Life Insurance and Demographic Change: An Empirical Analysis of Surrender Decisions Based on Panel Data

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Abstract

We investigate empirically which individual and household specific sociodemographic factors influence the surrender behavior of life insurance policyholders. Based on the Socio-Economic Panel (SOEP), an ongoing wide-ranging representative longitudinal study of around 11,000 private households in Germany starting in 1984, we construct several proxies to identify life insurance surrender in the data. We use these proxies to conduct a linear regression, a fixed effects model, and a cross-section analysis. Our analyses provide evidence for a positive relation between life insurance surrender and household specific factors, such as recent divorce, the number of children in the household, recent acquisition of real estate, recent unemployment, and care-giving expenses in a household. Our results hold when accounting for region specific trends. They vary however for different age groups. The findings obtained in this study can help life insurers and regulators to detect and understand industry specific challenges of the demographic change.

Keywords: Life Insurance, Surrender, Demographic Change

1 Motivation and Research Objective

The risks that can arise from life insurance policy surrenders[1] are of high importance for the stability of the insurance industry and therefore also affect insurance regulation.[2] Kuo et al. (2003) categorize the effects surrender can have on an insurer into three groups: (1) As surrender stops the insurer's premium inflow, it might not earn enough premiums to cover the initial expenses it had before issuing the policy, such as costs of acquiring new business and underwriting. (2) As impaired policyholders with a life expectancy below average do not tend to surrender their life insurance policies, this kind of adverse selection can cause the pool of insured to contain a higher fraction of "bad risks" when the surrender rate is high compared to a case without policy surrender. (3) As most life insurance policies ensure the policyholder a cash surrender value (CSV)[3], a high rate of policy surrenders can cause liquidity problems to the insurer. If the insurer's asset allocation was determined without accounting for the surrender rate or by using an incorrectly estimated surrender rate, the insurer might not be able to liquidate a sufficient amount of assets to meet its obligations. Therefore, it is of high importance for an insurer to have a realistic assessment of the surrender rate and its fluctuation over time.

Empirical research on the topic investigates which factors influence the surrender behavior of life insurance policyholders. Most articles either look at the economic environment, such as economic growth, interest rate environment and unemployment rate[4] (e.g. Outreville (1990), Kagraoka (2005), Kim (2005), Kiesenbauer (2012), and Russell et al. (2013)), or they look at insurance policy characteristics (e.g. Renshaw and Haberman (1986), Cerchiara et al. (2008), Milhaud et al. (2011), Eling and Kiesenbauer (2014), Moenig and Zhu (2014) and MacKay et al. (2015)). Only in the very recent years, individual or household characteristics have been studied on a microlevel in this context (e.g. Fang and Kung (2012), Fier and Liebenberg (2013), Belaygorod et al.

[1] The terms *lapse* and *surrender* both describe the termination of an insurance policy before maturity. However, they differ as lapse refers to termination without any payout to the policyholder, while surrender usually indicates that a surrender value is paid (See e.g. Kuo et al. (2003) or Gatzert et al. (2009)). Throughout this paper the term *surrender* is used referring to both surrender and lapse situations.

[2] See Eling and Kochanski (2013).

[3] See Fang and Kung (2012).

[4] Initially, only two economic explanatory variables had been studied in this area: The impact of interest rates on surrender, referred to as the interest rate hypothesis, and the impact of unemployment on surrender, referred to as the emergency fund hypothesis. The latter explains that in times of personal financial crises life insurance is turned into cash values. Later on, this work has been extended by taking into account additional economic drivers of policy surrender.

(2014), Mulholland and Finke (2014) and Sirak (2015)).[5]

Extracting the drivers of life insurance surrender can help predicting future surrender rates. Regarding surrender behavior that is related to certain insurance policy features, a part of the academic literature looks at how life insurance companies can lower their surrender rate by designing the policies accordingly (e.g. Moenig and Zhu (2014) and MacKay et al. (2015)). However, insurance companies have little or no influence on surrender rates that are driven by economic factors and individual characteristics. Liebenberg et al. (2012) use data from the 1983 – 1989 *SCF panel study* to examine amongst other variables the impact of education levels, marital status, number of children and financial vulnerability on the demand for life insurance policies. They find a significant relationship between individual life events, such as new parenthood, and demand for life insurance as well as a higher likelihood to surrender for households in which either spouse has become unemployed. When regarding economic and individual characteristics related to surrender decisions, one has to take into account that these factors may collectively change over time. To our knowledge, no study has combined the investigation of factors that drive surrender decisions with prognoses on the demographic change, aiming to arrive at surrender rate forecasts for an ageing society.

As reported by The World Bank (2015), life expectancy at birth has increased from 70.6 years in 1970 to more than 80 in 2013. Due to this increase in lifetime the number of people over the age of 80 will double to 9 million in Germany by 2060 (German Federal Statistical Office, Statistisches Bundesamt (2015)). According to Gruenberg (1977), the additional years that people live due to increasing longevity are increasingly spent in bad health condition and disability (so called medicalisation hypothesis). Consequently, the expenditure on care products at high ages will increase with longevity and the subsequent demographic changes towards an ageing society.[6] A longevity increase then leads to an increasing demand for liquidity at high ages, potentially forcing more life insurance and annuity policyholders to surrender eventually to finance their parents' long-term care.

This article aims to investigate empirically which individual and household specific sociodemographic factors influence the surrender behavior of life insurance policyholders and to address

[5] See Eling and Kochanski (2013) for a more detailed and more extensive overview on the empirical and theoretical research that has been done in the area of life insurance surrender.

[6] See Felder (2012) or Niehaus (2006).

the question in which way demographic or societal changes affect life insurance surrender rates through the found characteristics.

The remainder of this paper is organized as follows. In Section 2, we describe our data and explain the process of constructing our sample and defining proxies for life insurance surrender. In Section 3, we present the estimations of the regression models and discuss the results. We conclude the analysis in Section 4. The Appendix contains additional technical descriptions and results.

2 Data Description and Identification of Surrender

2.1 Data Description

For our empirical investigation, to the best of our knowledge, we are the first ones using the German Socio-Economic Panel (SOEP) in the life insurance surrender context. *SOEP*, the ongoing wide-ranging representative longitudinal study of private households started in 1984 and is located at the *German Institute for Economic Research, DIW Berlin*. The data in version 30 that we are using include all waves until the year 2013. Each year, around 11,000 households and 30,000 people have been surveyed by the fieldwork organization *TNS Infratest Sozialforschung*. The data provide very detailed and various information on all household members, consisting of Germans, foreigners, and recent immigrants living in Germany, including topics such as household composition, wealth, employment, income, health, consumption and satisfaction indicators. Due to the fact that respondents, in principle, stay the same throughout the panel[7], long-term social and societal trends can be explored.

The data do not contain a variable indicating life insurance policy surrender. However, respondent households have been asked, whether they had owned a life insurance policy as a savings or investment security in the previous year.[8] Therefore, the dummy for life insurance ownership

[7] Throughout the panel, the same households have been surveyed repeatedly every year. However, new entrants through birth or move into *SOEP* households and survey related attrition have to be taken into account.

[8] The exact question in the questionnaire is: "Did you or another member of the household own any of the following savings or investment securities in the last year?" The households can then indicate "yes" or "no" for the following securities: Savings account; Savings contract for building a home; Life insurance; Fixed interest securities (e.g. saving bonds, mortgage bonds, federal savings bonds); Other securities (e.g. stocks, funds, bonds, equity warrant); Company assets (for your own company, other companies, agricultural assets). The question does not differentiate between various types of life insurance products but it aims to address life insurance as a savings or investment security.

is defined as:

$$LI_{it} = \begin{cases} 1 & \text{if household i claims at } t+1 \text{ to have owned a life insurance policy at time } t \\ 0 & \text{otherwise,} \end{cases} \tag{1}$$

where $t \in [1983, 2012]$ From the panel, we observe households that change their status of owning a life insurance policy together with their household characteristics and the individual characteristics of the household members. We use an observed change from life insurance ownership to non-ownership as a proxy for policy surrender.[9]

By doing so, our proxy for life insurance policy surrender will not only capture premature contract termination but also the contract termination at maturity. However, the *SOEP* data allows us to make assumptions about the differentiation of these two cases as it offers information about life insurance ownership throughout the time series, households' income and wealth as well as information on whether money has been put aside for emergencies[10]. We use this information to define further proxies for life insurance surrender and evaluate the performance of these adjusted proxies by comparing them to surrender statistics from the German insurance market provided by the German Insurance Association (GDV). According to this cross-check with *GDV* data, we use the best proxies to conduct our empirical analysis.

We investigate the effect that household specific characteristics that are influenced by the demographic change have on households surrender behavior. For this, we apply multiple linear regressions and fixed effects regression models and aim to extent the analysis further comparing our findings to results that we obtain in a hazard model. Furthermore, we assess whether our results change conditional on age group specific and region specific trends.

2.2 Definition of Proxies for Life Insurance Surrender

In order to identify life insurance surrender in the panel, we start with observing households that claimed in year t that they had owned a life insurance contract in the previous year ($LI_{it-1} = 1$), while in the next survey period (at $t+1$), they claimed to not have owned a life insurance policy

[9] We do not capture a change of owning more than one life insurance policy to owning only one (or one less) policy. Therefore, we might underestimate surrender for households that own multiple policies.

[10] This information is provided for only certain years in the panel and can therefore be used conducting an analysis based on these years only.

in the previous year ($LI_{it} = 0$). This change from life insurance ownership to non-ownership displays our baseline proxy for policy surrender

$$SP1_{it} = LI_{it-1} * (1 - LI_{it}) \tag{2}$$

$SP1_{it}$ will not only capture premature contract termination but also termination at contract maturity. However, the *SOEP* data allows us to make assumptions about the differentiation of these two cases as it offers information about life insurance ownership of each household throughout the time series. Since most life insurance contracts have a time to maturity of at least 12 years[11], we define our second proxy $SP2_{it}$ by excluding these policyholders, who have claimed to have owned a life insurance policy for 11 years or more from $SP1_{it}$. Their policies are likely to have matured. For all households i and years t, in which the respective households were surveyed, the second proxy is defined as:

$$SP2_{it} = LI_{it-1} * (1 - LI_{it}) * (1 - \prod_{\tau=2}^{10} LI_{it-\tau}) \tag{3}$$

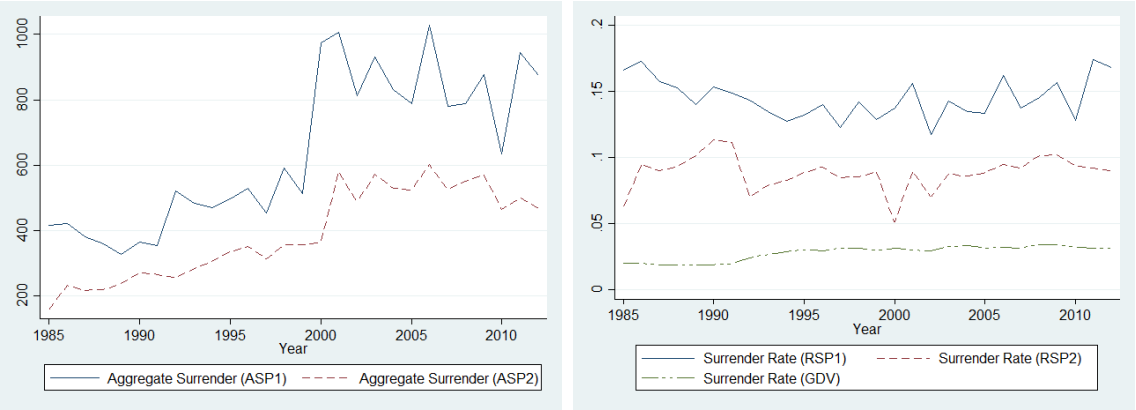
In order to compare the proxies for life insurance surrender $SP1_{it}$ and $SP2_{it}$ by year, Figure 1a shows the absolute number of all surrendered life insurance policies, i.e. for $K = 1, 2$ it is

$$ASPK_t = \sum_{i=1}^{n_t} SPK_{it}, \tag{4}$$

with $n_t \in \mathbb{N}$ being the number of households surveyed in the respective year. Figure 1b displays the surrender rate, i.e. the share of surrendered policies relative to the aggregate number of all policies in the panel per year. The surrender rate is defined as

$$RSPK_t = \frac{ASPK_t}{\sum_{i=1}^{n_{t-1}} LI_{it-1}} \tag{5}$$

[11] 12 years are the minimum contract period that yields a (partial) tax exemption of investment returns



(a) Absolute Number of Surrendered Life Insurance Policies by Year

(b) Surrendered Life Insurance Policies Relative to the Aggregate Number of Policies in the Panel by Year

Figure 1: Life Insurance Policy Surrender by Year (SP1 and SP2)

The absolute number of surrenders per year in the panel illustrated in Figure 1a is increasing from 1985 to 2000 exhibiting minor drops and a large peak in 2000 that is explained by the peak in the existing insurance portfolio shown in Figure 5a in Appendix A.1. However, the peak in 2000 is less severe and aggregate surrender is overall less volatile, taking the contract duration into account for the definition of life insurance surrender ($ASP2_t$). Both, aggregate surrender and the surrender rate calculated with the proxy $SP2_{it}$ are strictly lower than if they are calculated using $SP1_{it}$ as a proxy for life insurance surrender, resulting from the fact that surrender determined by $SP2_{it}$ is a subset of surrender defined by $SP1_{it}$. Figure 1b displays that in comparison to the surrender rate calculated based on *GDV* data with a mean of 0.300, the surrender rates in the *SOEP* based on the proxies $SP1_{it}$ and $SP2_{it}$ with a mean of 0.1442 and 0.0883, respectively, are higher and more volatile.[12] $SP2_{it}$ does not include policy termination at maturity of contracts that have an original time to maturity of more than 11 years. However, it might incorrectly declare policy termination at maturity as surrender, if the contract's original time to maturity was less than 11 years, for example if it was set in order to mature at retirement age. To display the relationship between age and surrender, we determine the aggregate number of surrender by age and the respective surrender rate by age, respectively as

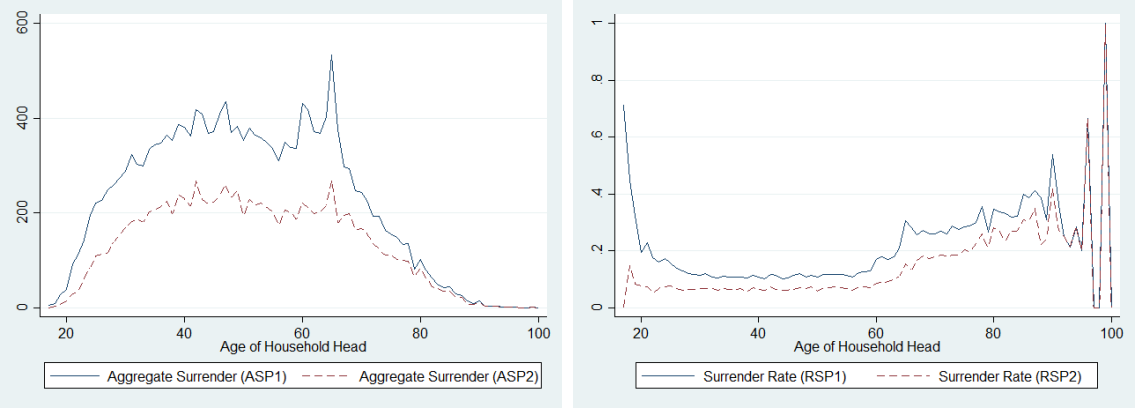
$$ASPK_x = \sum_{i=1}^{n_x} SPK_{ix} \tag{6}$$

[12] Table 8 in Appendix A.3 provides a detailed summary of the surrender rates.

and

$$RSPK_x = \frac{ASPK_t}{\sum_{i=1}^{n_{x-1}} LI_{ix-1}}, \tag{7}$$

where x specifies the age with $x \in [17,100]$ and n_x is the number of household heads at the respective age throughout the panel.



(a) Absolute Number of Surrendered Life Insurance Policies by Age

(b) Surrendered Life Insurance Policies Relative to the Aggregate Number of Policies in the Panel by Age

Figure 2: Life Insurance Policy Surrender by Age (SP1 and SP2)

Figure 2a shows that while $ASP1_x$ exhibits a large peak at the age of 65, this peak is much lower, however still visible taking into account the contract duration with $ASP2_x$. While the graph for $ASP2_x$ is again strictly lower or equal than the one for $ASP1_x$ for all ages due to capturing less observations, both proxies display a hump between the age of 40 and 55. However, Figure 2b shows that the hump shape is driven by the fact that a large fraction of life insurance policies is owned by this age group, as in relative terms the hump disappears for both proxies. For age groups above 65, absolute surrender decreases in age while relative surrender is increasing. This suggests that most life insurance contracts have already matured or surrendered before the age of 65, making the denominator in Equation (7) decrease faster than the numerator. The fact that only a very small fraction of the life insurance portfolio in the market is held by households whose heads are younger than 20 or older than 80 years old explains the high volatility of the surrender rate at the extreme ages.

To find an alternative approach to approximate life insurance policy surrender in the panel than by looking at the policy duration, we consider the drivers for life insurance surrender most

commonly discussed in the scientific literature. (See Section 1.) Since we can only capture surrender based on the interest rate hypothesis in case the new policy was not acquired in the same year as the old policy was surrendered, we concentrate on the emergency fund hypothesis, more specifically on liquidity needs as a driver of life insurance policy surrender. From the panel we observe households that have claimed to not have put money aside for larger purchases, emergencies or to build savings. This information is provided for only certain years[13] and can therefore be used for conducting an analysis based on these years only. With this information we create further proxies for life insurance surrender and define the dummy variable for a household's reserves as follows.

$$RESERVES_{it} = \begin{cases} 1 & \text{if household i claims to have put aside money for emergencies at time } t \\ 0 & \text{otherwise.} \end{cases} \tag{8}$$

Given the assumption that respondents can assess correctly how much money they would need in case of an emergency, it is sensible to assume that household heads who claim to have put aside money for emergencies would use these reserves first rather than surrendering their life insurance policy if they face a need for liquidity. Therefore, we exclude these households from our next proxy, as for them contract termination seems more likely to occur due to contract maturity than due to policy surrender. For the years $t = 2001, 2003, 2005, 2007, 2011$[14], we define the proxy for life insurance surrender $SP3L_{it}$ as life insurance policy termination conditioning on that the household claims to have put aside money for emergencies in the current year, i.e.

$$SP3L_{it} = LI_{it-1} * (1 - LI_{it}) * (1 - RESERVES_{it}) \tag{9}$$

One might also consider this kind of proxy accounting for reserves which a household had put aside in the previous year. However, the results do not differ largely. Appendix A.2 gives a brief overview of this case displayed in the proxy $SP4L_{it}$.

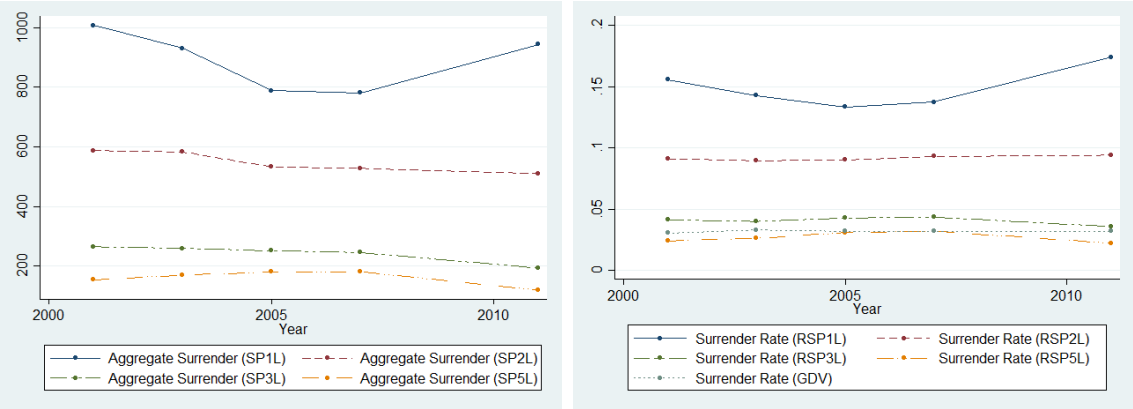
Considering both, the contract duration and the question whether households have put money aside for emergencies combined, we define $SP5L_{it}$ as life insurance contract termination, con-

[13] More specifically for the years $t = 2001, 2003, 2005, 2007, 2011, 2013$.
[14] We cannot include the year 2013, because LI_{it} is defined until 2012 only.

ditional on that the household claims to not have put aside money for emergencies in the current year and to not have had life insurance at least once within the last 11 years, i.e.

$$SP5L_{it} = LI_{it-1} * (1 - LI_{it}) * (1 - \prod_{\tau=2}^{10} LI_{it-\tau}) * (1 - RESERVES_{it}) \tag{10}$$

In order to compare life insurance surrender identified by the various proxies, we specify a light versions for $SP1_{it}$ and $SP2_{it}$ that are only defined for the years $t = 2001, 2003, 2005, 2007, 2011$. We call them $SP1L_{it}$ and $SP2L_{it}$, respectively. The verbal and technical definitions of all proxies are summarized in Table 7 in Appendix A.3. The aggregate number of surrender and the respective surrender rate for these proxies are defined analogously to Equations (4), (5), (6) and (7) for $t = 2001, 2003, 2005, 2007, 2011$ and $K = 1L, 2L, 3L, 4L, 5L$.



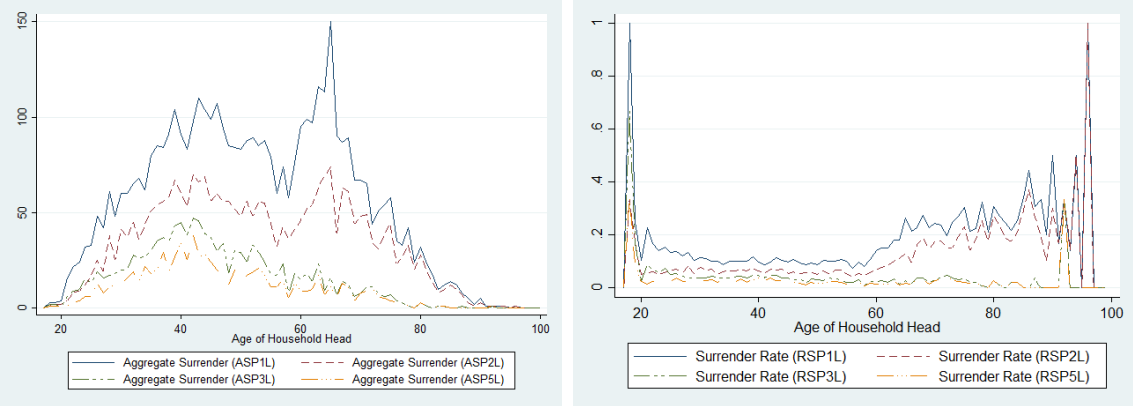
(a) Absolute Number of Surrendered Life Insurance Policies by Year

(b) Surrendered Life Insurance Policies Relative to the Aggregate Number of Policies in the Panel by Year

Figure 3: Life Insurance Policy Surrender for the years 2001, 2003, 2005, 2007 and 2011 (SP1L, SP2L, SP3L, SP5L)

Figure 3a shows that for the respective years, surrender rates determined by the proxies accounting for the variable $RESERVES_{it}$ are similar to the surrender rates based on the data provided by the GDV. For a more detailed comparison, Table 9 in Appendix A.3 summarizes the different surrender rates. Again it is obvious that the absolute number of surrender is lower for proxies that define surrender based on more or stricter criteria than the others as they exclude more observations from the data. Therefore, also aggregate surrender by age measured with $SP5L_{it}$ is strictly lower or equal than the absolute number of surrender measured by $SP2L_{it}$ and $SP3L_{it}$ for all ages. However, Figure 4a shows that including the question whether the house-

holds have put money aside for emergencies eliminates the peak between ages 60 and 65 in the aggregate surrender curve, while the hump around the age of 40 is still noticeable. The elimination of the peak between ages 60 and 65 in aggregate surrender offsets the effect of the increasing surrender rate for age groups above 65. This suggests that the proxies $SP1L$ and $SP2L_{it}$ tend to overestimate surrender primarily at the age groups starting from 65, capturing also the termination of life insurance policies that were set to mature at retirement age and life insurance policy surrender that occurred due to a different motive than the emergency fund hypothesis.



(a) Absolute Number of Surrendered Life Insurance Policies by Age

(b) Surrendered Life Insurance Policies Relative to the Aggregate Number of Policies in the Panel by Age

Figure 4: Life Insurance Policy Surrender by Age (SP1L, SP2L, SP3L, SP5L)

3 Regression Analysis

In order to exploit the panel structure, we will first use the surrender proxy $SP2_{it}$ as dependent variable for the multiple linear regression and the fixed effects regression model. The data allow us to use regional data as control variables, in order to test the impact of the geographical living situation on our results.

Since Figures 4a and 4b suggest that $SP2_{it}$ tends to overestimate surrender primarily at the older ages, we will divide the data into sub-samples by age to gain a better understanding of the relationship between sociodemographic factors, household characteristics and life insurance surrender.[15]

[15] This division is also economically meaningful, as individual drivers for surrender do not necessarily have to be the same for all groups of the *SOEP* sample. Fang and Kung (2012), for instance, find that surrender at younger age is mainly driven by idiosyncratic shocks that are uncorrelated with individual characteristics, such as health, income and bequest motives, while these characteristics play a more important role for older policyholders.

We will then compare the results with a cross sectional analysis using $SP3L_{it}$ and $SP5L_{it}$. Furthermore, we conduct a cross sectional analysis for the year 1987, as in this particular year the *SOEP*-questionnaire contained specific questions about the households' exposure to care specific costs and efforts. For the care specific regression we will use again $SP2_{it}$ as the dependent variable, as $SP3L_{it}$ and $SP5L_{it}$ are not defined for 1987.

3.1 Linear Regression

For the linear regression, we use $SP2_{it}$ as the dependent variable. As explanatory variables, we look at the number of children in the household[16], age and the household income as well as dummy variables for the questions, whether the household head became unemployed within the last three years, whether the household head got divorced within the previous or the current year, and whether the household head acquired the apartment or the buildings that he or she[17] lives in during the previous or current year. For a better understanding of the households' investment and surrender behavior, we also include four dummy variables derived from the question about the households' savings or investment securities mentioned in Section 2. The variable equals one if the household owned liquid[18] savings or investment securities in the previous year, or the household owns illiquid[19] savings or investment securities in the current year, or the household has acquired new savings or investment securities in the previous or current year, or the household has sold savings or investment securities in the previous or current year, respectively. For all four dummies we have excluded life insurance policies from savings or investment securities. The rationale of including these dummy variables is that a household which faces a need for liquidity is more likely to spend liquid assets, if present, before surrendering a life insurance policy due to liquidation costs. Moreover, such a household is unlikely to acquire new savings or investment securities. Therefore, we expect a negative correlation between having liquid assets in the previous year and life insurance surrender, as well as acquiring new assets and life insurance

[16] This variable is only available for the time period 1995 to 2012. Therefore, the effect resulting from it might be underestimated in analyses using the whole panel. However, from all variables that are related to the existence or the number of children in the household, this one is available for the longest period.

[17] For simplicity, we will only use the male form when referring to the household head throughout this paper.

[18] From the possible answers to the question about savings or investment securities, we categorize the following as liquid: Savings account, fixed interest securities, other securities.

[19] From the possible answers to the question about savings or investment securities, we categorize the following as illiquid: Savings contract for building a home and company assets.

surrender.

Table 1 displays the correlation between the explanatory variables and the life insurance surrender proxy $SP2_{it}$ resulting from linear regression.

Table 1: OLS Regression

	(1) SP2		(2) SP2	
Liquid Assets Prev. Year	-0.00914***	(0.00128)	-0.00896***	(0.001285)
Illiquid Assets	-0.0116***	(0.00103)	-0.0115***	(0.00104)
Number of Children	0.00125**	(0.000560)	0.00122**	(0.000560)
Recently Unemployed	0.00287**	(0.00135)	0.00347**	(0.001365)
Bought Dwelling	0.0164***	(0.00382)	0.0163***	(0.00382)
Log_Age	0.00873***	(0.00140)	0.00886***	(0.00140)
Log_Income	0.0122***	(0.000869)	0.0121***	(0.000873)
Divorce	0.0174***	(0.00429)	0.0172***	(0.00429)
New Assets	-0.0458***	(0.00238)	-0.0458***	(0.00238)
Neg. Change Assets	0.202***	(0.00211)	0.2015***	(0.00211)
Bavaria			0.0106	(0.209)
Hesse			0.0093	(0.209)
Brandenburg			0.006	(0.209)
Berlin			0.00831	(0.209)
Saxony			0.0135	(0.209)
Northrhine-Westphalia			0.0136	(0.209)
Mecklenburg WP			0.00789	(0.209)
Thuringia			0.00716	(0.209)
Saxony-Anhalt			0.00638	(0.209)
Saarland			0.0179	(0.209)
Baden-Wuerttemberg			0.0106	(0.209)
Rhineland Palatinate			0.0219	(0.209)
Bremen			0.00153	(0.209)
Lower Saxony			0.0137	(0.209)
Hamburg			0.0074	(0.209)
Schleswig Holstein			0.0102	(0.209)
Constant	-0.0741***	(0.00793)	-0.0851	(0.209)
Observations	215936		215936	
Adjusted R^2	0.049		0.049	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All explanatory variables introduced above exhibit a positive correlation to life insurance surrender, except the dummy variables for having liquid assets in the previous year, for having illiquid assets in the current year, and for having acquired new assets. Column (2) shows that the

correlations don't vary much, accounting for the households living in certain States of Germany.

When dividing the data into sub-samples for the age groups below 36, between 36 and 55, and above 55, Table 2 shows that households whose heads are younger than 36 exhibit very similar correlations compared to the ones reported in Table 1, while the number of children, and recent unemployment does not seem to play a major role for household heads above 35.

Table 2: OLS Regression for Different Age Groups

	(1) Age < 36		(2) 35 <Age< 56		(3) 55 <Age	
	SP2		SP2		SP2	
Liquid Assets Prev. Year	-0.00992***	(0.00249)	-0.0103***	(0.00194)	-0.00393*	(0.00232)
Illiquid Assets	-0.00478**	(0.00204)	-0.0131***	(0.00163)	-0.0113***	(0.00177)
Number of Children	0.00837***	(0.00112)	-0.000810	(0.000722)	-0.00299	(0.00211)
Recently Unemployed	0.00493**	(0.00226)	-0.00154	(0.00206)	-0.00297	(0.00294)
Bought Dwelling	0.0143**	(0.00656)	0.0173***	(0.00581)	0.0163**	(0.00752)
Log_Age	0.0257***	(0.00671)	-0.000997	(0.00576)	-0.0255***	(0.00687)
Log_Income	0.0123***	(0.00190)	0.00912***	(0.00149)	0.0118***	(0.00141)
Divorce	0.0173*	(0.00946)	0.00733	(0.00707)	0.0236***	(0.00657)
New Assets	-0.0368***	(0.00437)	-0.0462***	(0.00379)	-0.0478***	(0.00417)
Neg. Change Assets	0.202***	(0.00407)	0.272***	(0.00342)	0.132***	(0.00351)
Constant	-0.140***	(0.0222)	-0.0118	(0.0234)	0.0732**	(0.0322)
Observations	46165		87204		82567	
Adjusted R^2	0.062		0.079		0.022	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

3.2 Fixed Effects Regression Model

Household specific characteristics that are constant over time or time specific characteristics, such as the interest rate environment, can have a huge impact on households' surrender behavior. To account for household and time fixed effects, we perform a fixed effects regression model with robust standard errors using $SP2_{it}$ as dependent variable and the same independent variables as in the linear regression model without fixed effects. Table 3 presents the results for the fixed effects model, where Column (2) shows the results taking into account regional specific trends. Due to the household fixed effects, we can interpret the coefficients as an indicator of how much of an extra unit explanatory variable will change an average households surrender

probability.

Table 3: Fixed Effects Regression Model with Robust Standard Errors

	(1) SP2		(2) SP2	
Liquid Assets Prev. Year	-0.0164***	(0.00224)	-0.0163***	(0.00224)
Illiquid Assets	-0.00915***	(0.00171)	-0.00911***	(0.00171)
Number of Children	0.00258***	(0.000998)	0.00260***	(0.000997)
Recently Unemployed	0.00259	(0.00200)	0.00261	(0.00200)
Bought Dwelling	0.00948**	(0.00443)	0.00945**	(0.00443)
Log_Age	0.0358***	(0.00958)	0.0357***	(0.00960)
Log_Income	0.0181***	(0.00172)	0.0181***	(0.00172)
Divorce	0.01000*	(0.00525)	0.00996*	(0.00525)
New Assets	-0.0626***	(0.00189)	-0.0626***	(0.00189)
Neg. Change Assets	0.207***	(0.00512)	0.207***	(0.00512)
Bavaria			0.00438	(0.0107)
Hesse			0.00419	(0.0125)
Brandenburg			0.0192	(0.0146)
Berlin			0.00283	(0.0133)
Saxony			-0.00135	(0.0133)
Northrhine-Westphalia			0.00454	(0.00860)
Mecklenburg WP			0.0137	(0.0226)
Thuringia			-0.00612	(0.0164)
Saxony-Anhalt			-0.00472	(0.0145)
Saarland			-0.0201	(0.0187)
Baden-Wuerttemberg			0.00894**	(0.00424)
Rhineland Palatinate			0.00453	(0.0123)
Bremen			0.00283	(0.0285)
Lower Saxony			0.00310	(0.0117)
Hamburg			0.0235	(0.0160)
Schleswig Holstein			0.00756	(0.0135)
Constant	-0.265***	(0.0335)	-0.270***	(0.0346)
Observations	215936		215936	
Adjusted R^2	0.053		0.053	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The fixed effects model confirms that the surrender probability of an average household increases with socioeconomic factors, such as the number of children, the acquisition of a dwelling and divorce, although the latter is significant only at the 10% level. Our results don't change by accounting for regional trends and except for one state, the geographical living situation does not impact surrender behavior to a statistically significant extent.

Table 4: Fixed Effects Model for Different Age Groups

	(1) Age < 36		(2) 35 <Age< 56		(3) 55 <Age	
	SP2		SP2		SP2	
Liquid Assets Prev. Year	-0.0200***	(0.00448)	-0.0166***	(0.00339)	-0.0193***	(0.00447)
Illiquid Assets	-0.00647*	(0.00377)	-0.00834***	(0.00283)	-0.0117***	(0.00305)
Number of Children	0.00783***	(0.00238)	-0.00122	(0.00155)	0.000630	(0.00368)
Recently Unemployed	0.00798**	(0.00375)	-0.000838	(0.00335)	-0.000519	(0.00442)
Bought Dwelling	0.0148*	(0.00823)	0.00708	(0.00671)	0.00825	(0.00918)
Log_Age	0.0916***	(0.0349)	0.0450*	(0.0241)	0.0551*	(0.0294)
Log_Income	0.0118***	(0.00317)	0.0173***	(0.00299)	0.0178***	(0.00363)
Divorce	0.00270	(0.0126)	0.00541	(0.00880)	0.0140*	(0.00802)
New Assets	-0.0601***	(0.00395)	-0.0725***	(0.00317)	-0.0625***	(0.00360)
Neg. Change Assets	0.211***	(0.0102)	0.268***	(0.00857)	0.139***	(0.00738)
Constant	-0.376***	(0.0995)	-0.301***	(0.0847)	-0.338***	(0.118)
Observations	46165		87204		82567	
Adjusted R^2	0.069		0.081		0.025	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Looking at the fixed effects model for the specific age groups, Table 4 shows that divorce only has a statistically significant impact on the surrender behavior of household heads above 55. While recent unemployment is statistically insignificant looking at all age groups together, it has a positive and statistically significant impact on the surrender probability for household heads younger than 36. Their surrender behavior is also driven by the number of children and the acquisition of a dwelling.

3.3 Cross Section Analysis

To cross-check our results obtained using $SP2L_{it}$ as dependent variable, we will compare them with a cross sectional analysis for the exemplary year 2003 using $SP3L_{it}$ and $SP5L_{it}$ instead. For this analysis, we also include a dummy variable that indicates whether the household has received payments from care insurance. This variable could not be included in the previous regressions as it is only defined for the years 1996-2012.

Table 5: Cross Section Analysis for the Year 2003 - Comparison of the Proxies

	(1) SP2L		(2) SP3L		(3) SP5L	
Liquid Assets Prev. Year	-0.0107*	(0.00613)	-0.0356***	(0.00411)	-0.0255***	(0.00340)
Illiquid Assets	-0.00828*	(0.00499)	0.00677**	(0.00335)	0.00176	(0.00277)
Number of Children	0.00270	(0.00236)	0.00641***	(0.00159)	0.00391***	(0.00131)
Recently Unemployed	-0.00435	(0.00624)	0.00742*	(0.00418)	0.00426	(0.00346)
Bought Dwelling	0.0160	(0.0140)	0.00352	(0.00936)	0.00468	(0.00776)
Log_Age	0.0137**	(0.00694)	-0.0132***	(0.00466)	-0.00657*	(0.00386)
Log_Income	0.00124	(0.00405)	-0.00598**	(0.00271)	-0.00299	(0.00225)
Divorce	0.00632	(0.0194)	0.0200	(0.0130)	0.00488	(0.0108)
New Assets	-0.0501***	(0.0120)	-0.0451***	(0.00807)	-0.0314***	(0.00669)
Neg. Change Assets	0.249***	(0.0101)	0.228***	(0.00676)	0.148***	(0.00560)
Payments by Care Insurance	0.0132	(0.0142)	0.0141	(0.00952)	0.0117	(0.00789)
Constant	-0.0359	(0.0486)	0.103**	(0.0326)	0.0509*	(0.0270)
Observations	10583		10583		10583	
Adjusted R^2	0.063		0.118		0.077	

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5 shows that the number of children exhibits a higher and more statistically significant correlation with life insurance surrender when surrender is identified by $SP3L_{it}$ or $SP5L_{it}$ instead of $SP2_{it}$. In all three regressions, payments received from care insurance by the household head do not show a statistically significant correlation with surrender.

In order to investigate the correlation between households' exposure to care specific costs and efforts on the one hand and life insurance surrender on the other hand, we conduct a cross section analysis for the year 1987, for which the care specific variables are provided in the panel. This allows us to include the burden a household claims to have due to caring for a person,

measured on a scale from 0 to 4. We also control for the entity or person who bears the cost for the care by the variables "Social Welfare Pays for Care" and "Household Pays for Care". Since the questionnaire in 1987 did not ask for the number of children in the household, we substitute this variable by a dummy variable, that equals one, if the household has received child allowance in the previous year.

Table 6: Cross Section Analysis for the year 1987

	SP2	
Child Allowance Prev. Year	0.00496	(0.00600)
Recently Unemployed	0.0168*	(0.00958)
Bought Dwelling	-0.0193	(0.0335)
Log_Age	0.0262***	(0.00912)
Log_Income	0.00585	(0.00563)
Divorce	0.0160	(0.0254)
Burden due to Caring for Person	0.0145**	(0.00730)
Social Welfare Pays for Care	-0.0839	(0.0701)
Household Pays for Care	0.0153	(0.0495)
Constant	-0.108**	(0.0543)
Observations	4776	
Adjusted R^2	0.002	

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The results presented in Table 6 show that a higher burden due to caring for a person has a positive correlation to life insurance surrender. Although they are not statistically significant, the signs of the coefficients of the variables "Social Welfare Pays for Care" and "Household Pays for Care" suggest that the positive correlation between life insurance surrender and the burden due to caring for a person, can (at least) partially be explained by the monetary costs that the household faces for care.

4 Discussion and Conclusion

In this article, we investigate empirically which individual and household specific sociodemographic factors influence the surrender behavior of life insurance policyholders. By using the Socio-Economic Panel (SOEP), we construct several proxies to identify life insurance surrender in the data. To exploit *SOEP*'s panel structure, we start assessing the relationship between

household characteristics and surrender with a linear regression and extend this analysis by a fixed effects model, and by accounting for the households' geographical living situation. Furthermore, we divide the data into three age groups in order to analyze age group specific drivers of life insurance surrender. Since care specific variables are only available for 1987, we conduct a cross section analysis for this year to assess the relationship between a household's exposure to care specific costs and efforts and life insurance surrender.

Except for a recent unemployment, the sociodemographic characteristics that we include (number of children, recent unemployment, recent divorce, acquisition of the dwelling) in our analyses exhibit a positive and significant relation to life insurance surrender that holds even conditioning on region specific trends. However, dividing our data into sub-samples shows that the number of children in the household only has a positive and statistically significant impact on the surrender probability for household heads younger than 36. Their surrender behavior is also driven by recent unemployment and recent acquisition of a dwelling. The positive relationship between recent divorce and surrender stays significant for the oldest age group.

Throughout all age groups and regions, we find that an average household head is less likely to surrender a life insurance policy if he did have liquid savings or investment securities in the previous year, still has other illiquid assets in the current year, and/or has acquired new savings or investment securities. Moreover, he is more likely to surrender if he has also sold or terminated these assets. These results suggest that households surrender their life insurance policy when they face a liquidity need and they do not have any other (more liquid) assets that they could liquidate prior to surrendering life insurance. Therefore, these results support the emergency fund hypothesis mentioned in Section 1. Our cross section analysis of the relationship between a household's exposure to care specific costs and efforts has shown a positive correlation between the burden a household has to carry due to caring for a person and the household's surrender behavior.

Overall, our analysis provides evidence that sociodemographic characteristics have an impact on life insurance surrender. However, we will extend the analysis further using different parametric and non-parametric models, such as a hazard model[20], to gain deeper insight into how the probability of surrender changes with these factors. Furthermore, we will try to identify other

[20] See for example Wooldridge (2010).

sociodemographic variables in the data and conduct various robustness checks. The overall goal will be to link the findings on demographic or societal changes and their effect on life insurance surrender rates with forecasts of sociodemographic factors, in order to predict future surrender rates.

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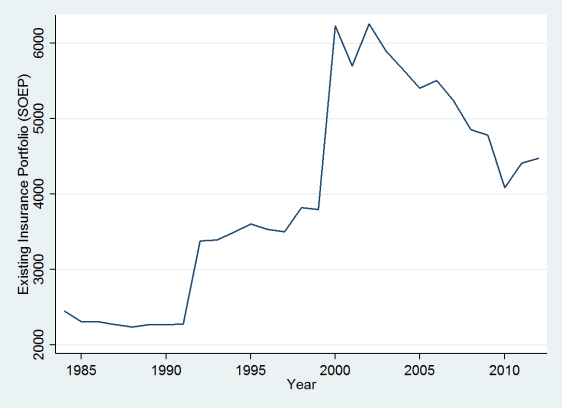
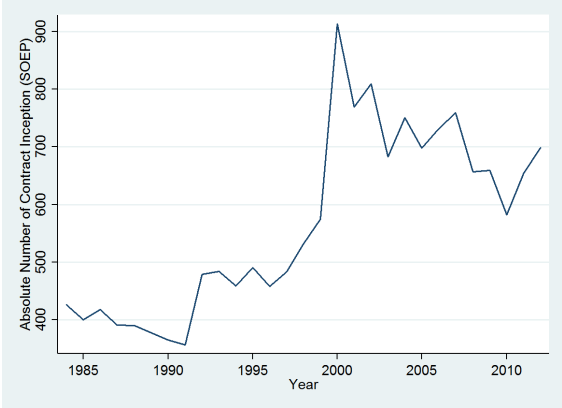
A Appendix

A.1 Data Description

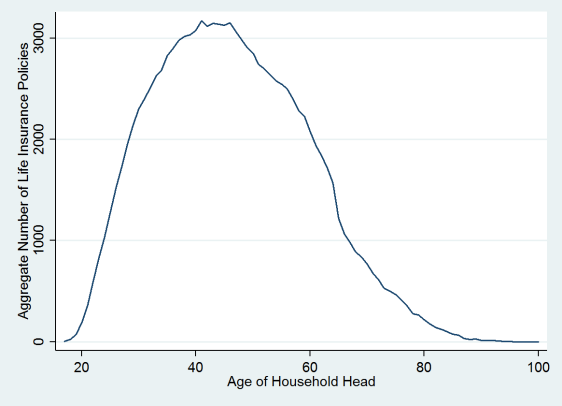


(a) Aggregate Number of Life Insurance Contracts in the Panel by Year

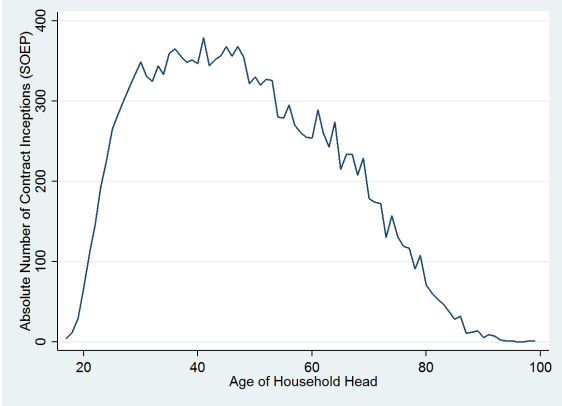


(b) Aggregate Number of Contract Inception in the Panel by Year

Figure 5: Life Insurance Contracts in the SOEP data by Year



(a) Aggregate Number of Life Insurance Contracts in the Panel by Age

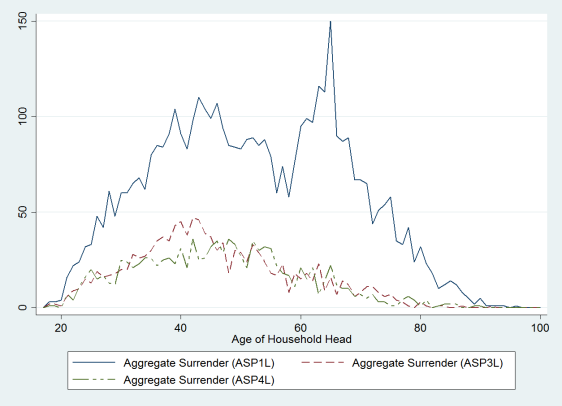


(b) Aggregate Number of Contract Inception in the Panel by Age

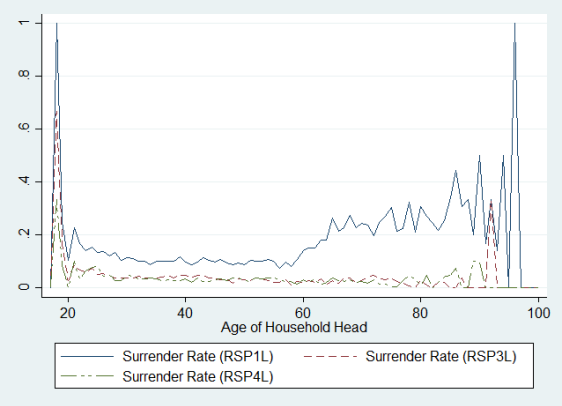
Figure 6: Life Insurance Contracts in the SOEP data by Age

A.2 Accounting For Reserves in the Previous Year

$$SP4L_{it} = LI_{it-1} * (1 - LI_{it}) * (1 - RESERVES_{it-1}) \tag{11}$$



(a) Absolute Number of Surrendered Life Insurance Policies by Age



(b) Surrendered Life Insurance Policies Relative to the Aggregate Number of Policies in the Panel by Age

Figure 7: Life Insurance Policy Surrender by Age (SP3L and SP4L in Comparison)

A.3 The Proxies for Life Insurance Surrender

Table 7: Definition of the Proxies for Life Insurance Surrender

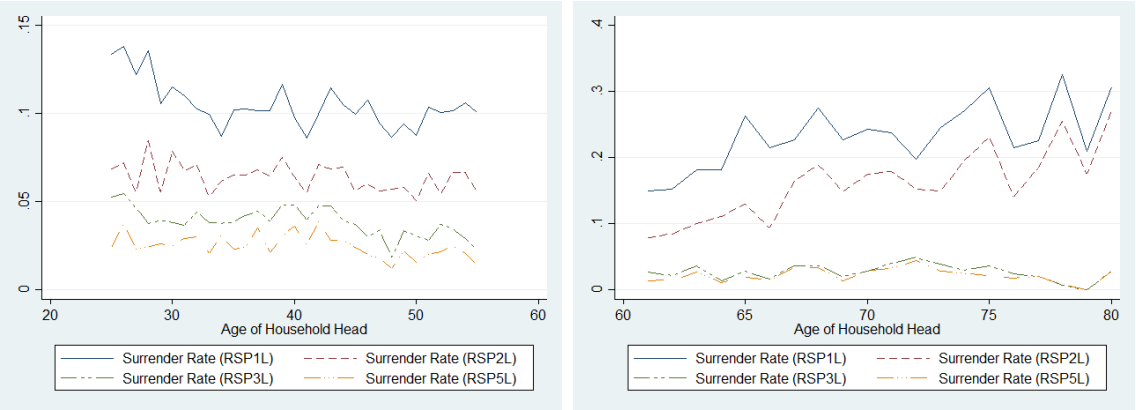
Proxy	Definition	Formal Definition	Definition Period
$SP1_{it}$	Contract termination	$SP1_{it} = LI_{it-1} * (1 - LI_{it})$	1984-2012
$SP2_{it}$	Contract termination conditional on that the household has claimed to not have had life insurance at least once within the last 11 years.	$SP2_{it} = LI_{it-1} * (1 - LI_{it}) * (1 - \prod_{\tau=2}^{10} LI_{it-\tau})$	1984-2012
$SP3L_{it}$	Contract termination conditional on that the household claims to not have put aside money for emergencies in the current year	$SP3L_{it} = LI_{it-1} * (1 - LI_{it}) * (1 - RESERVES_{it})$	2001,2003, 2005,2007, 2011
$SP4L_{it}$	Contract termination conditional on that the household claims to not have put aside money for emergencies in the previous year	$SP3L_{it} = LI_{it-1} * (1 - LI_{it}) * (1 - RESERVES_{it-1})$	2001,2003, 2005,2007, 2011
$SP5L_{it}$	Contract termination conditional on that the household claims to not have put aside money for emergencies in the current year and to not have had life insurance at least once within the last 11 years	$SP5L_{it} = LI_{it-1} * (1 - LI_{it}) * (1 - \prod_{\tau=2}^{10} LI_{it-\tau}) * (1 - RESERVES_{it})$	2001,2003, 2005,2007, 2011

Variable	**Mean**	**Std.Dev.**	**Min**	**Max**
$RSP1_t$	0.1442	0.0152	0.1173	0.1741
$RSP2_t$	0.0883	0.0125	0.0512	0.1137
GDV-Data	0.0300	0.0043	0.0190	0.0345

Table 8: Summary of the Surrender Rates determined by $RSP1$ and $RSPL$

Variable	**Mean**	**Std.Dev.**	**Min**	**Max**
$RSP1L_t$	0.1491	0.0149	0.1334	0.1741
$RSP2L_t$	0.0915	0.0017	0.0895	0.0940
$RSP3L_t$	0.0405	0.0027	0.0358	0.0433
$RSP5L_t$	0.0268	0.0037	0.0221	0.0318
GDV-Data	0.0317	0.0008	0.0302	0.0329

Table 9: Summary of the Surrender Rates determined by $RSP1L$, $RSP2L$, $RSP3L$, $RSP5L$ and the GDV-Data for the years 2001, 2003, 2005, 2007, 2011



(a) Share of Surrendered Policies for Household Heads at Age 25-55

(b) Share of Surrendered Policies for Household Heads at Age 60-80

Figure 8: Surrendered Life Insurance Policies Relative to the Aggregate Number of Policies in the Panel by Age (SP1L, SP2L, SP3L, SP5L)