Does Surplus Participation Reflect Market Discipline? An Analysis of the German Life Insurance Market

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Abstract

The aim of this paper is to analyze whether the level of surplus participation affects customer demand. We use multivariate linear regression models and data on surplus participation, new business and lapse for the German life insurance market from 1998 to 2008. We find a significant positive dependence between surplus participation and new business growth as well as a significant negative dependence between surplus participation and growth of lapse volume. Overall, these findings indicate that customers do react to changes in product characteristics, which might be seen as indicative of market discipline. Our results are important for insurance company managers, regulators, and boards of insurance associations.

Keywords Regulation · Market discipline · Life insurance · Surplus participation · New business growth · Lapses

JEL Classification G22 · G28 · G38

1 Introduction

In this work we analyze the sensitivity of customer demand with regard to surplus participation which is one of the most important product characteristics of life insurance products. The sensitivity of customer demand depends

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on market transparency. In cases of high transparency, customers might monitor the state of a company, compare product features, and react to changes accordingly. This reaction mechanism, known as market discipline, also influences management decisions (Flannery, 2001). Market discipline has recently been discussed as a new feature of insurance regulation in the European Union (new Solvency II regulation) and in the U.S. (new Solvency Modernization Initiative). In this work we focus on the situation in the European Union and especially in Germany, but we analyze questions that are relevant for other insurance markets as well. Regulators in the European Union expect a transparent market to require less government regulation since market participants themselves force insurers to behave appropriately by rewarding good management and sanctioning poor management. Market discipline constitutes one of the three pillars of the new Solvency II regulation that will be implemented by the end of 2012.

The focus of regulators in Solvency II is on risk management. Also literature on market discipline in insurance typically analyzes the risk sensitivity of customer demand (Zanjani, 2002; Epermanis and Harrington, 2006; Eling and Schmit, 2010). Many market participants in the European insurance industry are, however, skeptical with respect to market discipline under Solvency II since they do not believe that customers are both willing and able to monitor the risk situation of an insurance company. Practitioners argue that the market is non-transparent and that at best customers will monitor surplus participation, which constitutes one of the most important product characteristics.[1] This line of argument is the motivation for our empirical analysis. We analyze the sensitivity of customer demand with regard to surplus participation. If we do not find evidence that customers react to changes in surplus participation, this would confirm many practitioners' skepticism of market discipline. If, however, we do find such evidence, this would indicate that customers react to changes in surplus participation and this might motivate regulators to improve market transparency in order to enhance market discipline.

The surplus participation mechanism in the German life insurance industry is complex and requires that customers participate adequately in three predefined surplus sources called investment result, risk result, and cost/other

[1]The academic evidence on risk sensitivity of customer demand comes to ambiguous results and supports the skepticism: Zanjani (2002) and Epermanis and Harrington (2006) find evidence for risk sensitivity of customer demand in the U.S. Eling and Schmit (2010) is the only study to analyze the risk sensitivity of customer demand outside the U.S. They find only limited evidence for market discipline and conclude that regulators need to enforce market transparency, if they want market discipline to be a strong element of Solvency II.

result.[2] The actual surplus participation is to a certain extent at the discretion of the management, as the regulation of policyholder participation defines only minimum requirements which are typically exceeded to attract new customers. Until 2002, more than 96% of earned surplus[3] have been used for customer surplus participation. This ratio started to deteriorate in 2003 as a consequence of the economic crisis from 2001 to 2003. This effect continued and has been reinforced during the recent financial crisis. In 2008, only about 88.5% of earned surplus has been allocated to surplus funds for customers.

Although the empirical analysis of surplus participation in this paper is restricted to the German market, our topic is also relevant for a number of other insurance markets. Other insurance markets with similar surplus participation mechanisms at least for selected products include European countries (e.g., U.K., Denmark, and Italy) but also the U.S. and Japan (see Ballotta et al., 2006; Hansen and Miltersen, 2002; Consiglio et al., 2008; Gatzert and Kling, 2007). Furthermore, the existence of market discipline that we try to identify by analyzing surplus participation is a topic of increasing interest in most insurance markets. The measurement approach presented here might not be transferable to every market since not all international insurance markets have products with the same surplus participation mechanisms. The idea, however, to analyze market discipline via measurement of the customer's reaction to changes in product characteristics can be easily transferred.

As the surplus participation rate is a highly transparent indicator of the insurer's performance, we expect that customers react to changes of that rate. The consideration of this indicator is not without shortcomings since it can be influenced by management decisions to some extent (i.e., the management can determine a high surplus participation rate at the cost of sustainability). Nevertheless, we believe that it is a good instrument to create market discipline for three reasons: (1) customers have easy access to this indicator as

[2]The German ordinance on minimum participation for customers in life insurance (MindZV) sets out strict formal requirements. Surplus participation needs to be at least equal to the sum of (1) the maximum of 90% of the investment result and the guaranteed interest rate (specified at the beginning of the contract), (2) 75% of the risk result, and (3) 50% of the cost/other result. If the values for (2) or (3) are negative, it is set to 0, i.e., cross-subsidization among different surplus sources is not allowed.

[3]The earned surplus is calculated as gross premiums earned + investment income - claims and insurance benefits incurred - acquisition and administrative expenses + reinsurance result - other expenses - income taxes. Policyholder participation is measured as net changes in reserves for insurance and investment contracts. The corresponding figures can be directly obtained from the annual profit and loss statement of German life insurers. The market average is obtained by aggregating the values across all companies.

it represents the most widespread information in the German life insurance market and is extensively covered in newspapers and product comparisons; (2) participation rates take into account the entire business operation (i.e., investment result, risk result, and cost/other result) allowing for competitive comparisons of German life insurers; and (3) the management influence is limited through a tight regulation of the surplus participation rate as described above.[4]

Two empirical studies analyzed the sensitivity of customer demand with regard to surplus participation in Germany and arrived at conflicting conclusions. Using scatter plots and correlation analysis, Tekülve (2007) finds a positive relationship between new business growth and changes in the surplus participation rate for the years 2003 and 2004. Cottin et al. (2007) analyze the same question using data from 1995 to 2004 employing univariate linear regression models and find no significant relationship. We build upon and extend this work by using multivariate linear regression models including fixed and random firm effects and data from 1998 to 2008. Our empirical analysis is also helpful to explain the conflicting results found in these two previous studies. Furthermore, our results shall be helpful to draw conclusions on the topic of market discipline.

Our findings indicate a significant positive dependence between surplus participation and new business growth. We also identify a significant negative dependence between surplus participation and growth of lapse volume. Overall, these findings indicate that customers react to changes in product characteristics (i.e., customers discipline the managers of insurance companies by changing product demand). We therefore conclude that surplus participation actually reflects market discipline in the German life insurance market. The level of discipline found in surplus participation and the efficiency of the market mechanism might motivate regulators to further increase risk sensitivity of customer demand as currently scheduled under pillar three of Solvency II. Our findings are therefore important for managers of insurance companies, regulators, and boards of insurance associations. Our findings are also relevant to customers since they reflect the customers' potential market power.

[4]Other possible performance indicators include the so-called Finsinger rating for German life insurers or the net interest return. The Finsinger rating is also easily publicly available and takes the entire business operations into consideration but strongly depends on the underlying rating methodology making it a less objective measure (for details see Section 3.4). The net interest return only takes into account the investment result of a company. Although this is definitely one of the main performance drivers, it neglects other surplus sources completely. Moreover, both measures can also be influenced by management decisions.

The remainder of this paper is structured as follows: Section 2 describes our theoretical framework including relevant literature and the derivation of our hypotheses. Section 3 describes the methodology and data employed. Section 4 presents the empirical findings and Section 5 concludes.

2 Related Literature and Hypotheses

Market discipline can be defined as monitoring and influencing of managers' actions by customers, investors, and intermediaries (Flannery, 2001; Eling, 2010). In the insurance literature, the sensitivity of customer demand with respect to risk has typically been analyzed in the context of market discipline (Zanjani, 2002; Epermanis and Harrington, 2006; Eling and Schmit, 2010). The risk sensitivity of demand is also an important aspect beyond the background of Basel III and Solvency II which covers the determination of appropriate risk-based capital standards (pillar 1) as well as the role of customers and investors in ensuring a safe and sound industry (pillar 3). This might explain why current research on market discipline in insurance focuses on risk sensitivity.[5]

The focus of this work reflects a different dimension of market discipline (see Figure 1). We analyze the sensitivity of customer demand with respect to the surplus participation rate. We believe that monitoring time and effort of surplus participation rates is much less for customers, as this information is more readily available (e.g., through product comparisons covered in newspapers and journals). More precisely, we want to answer whether and to which extent customers react to changes in the surplus participation rate. If market discipline does exist, one can expect customers to monitor the insurers' behavior and react accordingly. Both favorable and adverse man-

[5]There are significant differences in market discipline between banking and insurance. In banking, there is a great deal of market discipline in stock and bond markets because the equity and debt of most large banks is traded on capital markets (see, e.g., Avery et al., 1988; Sironi, 2003). Much market discipline can thus be observed with traded debt, such as yields on subordinated debt. The insurance sector, however, is fundamentally different as many insurers are mutuals, not stock companies. Furthermore, many of the insurers that are organized as stock companies are not traded on the stock market, thus making effects on stock prices difficult to observe. There is also hardly any traded debt in the insurance industry since the reserves of the policyholders are in general the major part of the insurers' liabilities. For example, in Germany it is prohibited to have debt other than the reserves for policyholders and only very restrictive exceptions are allowed from this general rule (e.g., with hybrid instruments). We thus cannot observe market discipline on insurance capital markets for either equity or debt as we do in banking. For this reason existing studies on market discipline can only focus on customers and not on investors. See Eling (2010) for more details.

agement actions regarding the surplus participation rate should be observed and valued by customers. For instance, a higher/lower surplus participation rate for an endowment policy of a certain insurer should yield (all else being equal) an increase/decrease in customer demand for this specific life insurance product. Such a customer response is likely to influence future management decisions. The influencing effect, however, is hard to measure (for a more detailed discussion of the influencing component of market discipline see Flannery, 2001). Therefore, we focus on the first part of the market discipline definition, i.e., whether customers monitor company decisions and act accordingly. If this question is answered in the affirmative, this might be interpreted as a sign that market discipline is actually enforced by customers.

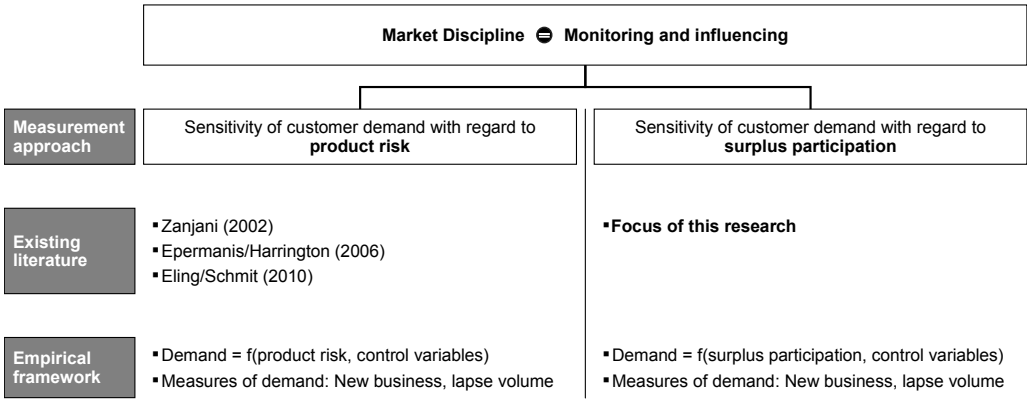

Figure 1: Research design and existing literature in insurance

In existing studies on market discipline in insurance, the customer demand is modeled as a function of product risk and other control variables. We take the identical approach, but focus on surplus participation. In our paper the customer demand is thus a function of the surplus participation rate and additional control variables. We also use the same measures of customer demand like existing literature: growth of new business and lapse volume (see, e.g., Zanjani, 2002). This allows us to consider the implications on both new business and business in force. Furthermore, we employ the same set of control variables that is typically used in empirical studies in insurance: age, size, and distribution channel. In our empirical analyses we also include measures of product risk as control variables (a solvency indicator and rating information).

Customer reaction to new business

There is a large body of empirical literature investigating macroeconomic drivers for life insurance demand, but this literature is not directly related to

surplus participation. Browne and Kim (1993), Outreville (1996), Beck and Webb (2003), and Li et al. (2007) focus on cross-national comparisons, while other authors focus on specific insurance markets (e.g., Lenten and Rulli 2006 - Australia; Millo and Carmeci 2008 - Italy; Truett and Truett 1990 - Mexico and the U.S.). An extensive overview on empirical studies regarding life insurance consumption can be found in Sen and Madheswaran (2007). All of these papers analyze insurance data at a country or regional level covering all insurance companies within the corresponding country/region, while we focus on company level data within the German life insurance market.

From a customer perspective, the life insurance purchase is usually considered as a matter of optimal capital allocation (see, e.g., Yaari 1965; Hakansson 1969; Fischer 1973) as life insurance is competing with other savings products. Sen and Madheswaran (2007) provide a detailed overview of the literature, especially of more recent publications. The corresponding discussions, however, focus on general differences between product categories. In contrast, we investigate to which extent differences in a specific product feature (surplus participation rate in our case) within the product category life insurance are monitored by customers. Different frameworks that guide individual customers in choosing the optimal life insurance contract are discussed. These take not only into account the policy premium, but also incorporate qualitative aspects like service quality. Puelz (1991) presents the analytic hierarchy process as decision framework. This approach captures individual preferences based on both subjective and objective criteria (e.g., contractual features, insurer's financial strength, and expected cash value) to maximize the customer's expected satisfaction.

A higher surplus participation rate increases, all else being equal, the cash value of a life insurance contract at the end of the contract term. As the cash value should be one of the main determinants in the decision process, we would expect that customers are particularly sensitive to participation rates. An increased cash value at the same price (assuming identical contracts that only differ in their surplus participation rates) should thus increase demand. Hence, new business growth and surplus participation rates should be positively related (*hypothesis 1*).

It is common belief that the surplus participation rate is an important factor in the competition for new business (Zimmermann 1996, p. 92; Milbrodt and Helbig 1999, p. 532), but the empirical evidence is limited so far. Two empirical analyses only study the relationship between new business development and surplus participation rates in the German life insurance industry.

Tekülve (2007) analyzes the relationship between new business premium growth and changes of the surplus participation rate credited to individual

contracts for 2003 and 2004. The author performs visual analyses employing scatter plots and correlation analyses to test the hypothesis whether there is a significant relationship between new business and surplus participation. Additionally, sub-samples (size, legal form, age, and primary distribution channel) are analyzed. Overall, the results indicate a weak and positive relationship of new business premium growth and changes in surplus participation rates, especially for companies with very high or very low participation rates. This conclusion also holds for the evaluated sub-samples.

Cottin et al. (2007) consider the impact of surplus participation rates on new business and lapse. The authors analyze data of 87 German life insurers from 1995 to 2004. They employ an univariate linear regression model to estimate the impact of the surplus participation rate spread.[6] Response and independent variables are modeled in absolute and relative terms. Different specifications of the response variable are tested, including regular premium split by product type and total number of new contracts. Additionally, different model specifications are considered, e.g., a joint model with all companies for all years and models for single companies over all years (for details see Cottin et al. 2007). Statistical tests are conducted and further measures of dependence are analyzed. Cottin et al. (2007) conclude that there is no evidence for a significant relationship between surplus participation and new business. The authors critically review their results in the light of the methodology employed. For example, they indicate that a joint univariate linear regression model for all companies seems not appropriate as well as considering regression models only for single companies.[7] They also conclude that these results should not be interpreted in such a way that the surplus participation rate has no impact on new business. Instead they assume that there is a relationship which is likely to increase in the future, but it is overlaid by other factors.

The last point constitutes a good starting point for the multivariate linear regression model that we employ in our analysis. The results of Tekülve (2007) and Cottin et al. (2007) are not consistent in that the former finds a positive relationship between surplus participation and new business, while the latter finds no such relationship. We build upon and extend the results of these two papers as follows. First, we shed new light on the conflicting results that might be explained by differences in modeling approaches and extent

[6] Cottin et al. (2007) define the surplus participation rate spread as the difference of the company specific surplus participation rate and the average surplus participation rate in the market for each year.

[7] A joint linear relationship of independent and response variable is rather unlikely. Having, however, only observations for ten years the reliability of regression models for single companies is limited (see Cottin et al. 2007, p. 345).

of analyzed data. Second, we supplement the analyses in four ways: (a) extension of the data set until 2008; (b) consideration of additional modeling approaches for the response variable using sum insured as additional variable; (c) consideration of fixed and random firm effects to account for company specific differences; and (d) use of multivariate regression models to account for additional influencing factors such as company size or solvency.

Customer reaction to business in force (lapse)

Zanjani (2002) studies lapse rates in the context of market discipline. He finds a positive relationship between company default risk and lapse rates based on U.S. data from 1988 to 1998. This result supports the conclusion that customers enforce market discipline in the U.S. market. The results found by Eling and Schmit (2010) for the German market are weaker.

The literature on lapse in life insurance takes either a customer or company perspective. Forster and Carson (2000) provide the marginal yield analysis as decision framework to support the customer when faced with the question as to whether it is beneficial to lapse an existing life insurance policy. According to Kuo et al. (2003) life insurance companies need to understand lapse behavior for three reasons: (1) The insurer might suffer losses from lapsed policies due to upfront investments for acquiring new business; (2) the insurer might face adverse selection with respect to mortality and morbidity as customers with adverse health are less likely to lapse their contract; and (3) the insurer might be exposed to a liquidity risk when forced to pay the cash surrender value for lapsed policies. The exercise of the lapse option by customers thus can impose certain threats to the profitability of life insurers (Gatzert and Kling, 2007; Gatzert and Schmeiser, 2008). A major decrease in number of lapses can also adversely affect the life insurers' profitability through reduced future surrender profits (Gatzert et al., 2009).

Two main causes for lapsing are discussed in literature. On the one hand, the interest rate hypothesis claims that an increasing market interest rate leads to increasing lapses.[8] On the other hand, customers might need to make use of cash surrender values as emergency funds in case of individual financial distress, especially during times of economic crisis. This latter approach is referred to as emergency fund hypothesis. See Dar and Dodds (1989) and Kuo et al. (2003) and the references therein for a more detailed discussion of both hypotheses. Because of the importance of lapsing behavior, different

[8]Due to the complex, interest rate volatility smoothing surplus distribution mechanisms in life insurance, the surplus participation rate follows longer term trends with a certain time gap. If the positive gap between market interest rate and surplus participation rate during periods of increasing interest rates exceeds surrender cost, lapse rates are likely to increase.

models are discussed in literature to model lapse rates appropriately (Kuo et al., 2003; Kim, 2005; Kolkiewicz and Tan, 2006).

We do not directly test one of these two hypotheses, but consider a slightly different question. We want to assess whether a significant relationship exists between surplus participation rates and lapse volumes in the German life insurance market. Viewing life insurance contracts as options package (Smith, 1982; Walden, 1985), we derive our hypotheses regarding the direction of impact. On the one hand, a contract with lower participation rate, all else being equal, is less valuable for the customer. Neglecting all surrender charges, the customer's likelihood to lapse should hence increase when the surplus participation rate decreases. One might argue that this relationship does not hold if surrender charges are considered since lapse might then be too costly. However, most customers might not be fully aware of these charges. Moreover, surrender charges have been significantly reduced in the German life insurance market through recent regulatory changes and legal practice (Becker, 2009). Additionally, due to missing incentives financial service professionals might not prevent customer lapses, even if it is not beneficial for the customer (Forster and Carson 2000). On the other hand, German life insurance saving products possess an additional option as a minimum guaranteed yield is credited on the accumulated savings.[9] It represents a put option on the surplus participation rate with the guaranteed interest rate as strike price. If the surplus participation rate is reduced and approaches the strike price, the minimum guarantee option becomes more valuable for the customer. The customer thus might be less likely to lapse when the surplus participation rate decreases. Altogether, we assume that surrender charges do not act as a deterrent and that the option value of the minimum guarantee has been limited in the considered time horizon (the average surplus participation rate in the German market has been above 4% throughout that period). Therefore, we expect a significant negative relationship between surplus participation rates and lapse volumes (*hypothesis 2*). Note that we test two joint hypotheses here. The first is that surrender charges are not too high to avoid lapses and the second is that there is a relationship between lapses and surplus participation rates.[10]

Cottin et al. (2007) is the only empirical analysis considering the relationship of surplus participation rates and lapse rates in the German market. Different modeling approaches for lapse rates are considered. However, the

[9]This guarantee is regulated and currently set to be 2.25% for new contracts, while older tariff generations receive a higher guarantee of up to 4.0%. In order to ensure the long-term fulfillment of insurance contracts this guarantee rate is defined conservatively.

[10]If the empirical analysis does not find a significant relationship, we are not able to determine whether the first or the second aspect does not hold.

overall model is the same as for new business (i.e., univariate linear regression models). The results are the same as for new business, as there is no evidence for a significant relationship between surplus participation and lapse rates. Again this does not mean that there is no relationship at all. Other effects might be present which are not covered by the univariate model. Therefore our goal is to address the hypothesis by extending the analyses to multivariate linear regression models and comparing our results to those of Cottin et al. (2007).

3 Methodology and Data

3.1 General analysis design

We analyze the influence of surplus participation rates on the development of new business and lapse volumes. Multivariate linear regression models allow us to take into account additional control variables. All data depends on the company and the year of observation. We consider the following panel data regression model

$$y_{i,t} = \beta_0 \cdot PR_{i,t} + (\beta_1, \ldots, \beta_5) \cdot CV_{i,t} + (\alpha + u_i) + \epsilon_{i,t},$$

where i indicates the respective life insurance company (individual or firm effect), t denotes the considered year (time effect), and $\epsilon_{i,t}$ specifies a mean-zero-disturbance.

The term $y_{i,t}$ denotes the response variable (see Section 3.2). We are interested in the coefficient vector $\beta = (\beta_0, \ldots, \beta_5)^T$ in order to assess whether the surplus participation rate $PR_{i,t}$ (see Section 3.3) and the control variables have a significant impact on the considered response variable. The vector of control variables $CV_{i,t} = (Size_{i,t}, FR_{i,t}, SI_{i,t}, Age_{i,t}, TA_{i,t})^T$ comprises company size, Finsinger rating, solvency indicator, company age, and distributional focus on tied agents (for all details see Section 3.4).

Three different types of regression models are analyzed depending on the specification of the intercept $\alpha + u_i$: (1) ordinary least squares (OLS), (2) fixed effects (FE)[11], and (3) random effects (RE)[12]. We conduct statistical

[11] Our data set covers an unbalanced panel of 66 to 70 insurance companies (depending on the considered response variable) over a time period of eleven years. The setup of a wide but short data set is typical for panel data. In this case heterogeneity across units is often the central analysis focus (see Greene 2003). Accordingly, we take into account only firm effects but no time effects. Besides the data design, the use of relative modeling approaches (see Sections 3.2 and 3.3) and multicollinearity issues with the considered control variables support the non-consideration of time effects.

[12] We apply the Nerlove method for estimating the variance components. This method

tests to determine the most appropriate model. We employ an F-test to assess the presence of firm effects. When firm effects are detected, a Hausman-test is used to check whether these effects are of fixed or random nature. The fixed effects model does not allow to account for time-invariant, observable control variables, such as legal form of insurance companies. Such information can be included in the OLS and RE models, but then the Hausman-test cannot be used to identify the best model. Therefore, we omit an indicator variable specifying the insurer's legal form in the regression models presented here.[13]

The regression analysis takes into account only complete data sets for a specific company and year. The data set for company i in year t is complete, if all values for response variable, participation rate, and additional control variables are available. Additionally, for each company, complete data sets are required for at least two years; otherwise the company is dropped completely from the analysis. Taking into account data availability the multivariate regression model covers roughly 50% of all company years from 1998 to 2008 (corresponding to 550 to 570 company years), but about two-thirds of new business premiums and gross premiums written.

3.2 Response variables

Two different response variables are considered: development of new business and lapse volumes. Premiums do not measure the quantity demand of insurance but represent a revenue number (i.e., price per unit times quantity; see Epermanis and Harrington 2006). To account for this potential bias, we consider the number of contracts and the sum insured as additional quantity measures. Hence, we use (1) gross premiums written, (2) number of contracts, and (3) sum insured to measure the volume of new and lapsed business.[14] We analyze (1a) total premiums (measured as annual premium equivalent[15]);

assures positive estimates of the variance components (see Baltagi 1995).

[13]The omission of potentially significant variables might introduce an estimation bias. Therefore, we run the OLS and RE regression models including an indicator variable for legal form (being 1 if the considered company is a mutual and 0 otherwise). The corresponding results indicate that this variable is significant only in three of 22 model specifications considered. Moreover, the inclusion of this variable does not materially change the coefficient estimates and significance levels for all other variables. We thus conclude that no severe bias is introduced by omitting the corresponding variable. Detailed results are available upon request.

[14]Regarding new business, one needs to distinguish between actual business (meaning new contracts) and other inflows from increases in sum insured of existing business. As we are analyzing new business effects, we only take into account the first kind of business.

[15]The annual premium equivalent combines single and regular premium business taking into account the differences in method of payment. It is calculated as sum of regular

(1b) regular premiums excluding single premiums[16] to assess the impact of single premiums; and (1c) regular premiums for endowments/annuities[17] to separate effects related to non-saving products (e.g., term life) and group insurance business. For the number of contracts we are also able to distinguish (2a) total business from (2b) endowment/annuity business. Information regarding sum insured is only available for total business. Hence, we consider six specifications for new business as response variable and five specifications for lapses (for single premiums no lapse data is available). This information can be derived from the annual reports of German life insurers.

We measure growth of the response variable relative to market growth (in percentage points), i.e.,

$$y_{i,t} = \frac{R_{i,t}}{R_{i,t-1}} - \frac{M_t}{M_{t-1}} \ ,$$

where $R_{i,t}$ denotes the value of the response variable in year t for company i and M_t represents the corresponding value for the entire market in year t. Alternative modeling approaches have been analyzed for the considered response variables (e.g., absolute growth, growth relative to market mean or median, or market share and changes of market share as proposed by Cottin et al. 2007).[18]

New business

The number of German life insurers was decreasing in recent years indicating a trend towards consolidation. While 120 life insurers were writing new business in 1998, only 97 were left in 2008. Summary statistics for average new business growth regarding premiums, contract numbers, and sum insured for all life insurers are displayed in Table 1. New business volumes were generally growing from 1997 to 2008. The growth in 1999 and 2004 was exceptional. These effects were driven by announcements of the German federal government to enforce the tax treatment of life insurance policies from the beginning of the following year. It resulted in a kind of 'closing sale' for these products driven by the different distribution channels. New business volumes then significantly dropped the following year.

premiums and 10% of single premiums assuming an average policy duration of ten years for single premium business (see Hardwick and Adams 2002).

[16]The differentiation between single and regular premiums is not possible for lapses as lapse volume is only measured in terms of regular premiums.

[17]The impact of the surplus participation might be more pronounced for endowment and annuity business containing a dominant savings component.

[18]All relative modeling approaches for the surplus participation rate yield consistent results and similar conclusions. Detailed results are available upon request.

Table 1: Summary statistics for development of new business growth, lapse volume growth, participation rate, and control variables (yearly averages, except for the solvency indicator for which the median is displayed)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
New business growth rates (in %)											
APE[a]	7.4	77.8	-37.4	21.8	10.6	16.2	59.3	-43.0	19.2	1.9	-4.2
RP[a]	10.0	79.7	-38.8	23.9	7.7	20.6	60.9	-45.0	14.6	2.1	-4.6
RP E/A[a]	7.2	76.9	-50.0	22.5	30.8	28.0	57.5	-51.7	6.1	-7.3	-7.1
NoC[a]	4.4	47.6	-27.8	16.9	24.1	-4.9	50.7	-33.9	14.6	1.4	-7.7
NoC E/A[a]	1.3	57.5	-43.8	20.8	89.0	-1.7	65.3	-43.0	15.3	-9.2	-19.7
Sum ins.	5.6	47.4	-32.2	18.5	6.0	9.8	50.1	-33.7	14.3	2.5	-2.7
Lapse volume growth rates (in %)											
RP[a]	4.9	-0.7	10.7	11.0	14.9	14.2	5.1	-3.7	3.1	-0.5	10.6
RP E/A[a]	4.0	-3.3	9.6	1.2	5.2	10.8	6.3	-5.4	1.0	-3.3	8.2
NoC[a]	7.6	-0.6	8.6	4.5	10.0	13.8	7.3	-3.2	2.0	-4.2	5.4
NoC E/A[a]	2.2	-2.3	10.3	-3.7	4.3	11.3	7.3	-6.8	1.3	-5.2	5.6
Sum ins.	4.4	2.5	7.3	13.4	10.0	13.3	3.7	1.8	2.3	-1.3	7.7
Participation rates (in %)											
Average	7.26	7.24	7.14	7.06	6.10	4.78	4.41	4.33	4.24	4.26	4.37
Control variables											
Size[b]	18.6	18.7	18.7	18.8	18.9	19.0	19.1	19.2	19.3	19.2	19.3
Rating	3.0	3.1	3.2	3.1	2.8	2.8	3.3	3.0	3.3	3.3	3.2
Solvency[c]	15.8	15.7	16.0	15.8	16.5	18.0	20.2	19.9	20.2	21.3	21.3
Age[d]	64.9	64.1	65.8	65.9	65.7	66.5	64.9	66.3	66.3	64.9	65.9
Dist. focus[e]	47.5	45.8	44.4	40.9	39.6	41.7	38.8	35.2	32.3	33.3	34.0

[a] APE = annual premium equivalent; RP = regular premiums; E/A = endowment and annuity business only; NoC = number of contracts
[b] Measured as natural logarithm of gross premiums written [in €]
[c] Median (in ‰); average is less meaningful due to outliers
[d] Measured in years
[e] Share of companies with tied agents as main distribution channel (in %)

The data is preprocessed in order to capture changes in company names as well as inorganic growth resulting from mergers, acquisitions, and portfolio transfers.[19] All of these events need to be registered with the German supervisory authority BaFin. Hence, we can identify them by reviewing the corresponding monthly notices that are published on the BaFin website. In cases of a change in name, we simply merged the corresponding time series to obtain a single time series for each company. In cases of inorganic growth, we treat the resulting larger insurer as 'new' company (see Hall, 1987). Therefore, a growth rate is neither available for the previously existing companies nor for the newly merged company in the year the transaction takes place.

As typically done in empirical research using growth rates, small compa-

[19] If raw data is used for the analysis, all variables are significant at the 1% level. This can be explained by the presence of outliers forcing the significance of the variables. The conclusions are the same when using preprocessed data but the results are more differentiated, i.e., not all variables being always significant.

nies have to be treated separately. Small premium volumes increase significantly the variation of the observed growth figures. Such figures are comparable only to a limited extent with growth rates of companies writing substantially new business and, hence, might significantly bias the results as outliers (see Barth and Eckles, 2009). While Epermanis and Harrington (2006) limit these effects by truncating log premium growth for such companies at -1 and 1 (corresponding to premium growth of approximately -63% and 172%), we remove very small companies completely as we have a rather large data set. We choose € 5 million, € 4 million, and € 2 million as threshold for new business annual premium equivalent, regular new business premiums, and endowment/annuity regular new business premiums, respectively.[20] Furthermore, we delete each observation from the contract data set, if the number of new contracts underwritten is less than 5,000 for total new business and 2,000 for endowment/annuity policies in the corresponding year. Finally, for new business sum insured a threshold of € 100 million is employed.

Lapse of business in force

The German supervisor distinguishes three types of lapse rates which are all calculated based on sum insured. First, early lapses are considered to assess the counseling quality, e.g., of different distribution channels, and the product quality. The early lapse rate is calculated as all lapses without surrender value as a percentage of new business written. For certain life insurance contracts this might not only happen at the beginning of the contract duration. The corresponding ratio, hence, strongly depends on the product design. Second, late lapses are supposed to provide an assessment of the service quality throughout the policy term. The late lapse rate is calculated as all lapses with surrender value plus all policies made paid-up (i.e., the customer stops premium payments but does not cancel the contract) as a percentage of the opening balance at the beginning of the calender year. This ratio again depends on the product design which determines the surrender value. Third, the total lapse rate is calculated as sum of early and late lapses divided by the average volume of business in force during the calendar year (i.e., half of the sum of opening and closing balance). The corresponding ratio measures to which extent any lapses are offset by new business written. It thus allows to draw conclusions on portfolio growth.

Early, late, and total lapse rates for the German life insurance market

[20]These and all other threshold values are the result of a trade-off between deleting the most extreme growth rates but keeping the data sample as large as possible. The number of deleted company years is not very sensitive to variations of the threshold. The corresponding analyses are available upon request.

are displayed in Figure 2. While the rates for late and total lapses are stable at about 5% over time, the early lapse rate fluctuates roughly between 7% and 17%. The higher volatility of the early lapse rate is due to the different denominator compared to late and total lapses. New business sum insured is significantly smaller than the sum insured of total business in force. Thus, similar changes in lapse volume lead to higher variations for the early lapse rate. The fluctuations in 1999/2000 and 2004/05 can again be explained by the 'closing sale' in the corresponding years. The distributional focus on life insurance increased volumes sold in 1999 and 2004, while lapses remained at the previous level. Hence, this yields a reduction in lapse rates. The increase of lapse rates in 2005 is due to an increase in absolute volume of lapses and reduced sales compared to the previous year 2004. This effect is less pronounced in 2000.

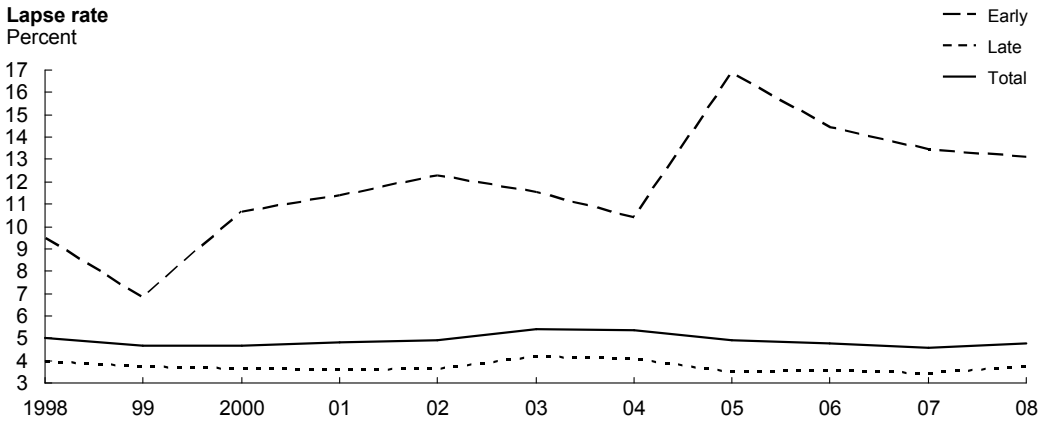

Figure 2: Lapse rates in the German life insurance market from 1998 to 2008

Instead of considering lapse rates we perform our analysis on the underlying data measuring the volume of lapses in premiums, number of contracts, and sum insured (as for new business). We always model total lapse volume including both early and late lapses. Summary statistics for the average growth in lapse volumes are displayed in Table 1. The corresponding data regarding volume of lapsed business has to be reported by each company under local GAAP. Again the lapse data is preprocessed as for new business to account for inorganic effects.

3.3 Participation rate

We consider the yearly declared surplus participation rate as a product characteristic influencing new business and lapse volumes. As this indicator takes

into account the entire business operation including investment result, risk result, and cost/other result, it is a strong indicator to assess company performance. The development of the average surplus participation rate in the German life insurance market from 1998 to 2008 is displayed in Table 1. The surplus participation rate today is significantly lower than it was at the end of the 1990s. This is primarily driven by the stock market crash of 2001 to 2003 following the dot-com bubble. This effect might be reinforced by the financial crisis starting in 2008. The average participation rates for 2009 and 2010 are 4.26% and 4.18%, respectively, down from 4.37% in 2008.

The surplus participation rate for each year is declared at the end of the previous year and is based on the surplus of the previous three years. Most companies make their announcements through press releases or in the annual statement. Comparisons of the participation rates are readily available for the largest insurers by third-party providers. This information is thus easily available to customers and other stakeholders. The surplus participation rate can differ by tariff generations and products. For the sake of simplicity and to have only one value for each year and company we consider only endowment products and take the arithmetic average of all tariff generations. This is a meaningful simplification since in practice most companies do have the same surplus participation rates for all tariff generations and products.

We model the surplus participation rate $PR_{i,t}$ relative to arithmetic market average (in percentage points) for year t which is declared at the end of year $t-1$. Alternative modeling approaches are considered for the participation rate, e.g., absolute surplus participation rate or change of surplus participation rate relative to size-adjusted mean (as used in Cottin et al. 2007). The results modeling participation rates relative to the market are consistent and yield similar conclusions (detailed results are available upon request).

3.4 Control variables

Additional control variables account for company-specific characteristics. We borrow the consideration of size, age, and distribution from Tekülve (2007). Furthermore, rating and solvency information are used as control variables.

For some control variables a lag period of one year is considered. This is due to the fact that the corresponding information is disclosed late in the year (or even in the beginning of the following year if financial statement data is involved). For simplicity, we assume that all information is available for all companies at the same time, although this is only an approximation as for instance the annual reports are usually published over a longer period of time. In particular, we assume that the information on size, rating, and

solvency is publicly available at the very end of each year. If we assume that these factors drive the customer decision and hence new business/lapse development, the corresponding effect will only be observable in the results of the following year.

Summary statistics for all control variables are displayed in Table 1. Data availability is limited for some variables, in particular rating information and data on distributional focus are not available for the entire market but for all large and medium-sized players.

Company size ($Size_{i,t}$)

Total premium volume takes not only into account new business written during the considered year, but also premiums from existing business. It hence allows controlling for size effects. As in other analyses we scale the size parameter by considering the natural logarithm (see Epermanis and Harrington 2006). The company size $Size_{i,t}$ in year t is measured as natural logarithm of gross premiums written (in €) in year $t-1$.

Finsinger rating ($FR_{i,t}$)

As we analyze customer reactions, we decided to use a rating that is publicly available and allows direct comparisons among competitors. We employ the Finsinger rating which is published annually in the economics magazine *WirtschaftsWoche*. This rating uses three components to assess the profitability of life insurance contracts from a customer perspective: (1) cost result taking into account both acquisition and administration costs; (2) ratio of surplus paid out to the customer in each year; and (3) long-term sustainability of the surplus participation rate based on a return on risk-adjusted capital approach. The assessment of the quality of a single life insurer is based on a three-step approach. First, a benchmark company is constructed as certain type of market average. The performance indicators are calculated for this theoretical company. Second, each company is compared to this benchmark assessing whether the considered life insurer performs better or worse. Third, the Finsinger indicator derived is translated into the Finsinger rating using a scale from 1 (lowest) to 5 (highest). Further details on the rating methodology can be found in Diboky and Finsinger (2003) and the yearly *WirtschaftsWoche* articles covering the updated Finsinger rating. This rating, like all others, has its shortcomings (see, for instance, the discussion in Häfele et al. 2000), but it provides a rating specific for the German life insurance market, is reported consistently, and allows a direct comparison of German life insurers. The Finsinger rating $FR_{i,t}$ in year t equals the rating at the end of the previous year $t-1$.

Solvency indicator ($SI_{i,t}$)

We use the ratio of own funds to insurance liabilities as proxy for the solvency of the German life insurers.[21] Contrary to the regulatory Solvency I margin which is currently used in the European Union, this ratio can easily be calculated from local GAAP representations. The company's solvency $SI_{i,t}$ in year t is assessed by the ratio of own funds to technical reserves (in ‰) at the end of the previous year $t-1$.

Company age ($Age_{i,t}$)

Another driver for the purchasing decision of insurance customers might be the company reputation. Companies that have been in the market for a long period of time have acquired reputation since they have typically proven their financial stability and ability to fulfill long-term contract obligations. We use the foundation year of the life insurance unit in case of insurance groups to derive the companies' age. The corresponding information can be obtained from the companies' websites. In cases where no specific foundation year for the life unit is available the foundation year of the corresponding insurance group is used instead. The company age $Age_{i,t}$ in year t is given by the number of years since company foundation.

Distributional focus ($TA_{i,t}$)

German life insurers sell their policies through a variety of distribution channels. Tied agents and brokers are still predominantly used, while the direct channel is steadily increasing. Additionally, life insurance contracts are sold through banks and branches. Data regarding the distribution mix of all channels is not readily available for most German life insurers. We used a variety of sources including company press releases and annual statements to estimate the annual distribution split for new business. Therefore, the data include rough estimates. $TA_{i,t}$ is an indicator variable specifying whether the tight agent channel is the main distribution channel, i.e., 1 if tied agent channel represents the largest share of new business premiums and 0 otherwise.

[21] Correlation tests have been performed to check for collinearity between Finsinger rating and solvency, but the values are close to zero. The Finsinger rating is not primarily a measure of financial strength. Instead it focuses on profitability and sustainability of contract performance. Hence, it represents more a risk-return indicator than a pure risk indicator.

4 Results

In a first step we use our data to reconcile the analyses of Tekülve (2007) and Cottin et al. (2007). Tekülve (2007) employs correlation analysis for the years 2003 and 2004 only, while Cottin et al. (2007) cover the time horizon 1995 to 2004 with their univariate linear regression analysis. Applying the methods of Tekülve (2007), we find a limited positive relationship between surplus participation and new business premium growth, but we do not find such an effect by means of the methodology of Cottin et al. (2007). The numerical and graphical results are in both cases almost identical to those presented in Tekülve (2007) and Cottin et al. (2007), respectively (detailed results are available upon request). Some differences remain because the underlying data sets are not completely identical and because of minor ambiguities regarding the analysis design.

In the following we discuss the results of the regression analysis outlined in Section 3.1. We assess the impact of the surplus participation rate on new business and lapse volume in terms of premiums, number of contracts, and sum insured.[22] Company size, Finsinger rating category, solvency indicator, company age, and distributional focus on tied agents are included as control variables. The analysis is based on information from 1998 to 2008.[23]

As discussed in Section 3.1 we employ three different model types (OLS, FE, and RE). It hence remains the question how to find the best model. On the one hand, statistical tests can be used as introduced in Section 3.1. On the other hand, economic considerations might be taken into account. We consider panel data covering 66 to 70 different German life insurers (depending on the considered response variable). Therefore, the presence of firm effect might be assumed, although we consider control variables to account

[22]The results for sum insured are very similar to those when total number of contracts is considered. For both new business and lapses an OLS model is preferred and the surplus participation rate has a significant positive and negative impact, respectively. The significance levels of the control variables change only slightly. Therefore, we do not present the corresponding results for sum insured in the following. Detailed results are available upon request.

[23]Additionally, we consider the time horizon 2003-08 to account for potential distortions due to the shift of the surplus participation rate following the economic crisis of 2001 to 2003. The overall picture remains unchanged. While there is a significant, positive relationship between new business and participation rates in four out of six model specifications, we find a significant, negative relationship only in two out of five cases for lapses. Due to the reduced level in the surplus participation rate and fixed surrender charges it becomes less profitable to lapse existing contracts. Therefore, the relationship between lapses and participation rates becomes less pronounced. Another factor might be the limited time horizon of six years for the analysis.

for these effects. Clearly, the available control variables cannot capture all differences between the considered life insurers. We have no information on, e.g., service quality, advisory quality (of distribution channels), customer focus, specific marketing campaigns, and product offerings/design (life insurance products might be considered as rather homogeneous but still differ in certain product features). In this work we present the results for all three model types (OLS, FE, RE) and assess the best model using statistical tests. But we also discuss under which circumstances an OLS model might be appropriate from an economic point of view. Firm effects are found in six out of eleven cases, while an OLS model is preferred in the other five cases. The significance levels and signs of the coefficient estimates for the surplus participation rate are consistent across the different regression models in almost all cases; our main findings thus hold for different modeling approaches. The OLS model is always related to the consideration of total business instead of endowment/annuity business. We conclude that cross-company differences are more pronounced when considering savings products for which the surplus participation rate is most relevant. Taking into account total business including term life insurance, group business, and unit-linked business company differences are not observable as different effects might interfere with each other.[24]

4.1 Relationship between surplus participation rates and new business

Measure 1 - New business premium growth

We consider total new business (measured as annual premium equivalent, or APE) as response variable in Panel A of Table 2.[25] According to the specification tests performed, a fixed firm effects model is most appropriate. Shades are used for all result tables to highlight the most appropriate model. The F-test with null hypothesis 'H_0: no fixed firm effects' and alternative hypothesis 'H_1: presence of fixed firm effects' is rejected at the 5% level

[24]Firm effects are identified for total business only when new business premium growth in terms of annual premium equivalent is considered. In this case single premium business is taken into account. Single premiums incur predominantly for savings products, i.e., endowment and annuity business. As we have seen that firm effects are present for those products, the presence of firm effects for growth in annual premium equivalent is not surprising.

[25]As robustness test we analyzed unweighted new business premiums (i.e., regular premiums + 100% of single premiums). The corresponding results are identical, except for minor changes in coefficient estimates and significance levels, but all variables are still significant.

indicating that (fixed) firm effects are present. The Hausman-test for random effects ('H_0: present effects are random' vs. 'H_1: present effects are not random') is rejected at the 5% level showing that the observed effects are not of random but of fixed nature.

The coefficients for participation rate, company size, and company age are all significant[26] at the 1% level in the fixed firm effects model, while rating category and distributional focus on tied agents are significant at the 5% level. The solvency indicator is also significant, but only at the 10% level. We find a positive impact of the surplus participation rate on new business APE growth, which supports *hypothesis 1*.

Company size has a negative effect on APE growth. The relationship of growth rates and firm size is studied extensively in literature across all industries as Gibrat's Law (for an overview of the related empirical literature see Santarelli et al. 2006). However, there is only one empirical study for the life insurance industry. Hardwick and Adams (2002) do not find a relationship between company growth and size for the U.K. life insurance industry for the whole sample period of 1987 to 1996, but smaller firms grew faster than larger ones from 1987 to 1990. The latter result supports our findings. This negative relationship might be explained through lower growth rates for larger insurers in a mature market and might also be a sign of underwriting discipline (i.e., insurers focusing more on profitability than on growth).

The rating has also a negative effect, i.e., a better rating hampers growth, which is not reasonable at first glance. It might be interpreted as a sign of underwriting discipline. Firms with slower growth might be showing signs of financial strength, including underwriting discipline, whereas faster growing insurers might be financially weaker companies (Eling and Schmit 2010; Harrington et al. 2008 discuss an example in medical malpractice). Moreover, the Finsinger rating focuses on performance indicators and the sustainability of the surplus participation rate as discussed in Section 3.4. The impact of solvency is negative, being a further sign of underwriting discipline, as companies with a higher solvency should more likely be able to fulfill their long-term contractual obligations.

Company age has a positive effect. There is extensive research on testing the relationship between firm growth and age of the company (for a recent overview see Choi 2010). Most of this research focuses on the manufacturing and service industry, but there are no examinations exclusively of the life in-

[26]Statements regarding the significance of control variables require the normality assumption for the regression residuals to hold. Although one might assume the residuals to be normally distributed for a large data set as in our case, we explicitly checked this assumption using Q-Q-plots. This test indicates that the normality assumption holds for the residuals of the considered regression models.

Table 2: Regression results for the effect of the surplus participation rate and additional control variables on new business premium growth relative to market growth

	OLS		**Fixed effects**		**Rand. effects**	
Panel A - Growth in total new business premiums (incl. single premiums)						
Controls	Est.	p-Value	Est.	p-Value	Est.	p-Value
$PR_{i,t}$	16.93	0.000***	24.66	0.000***	23.46	0.000***
$Size_{i,t}$	-3.22	0.013**	-42.24	0.000***	-25.98	0.000***
$FR_{i,t}$	-0.48	0.721	-6.35	0.013**	-4.83	0.041**
$SI_{i,t}$	0.01	0.797	-0.17	0.065*	-0.07	0.395
$Age_{i,t}$	-0.01	0.762	2.62	0.000***	0.66	0.022**
$TA_{i,t}$	0.25	0.932	15.82	0.011**	12.60	0.028**
Adj. R-squared	0.06		0.22		0.09	
Specification test[a]	N/a		0.021**		0.031**	
Panel B - Growth in regular new business premiums (w/o single premiums)						
Controls	Est.	p-Value	Est.	p-Value	Est.	p-Value
$PR_{i,t}$	13.21	0.000***	22.49	0.000***	21.31	0.000***
$Size_{i,t}$	-2.54	0.046**	-34.32	0.000***	-19.87	0.000***
$FR_{i,t}$	0.32	0.801	-4.79	0.048**	-3.29	0.144
$SI_{i,t}$	0.04	0.416	-0.12	0.170	-0.03	0.665
$Age_{i,t}$	0.01	0.767	2.63	0.000***	0.71	0.012**
$TA_{i,t}$	1.66	0.544	12.16	0.043**	8.85	0.113
Adj. R-squared	0.05		0.21		0.07	
Specification test[a]	N/a		0.014**		0.027**	
Panel C - Growth in regular endowment/annuity new business premiums						
Controls	Est.	p-Value	Est.	p-Value	Est.	p-Value
PR_t	24.04	0.000***	32.44	0.000***	30.27	0.000***
$Size_t$	-5.80	0.000***	-45.35	0.000***	-23.28	0.003***
FR_t	2.68	0.114	-5.16	0.111	-2.73	0.357
SI_t	0.05	0.439	0.01	0.942	0.07	0.510
Age_t	0.04	0.311	3.33	0.000***	0.77	0.037**
AO_t	1.56	0.670	22.40	0.005***	19.32	0.009***
Adj. R-squared	0.1		0.25		0.08	
Specification test[a]	N/a		0.027**		0.063*	

*** (**, *) Significant at the 1% (5%, 10%) level (two-tailed t-test)

[a] p-values of F-test for no fixed effects (fixed effects model) and Hausman-test for random effects (random effects model)

surance industry. Therefore, the corresponding results might not be directly transferable to our analyses. Indeed, most research finds a negative relationship between firm growth and age. Choi (2010) also finds that younger firms in the U.S. property and liability insurance industry grow faster than older ones. However, Barron et al. (1994) find a non-monotonic relationship between age and growth of New York credit unions. While the youngest firms experience the fastest growth, the oldest firms grow faster than the adolescent ones. Our result thus might be interpreted as sign of stability, as older companies have proven for a longer time that they are able to fulfill their long-term contractual obligations. Along with an increased brand awareness and reputation, this might fuel additional sales.

Distributional focus has a positive impact on new business. This effect is not as expected since sales through the tight agent channel are decreasing in the German life insurance market in recent years. Further new business growth is mainly generated through the broker and bank channel.

We observe only minor variations when changing the response variable from APE growth to growth of regular new business premiums. The model choice remains unchanged when considering total premiums (Panel B in Table 2) and endowment/annuity business (Panel C of Table 2). These results support the conclusion of Cottin et al. (2007) that an OLS regression neglecting company specifics is not an appropriate model in this context. However, when the OLS model is considered, the surplus participation rate has still a significant effect on regular premium growth in both cases.[27] In case of total regular new business premiums, the surplus participation rate has again a significant positive impact at the 1% level. The sign indicating the direction of impact remains unchanged for all other control variables. Moreover, the significance levels remain unchanged, except for solvency that is no longer significant.

Also for regular new business premiums for endowments/annuities the surplus participation rate has a positive, highly significant impact.[28] Con-

[27]This does not hold for the OLS model when absolute market share is considered as response variable which is studied by Cottin et al. (2007). They report the strongest relationship between new business and surplus participation rate for the OLS model with absolute market share and absolute surplus participation rate spread. Using this model specification we find a significant relationship for the fixed firm effects model suggested by the specification tests, but we do not find any significant relationship when the OLS is considered. Moreover, we do not find any significant relationship between changes in market share and the surplus participation rate spread. These observations are in line with the findings of Cottin et al. (2007).

[28]Contrary to Cottin et al. (2007) we even find a significant relationship between changes in market share or absolute market share and surplus participation rate spread. Note that we consider endowment/annuity business jointly, while Cottin et al. (2007) consider them

trary to the results for APE rating and solvency are not significant, while the significance level for all other control variables stays the same or even increases.

Measure 2 - Growth in number of new contracts

As discussed in Section 3.2, we consider the effects on the number of new contracts separately to distinguish between revenue and demand. We performed the same analysis as for new business premiums/APE. Table 3 displays the corresponding results. It contains both the results for total number of contracts and endowment/annuity contracts only. The specification tests suggest an OLS model as most appropriate for total new business, as the F-test for no firm effects is not rejected. Considering endowment/annuity contracts, a random firm effects model is most appropriate.

Table 3: Regression results for the effect of the surplus participation rate and additional control variables on number of new contracts growth relative to market growth

	OLS		**Fixed effects**		**Rand. effects**	
Panel A - Growth in total number of new contracts						
Controls	Est.	p-Value	Est.	p-Value	Est.	p-Value
$PR_{i,t}$	2.73	0.351	10.31	0.017**	9.42	0.020**
$Size_{i,t}$	-1.11	0.304	-24.80	0.000***	-12.76	0.004***
$FR_{i,t}$	0.70	0.513	-1.69	0.414	-0.89	0.641
$SI_{i,t}$	0.03	0.394	-0.01	0.873	0.06	0.367
$Age_{i,t}$	-0.02	0.389	1.66	0.002***	0.29	0.131
$TA_{i,t}$	1.35	0.567	6.51	0.222	4.03	0.407
Adj. R-squared	0.02		0.15		0.04	
Specification test	N/a		0.323		0.160	
Panel B - Growth in number of new endowment/annuity contracts						
Controls	Est.	p-Value	Est.	p-Value	Est.	p-Value
PR_{t-1}	10.69	0.024**	15.90	0.020**	14.81	0.019**
$Size_{t-1}$	-4.38	0.006***	-18.93	0.077*	-6.33	0.314
FR_{t-1}	3.34	0.047**	-3.65	0.257	-1.77	0.539
SI_{t-1}	0.08	0.259	0.16	0.190	0.19	0.081*
Age_t	0.02	0.607	1.73	0.040**	0.13	0.546
AO_t	4.65	0.207	24.61	0.002***	20.71	0.004***
Adj. R-squared	0.05		0.2		0.04	
Specification test	N/a		0.090*		0.594	

separately.

In contrast to new business premium/APE growth, the surplus participation rate is not significant when considering growth of total contract numbers (Panel A). Restricting to endowment/annuity policies (Panel B) the surplus participation rate has again a significant positive impact at the 5% level.

While in the case of all new contracts none of the control variables is significant, solvency and distributional focus on tied agents are significant for the endowment/annuity business both having a positive effect. While the relationship for distributional focus is consistent with the results for premium growth, the positive effect of solvency is different, but it is only significant at the 10% level.

The result for total new contract growth might partially support the conclusion that participation rates do not have a significant influence on life insurance demand. However, participation rates have a significant positive impact on new business premium growth, as we have seen before. New business premium growth is thus higher for companies with higher participation rates, while participation rates have no impact on growth of contract numbers. This means that the average new business premium calculated as ratio of new business premiums over new business contracts is larger for life insurers with higher participation rates. Hence, customers purchasing insurance contracts with higher volume (measured as sum insured) seem to pay closer attention to surplus participation rates when making their buying decision, which still provides a sign of market discipline.[29]

4.2 Relationship between surplus participation rates and lapse

In this section we analyze *hypothesis 2*, i.e., whether there is a significant negative relationship between lapse volume and surplus participation rates. As discussed in Section 3.2 we do not consider aggregated lapse rate data that is used by Cottin et al. (2007). Instead we use the underlying data on lapse volumes including both early and late lapses. We employ data on lapsed regular premiums, number of lapsed contracts, and lapsed sum insured following the same modeling approach as for new business. Therefore, we are not able to compare our results directly to those of Cottin et al. (2007).

Measure 1 - Lapsed regular premiums

The results using volume of regular premiums lapsed both for total business and for endowment/annuity business as response variable are presented in Table 4.

[29] As Cottin et al. (2007) do not explicitly state the results of their analysis for number of contracts, we are not able to compare our results with their findings in this case.

Table 4: Regression results for the effect of the surplus participation rate and additional control variables on lapsed regular premium growth relative to market growth

	OLS		**Fixed effects**		**Rand. effects**	
Panel A - Growth in total lapsed regular premiums						
$PR_{i,t}$	-5.62	0.000***	-10.13	0.000***	-9.40	0.000***
$Size_{i,t}$	-0.14	0.803	1.49	0.636	-0.72	0.671
$FR_{i,t}$	2.12	0.000***	2.58	0.017**	2.26	0.016**
$SI_{i,t}$	0.03	0.103	0.01	0.771	0.00	0.956
$Age_{i,t}$	-0.03	0.076*	-0.44	0.102	-0.05	0.357
$TA_{i,t}$	-1.62	0.170	-1.49	0.592	-1.02	0.662
Adj. R-squared	0.07		0.17		0.05	
Specification test	N/a		0.849		0.863	
Panel B - Growth in lapsed regular endowment/annuity premiums						
Controls	Est.	p-Value	Est.	p-Value	Est.	p-Value
$PR_{i,t}$	-6.04	0.000***	-11.73	0.000***	-10.99	0.000***
$Size_{i,t}$	-0.43	0.378	5.94	0.060*	0.69	0.754
$FR_{i,t}$	2.22	0.000***	3.03	0.002***	2.47	0.005***
$SI_{i,t}$	0.06	0.004***	0.00	0.910	-0.01	0.747
$Age_{i,t}$	-0.04	0.005***	-0.84	0.001***	-0.18	0.049**
$TA_{i,t}$	-2.21	0.040**	-1.53	0.527	-1.00	0.653
Adj. R-squared	0.12		0.26		0.07	
Specification test	N/a		0.039**		0.186	

Contrary to the fixed firm effects model for total regular new business premiums, the OLS model is identified as most appropriate for total regular lapsed premiums (Panel A). While the surplus participation rate and all control variables except for solvency are significant in case of new business, only participation rate, rating, and company age are significant for lapsed business. The surplus participation rate has a negative impact on lapse volume. Thus, a higher surplus participation rate leads to a lower growth of lapse volume, which supports *hypothesis 2*.

The rating variable has a positive effect on lapses meaning that companies with better rating experience above average lapse volume growth. This result is in line with the growth of new business premiums/APE as discussed above. There we found that a better rating results in below average growth. The argument of underwriting discipline, however, does not apply for lapses. As discussed in Section 3.4 the Finsinger rating is not a pure financial strength indicator but focuses more on the sustainability of the surplus participation

promise. Therefore, companies having a better rating might not have the highest surplus participation rates. This might explain the positive relationship to a certain extent.

Company age has a negative impact on the growth of lapse volumes, i.e., older companies experience less lapses. This result is in line with the one for new business (with opposite sign) and might be interpreted accordingly as sign of stability (see Section 4.1).

A random firm effects model is suggested by the specification tests when considering lapsed regular premiums for endowment/annuity business (Panel B). Participation rate, rating, and age have a significant impact on lapse volumes. These results differ from those for endowment/annuity new business premiums. The model choice is different and rating is significant instead of size and distributional focus. The surplus participation rate has again a negative impact supporting *hypothesis 2*. The impact of rating and age is consistent with total lapsed premiums as discussed above.

Measure 2 - Number of lapsed contracts

Now we consider the number of contracts lapsed instead of regular premium volume. The regression analysis performed remains unchanged. The results are presented in Table 5.

The model choice is exactly the same as for both volume of lapsed regular premiums and number of new business contracts. An OLS model is most appropriate if total business is considered (Panel A), a random firm effects model is proposed for endowment/annuity business (Panel B). The surplus participation rate is significant in both cases having a negative impact which supports *hypothesis 2*.

Considering total number of lapsed contracts, rating and company age have a significant positive and negative impact, respectively, consistent with the results for lapsed premiums. In addition, distributional focus on tied agents has a significant negative effect, i.e., a focus on the tied agent channel reduces lapses. This might be explained with the closer relationship that tied agents usually have with their customers. If a customer plans to cancel a policy, the agent might be able to convince the customer not to do so.

Focusing on endowment/annuity policies only, rating is still significant, having a consistent positive effect. Amongst the other control variables, only solvency has a significant impact instead of company age in the case of regular lapsed premiums. Solvency has a positive impact on lapses, i.e., a better solvency position yields increased lapses. Companies with a better solvency ratio might focus on long-term stability. These companies, hence, might provide a more conservative surplus participation rate explaining higher lapse volumes.

Table 5: Regression results for the effect of the surplus participation rate and additional control variables on number of lapsed contracts growth relative to market growth

	OLS		**Fixed effects**		**Rand. effects**	
Panel A - Growth in total number of lapsed contracts						
Controls	Est.	p-Value	Est.	p-Value	Est.	p-Value
$PR_{i,t}$	-2.79	0.015**	-3.74	0.028**	-3.42	0.029**
$Size_{i,t}$	0.11	0.796	1.76	0.468	-0.32	0.823
$FR_{i,t}$	1.82	0.000***	1.84	0.028**	1.57	0.034**
$SI_{i,t}$	0.01	0.389	0.02	0.621	0.00	0.868
$Age_{i,t}$	-0.03	0.006***	-0.40	0.053*	-0.05	0.305
$TA_{i,t}$	-3.00	0.001***	-3.36	0.104	-2.87	0.109
Adj. R-squared	0.09		0.21		0.02	
Specification test	N/a		0.400		0.791	
Panel B - Growth in number of lapsed endowment/annuity contracts						
Controls	Est.	p-Value	Est.	p-Value	Est.	p-Value
$PR_{i,t}$	-2.26	0.027**	-2.75	0.052*	-2.30	0.082*
$Size_{i,t}$	-0.17	0.643	2.28	0.303	-0.66	0.660
$FR_{i,t}$	1.70	0.000***	1.98	0.003***	1.61	0.009***
$SI_{i,t}$	0.09	0.000***	0.10	0.000***	0.09	0.000***
$Age_{i,t}$	-0.02	0.009***	-0.49	0.004***	-0.08	0.204
$TA_{i,t}$	-2.33	0.004***	-2.20	0.192	-1.82	0.238
Adj. R-squared	0.17		0.37		0.06	
Specification test	N/a		0.000***		0.314	

5 Conclusions

We analyze the relationship between new business, lapse and surplus participation rates in the German life insurance market from 1998 to 2008. In accordance with our hypotheses, surplus participation rates have a significant positive effect on new business growth and a significant negative effect on growth of lapse volumes. These relationships hold for different measures (premiums, number of contracts, and sum insured). A significant relationship is found in ten of eleven modeling specifications analyzed. Our results are consistent with those of Tekülve (2007) who also finds a positive relationship between new business premium growth and surplus participation rate changes. Our results are not in line with those of Cottin et al. (2007) who do not find a significant relationship between new business/lapse and surplus

participation. However, latter differences can be explained by (1) the use of multivariate instead of univariate linear regression models, (2) the consideration of statistical tests to assess the significance, and (3) different modeling approaches of the participation rate.

These results indicate that customers monitor the surplus participation rate of German life insurers and react accordingly. Companies granting higher participation rates are rewarded with above average new business growth and below average growth in lapse volume. According to our definition of market discipline in Section 2 this provides strong evidence for market discipline conducted by customers. Therefore, surplus participation in fact reflects market discipline in the German life insurance market. It remains, however, ambiguous to which extent it is actually driven by the customers (pull effect). We did not address the role of intermediaries and other stakeholders in the sales process. An above average participation rate, for instance, might increase the confidence of sales agents in selling the corresponding product (push effect).

The present analysis can be extended in various directions and serve as a basis for future research. First, the considered multivariate regression with panel data can be applied to other insurance markets. This would allow to address the question as to whether similar relationships hold with respect to other product characteristics, which must not necessarily be surplus participation. Second, the importance of different distribution channels might be assessed by fitting separate regression models for each distribution channel. Third, focusing on model fit the linear regression model can be extended to nonlinear approaches. For example, Cottin et al. (2007) discuss logistic functions to model the relationship between new business/lapse and surplus participation rates.

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