219	516	401	788	1,045	2,344	206	603
		yes	221	517	406	794	1,055	2,345	208	602
		no	146	492	254	638	754	2,328	130	657
	F		0.671	0.023	1.139	0.383	0.556	0.001	0.483	0.038
	Sig.		0.413	0.880	0.287	0.536	0.456	0.982	0.487	0.845
Owning a life insurance product	mean (in CHF)	total	219	516	401	788	1,045	2,344	206	603
		no (no signing	246	552	427	904	1,204	2,607	218	618
		no (signing planned)	54	396	232	607	367	1,616	29	662
		yes (one contract)	238	551	425	816	1,103	2,457	209	630
		yes (multiple contracts)	213	496	393	754	1,017	2,262	212	582
	F		1.478	0.501	0.675	0.669	1.391	0.637	0.956	0.076
	Sig.		0.220	0.682	0.568	0.572	0.245	0.592	0.414	0.973

Notes: G I = money-back guarantee; G II = 2% guaranteed interest rate on premium; medium-risk fund = 50% money market and 50% stocks; high-risk fund = 100% stocks.

* F is significant at the 0.1 level.

** F is significant at the 0.05 level.

Table 10: ANOVA between customer characteristics and WTP for the subsamples WTP ≥ OPT

		Mean (in CHF)	F	Sig.
Guarantee II, medium-risk fund (OPT price = 1,003 CHF)				
Job	total	1,851	2.758	0.080 *
	insurance area	1,952		
	financial area	1,171		
	different area	1,783		
Guarantee II, medium-risk fund, premium CHF 50,000 (OPT price = CHF 5,015)				
Owning stocks	total	8,950	2.899	0.099 *
	yes	8,655		
	no	11,018		
Guarantee I, medium-risk fund, contract term 20 years (OPT price = CHF 204)				
Gender	total	671	3.218	0.076 *
	male	650		
	female	1,133		

Notes: Guarantee I = money-back guarantee; Guarantee II = 2% guaranteed interest rate on premium; medium-risk fund = 50% money market and 50% stocks; high-risk fund = 100% stocks.

* F is significant at the 0.1 level.