

The Impact of Policy Returns on Surrender Behavior in Investment-Type Unit-Linked Life Insurance

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POVZETEK: Raziskava uporablja podatke iz dveh življenjskih ubezinskih kompanij, da izuči vpliv političnih vrhuncev na pustilno ponašanje v ubezkah politih za ustreznost. Natančno je najdeno, da politiki z pozitivnimi vrhunci imajo pustilne stopnje, ki so približno 40% manjše, kot politiki z negativnimi vrhunci. Rezultati niso v celoti objašnjeni s statičnimi političnimi in osebni stopnji vrhuncev ali hipotezo o vrhunecu (IRH) ali hipotezo o nesrečnem nalogu (EFH). Dodatne analize potrdi, da kratkih obdobjnih vrhunce in prebivalni vrhunci znatno vplivajo na pustilne stopnje. Dodatno je najdeno podpora hipotezi, da je vpliv vrhuncev v politih za ustreznost zavisan od vpliva vrhunca: povečanje zasebnega vrhunca smanjuje vrhunce politiki, kar poveča pustilne stopnje.

METODA: Raziskava uporablja politične vrhunce na politih za ustreznost, da izuči pustilno ponašanje. Podatki so pridobljeni iz dveh življenjskih ubezinskih kompanij. Dodatne analize potrjujejo, da kratkih obdobjnih vrhunce in prebivalni vrhunci znatno vplivajo na pustilne stopnje.

KLJUČNE UGOTOVITVE:

- Politiki z pozitivnimi vrhunci imajo pustilne stopnje, ki so približno 40% manjše, kot politiki z negativnimi vrhunci.
- Statične politične in osebne stopnje vrhuncev, IRH in EFH ne morejo v celoti objašniti pustilne ponašanja.
- Kratkih obdobjnih vrhunce in prebivalni vrhunci znatno vplivajo na pustilne stopnje.
- Vpliv vrhuncev v politih za ustreznost je zavisan od vpliva vrhunca.

POMEN ZA TRGOVANJE: Raziskava je pomembna za razumevanje in predviđanje pustilnega ponašanja v ubezkah politih za ustreznost, kar je ključno za učinkovito upravljanje rizikov in optimizacijo finančnih rezerv. Razumevanje tega ponašanja lahko pomaga ubezniškim kompanijam v bolj učinkovitem upravljanju rizikov in finančnih rezerv, kar je ključno za učinkovito trgovino.

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Abstract

This study uses policy-level data from two life insurance companies to examine the impact of policy returns on surrender behavior in unit-linked investment-type life insurance policies. I find that policies with positive returns have surrender rates that are approximately 40% lower than those with negative returns. The results show that static policy-level and policyholder-level variables, as well as the interest rate hypothesis (IRH) or emergency fund hypothesis (EFH), do not fully explain surrender behavior. Additional analyses confirm that short-term rolling returns and excess returns also significantly affect surrender rates. In addition, I find support for the explanation that IRH in unit-linked policies is driven by the return effect: an increase in the interest rate decreases policy returns, thereby increasing surrender rates. This proposed return effect extends the common explanation, according to which an increase in the interest rate increases the opportunity cost of holding an insurance policy and, hence, increases surrender rates.

JEL classification: G11, G40, D14

Keywords: Behavioral finance, Life insurance, Surrender behavior, Behavioral insurance

1 Introduction

Understanding policyholder lapse behavior in life insurance is essential.¹² Incorrectly specified lapse behavior can lead to financial losses, such as adverse selection and loss of liquidity (e.g., Pinquet et al., 2011; He, 2011; Chang and Schmeiser, 2021). For example, at the beginning of 2023, a large Italian life insurer, Eurovita, faced significant challenges due to increased interest rates, which resulted in decreased asset valuations and higher policy lapse rates. During 2023, Eurovita was eventually liquidated

¹A working version of this paper was called *How Does Policy Return Affect Surrender Behavior and Technical Provision Valuation of Savings Policies?*. The data set and part of the empirical analysis overlap with the current version.

²It is useful here to highlight the difference between lapse and surrender. Lapse refers to the voluntary termination of an insurance policy or termination due to non-payment of premiums. A *surrender* is a special case of lapse, where a policy with a savings component lapses, and the surrender value is paid back to the policyholder. The introduction uses the term 'lapse' when referring to other studies, but this study uses 'surrender' elsewhere.

(Yahoo Finance, 2023; Reuters, 2023; Eurovita, n.d.). One of the primary reasons for Eurovita’s downfall was a lack of understanding and preparation for policyholder lapse behavior. Understanding lapse behavior is further required in the Solvency II regulation and the IFRS 17 standard.³

Empirical research on lapse behavior commonly employs macroeconomic variables as well as policyholder-specific, policy-specific, and household-specific variables to explain lapse rates (for an overview, see, for example, Eling and Kochanski, 2013 and Shamsuddin et al., 2022). The policyholder-level or policy-level studies find that lapse rates differ by sex, policy age, and policy type (e.g., Pinquet et al., 2011; Milhaud et al., 2011; Eling and Kiesenbauer, 2013; Fier and Liebenberg, 2013) and are affected by value of the surrender option (Knoller et al., 2015), unfavorable household events (Fier and Liebenberg, 2013; Nolte and Schneider, 2017), and policyholders’ cognitive ability (Mulholland and Finke, 2014). A specific theme has been to study the interest rate hypothesis (IRH) and the emergency fund hypothesis (EFH) (for example, Dar and Dodds, 1989; Outreville, 1990; Kuo et al., 2003). According to the IRH, an increase in the general interest rate leads to higher lapse rates. According to the EFH, a decrease in income or wealth, or an increase in unemployment, leads to higher lapse rates. However, many life insurance products, such as unit-linked policies, also function as investment products, making them relevant to other aspects of household investment behavior. A particularly well-studied topic is how asset return affects investors’ propensity to sell the asset. The disposition effect, which refers to the tendency for investors to sell winning investments and hold onto losing ones (Shefrin and Statman, 1985), is one of the most robust findings in behavioral finance (for an overview, see Kaustia, 2010a). On the other hand, mutual fund investors have demonstrated behavior opposite to the disposition effect (Ivković and Weisbenner, 2009; Chang et al., 2016). Studies on selling behavior, particularly the disposition effect, show that asset return affects selling decisions. This raises a question of whether the current lapse

³Solvency II requires that insurance companies use realistic policyholder behavior assumptions when calculating the best estimate of technical provisions (Directive 2009/138/EC of the European Parliament and the Council). The assumptions on policyholder behavior also have to account for the influence of past and future economic conditions (Commission Delegated Regulation (EU) 2015/35). The revised Solvency II guidelines on the valuation of technical provisions emphasize the dynamic lapse behavior model, which means that the lapse rate depends on financial market variables, such as interest rates, policy returns, or the value of embedded options.

studies, which do not consider policy return, adequately explain policyholder behavior, especially in unit-linked policies.

To date, the lapse behavior literature has not explored how policy returns affect surrender behavior. This study utilizes a detailed and extensive policyholder-level data set from two Finnish life insurers to examine how policy returns affect surrender behavior in unit-linked investment-type life insurance without guarantees. Unit-linked investment-type policies (savings policies) are a significant asset class for households in Finland⁴, similar to unit-linked insurance plans in Europe and variable universal life insurance policies without guarantees in North America. The data set used in this study comprises approximately 20,000 policies and spans the period from June 2009 to June 2019. The statistical methods employed in this study include logistic regression and survival analysis, utilizing the proportional hazards model.

The first finding is that unit-linked investment-type policies with positive return, measured at the policy-level from the inception of the policy, have approximately 40% lower surrender rates than policies with negative return. The policy return affects the surrender rate, even when statistical models control for macroeconomic and financial variables, such as the general stock index return, the risk-free rate, inflation, the unemployment rate, and policy-specific and policyholder-specific covariates. The findings indicate that failing to consider policy return when explaining surrender behavior leads to an incomplete understanding of the surrender behavior and may introduce omitted variable bias into statistical models. Therefore, the IRH and the EFH, as well as basic non-dynamic policy-related and policyholder-related covariates, are insufficient in explaining surrender behavior among unit-linked policyholders.

Second, I examine how different performance measures, in addition to the aforementioned positive return dummy, affect surrender behavior. Rolling 3-month, 6-month, and 12-month returns, as well as the continuous holding-period return for the entire policy lifetime, affect surrender behavior. Additionally, I examine the effect of a 12-month excess return, compared to the OMX Helsinki 25 index return and a 3-month Euribor yield, on surrender behavior. The findings indicate that all policy-level return

⁴At the end of June 2016, the total investment assets of Finnish households were 277.3 bn EUR, of which savings policies were 19.8 bn EUR. For comparison, listed stocks were 31.1 bn EUR, mutual funds 20.0 bn EUR, and bank deposits 90 bn EUR.

variables are statistically and economically significant factors in explaining surrender behavior.

Third, I provide results on how basic policy-specific and policyholder-specific covariates influence surrender behavior. I find that women, older policyholders, and policies with higher savings have lower surrender rates. Additionally, providing policyholders with salient information about their policy increases surrender rates. These findings strengthen earlier empirical findings on heterogeneity in lapse behavior (e.g., Eling and Kiesenbauer, 2013; Fier and Liebenberg, 2013).

Fourth, I document how various financial and macroeconomic variables, commonly used to analyze the interest rate hypothesis (IRH), affect surrender behavior in unit-linked policies. Previous research has primarily found evidence supporting the IRH. This study finds that a high interest rate is associated with a higher surrender rate. In some model specifications, the effect is statistically significant, while in others it is insignificant. I examine the mechanism behind IRH in more detail and find that when controlling for the policy return, the interest rate has a near-zero and statistically non-significant effect on the surrender rate.

These results suggest that IRH could be caused in unit-linked policies due to a return effect: an increase in interest rate causes a negative policy return for policies that are linked to fixed-coupon bond funds. This negative return would then cause the increased surrender rate. The return effect is an alternative or complementary to the opportunity cost effect, which is commonly proposed to cause IRH (e.g., Kuo et al. 2003; Yu et al. 2018). According to the opportunity cost effect, a high interest rate increases the opportunity cost of holding the policy, meaning that the policyholder could get a better return from alternative assets, e.g., bonds or bond funds, thus increasing the surrender rate.

This study also finds that stock market return affects surrender behavior in two opposite ways: through the return effect, where a positive stock market return results in a positive policy return, decreasing the surrender rate, and through the opportunity cost effect, where a positive stock market return may cause policyholders to expect other assets to outperform unit-linked policies in the future thus increasing the opportunity

cost of holding the policy.

The paper proceeds as follows. Section 2 provides an introduction to the data set, variables, and econometric methods. Section 3 presents how various factors affect surrender behavior and discusses the results. Section 4 concludes the article.

2 Data and methods

2.1 Unit-linked savings policies

A savings policy is an investment product sold by life insurance companies in Finland. This study focuses on pure unit-linked savings policies, similar in nature to variable universal life insurance policies in the USA or the UK's unit-linked insurance plans. Figure 1 illustrates the basic functionalities of the unit-linked savings policies. In unit-linked savings policies, the policyholder can choose the underlying index or indices from actively managed mutual funds and wealth management baskets. Investors use unit-linked savings policies for investing and saving, and older policyholders also use them for bequest planning.

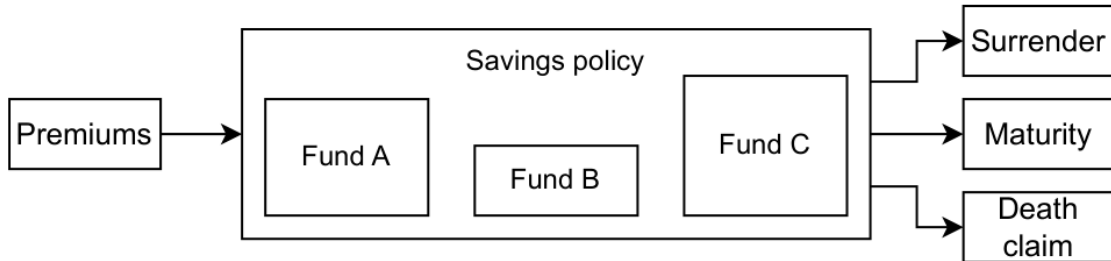


Figure 1: This figure illustrates the main functionality of the savings policy. All savings can be allocated in any proportion between different open-ended or closed-ended mutual funds. Policyholders can freely pay premiums, which increase the policy savings after the deduction of the premium fee (between 0.0% and 2.2%). The policy ends either in the policyholder surrendering the policy, the policy expiring at the maturity date, or the death of the insured.

The only risk cover included in the policies is a death cover, which varies between 95% and 105% of the insurance savings. The most common death cover is 100% of the insurance savings, and the death cover varies as the insurance savings vary. All policies can have a continuous payment plan, but these plans are not binding. All policies also

have an option to surrender, but the insurance company might charge a surrender fee during the first three years of the policy. Policyholders receive an account statement for their policy annually, typically in the first quarter. The account statement provides a detailed analysis of how the policy’s insurance savings have evolved, along with other relevant data regarding the policy. There are no secondary markets for savings policies, and policyholders cannot transfer their policies to another insurance company. Also, each policyholder has only one policy in the sample.

The savings policies are subject to Finnish tax law, which prohibits deducting capital losses from surrendering a policy from other capital gains or income during the sample period. Thus, surrendering a savings policy at a loss yielded no tax benefits. Additionally, savings policies were particularly compelling in bequest planning during the sample period because death benefits were tax-free, up to 35,000 EUR for all beneficiaries’ next of kin. For the insured person’s widow, 50% of the death benefit, or at least 35,000 EUR, is tax-free. The inheritance tax benefit was removed from the policies at the end of 2017. The third tax-related aspect is that a policyholder can reallocate savings inside the savings policy without tax consequences.

These tax benefits (inheritance tax benefits and tax-free reallocations) and disadvantages (no capital gains on policy surrenders at a loss) may affect the extent to which the results generalize to other asset classes or regions. Unit-linked policyholders likely resemble mutual fund investors more in terms of risk appetite, as policies are linked to mutual funds. The strong link between unit-linked policies and bequest planning may lead to a different selection from that of common mutual fund investors. Tax regulations vary across countries and over time, which may affect how well the results generalize to other unit-linked policies, even though the underlying rationale for retail investors to invest in unit-linked policies is likely similar across countries.

2.2 Sample

The sample comprises 21,701 unit-linked savings policies issued by two Finnish life insurance companies and consists of quarterly observations from June 30, 2009, to June 30, 2019. The sample is a random subsample of both firms’ savings policies, and the number of policies is roughly equal across firms (11,715 for Firm 1 and 9,986

for Firm 2). Not all policies are in force throughout the entire observation period, as policies may begin or end during it. The sample has 360,103 quarterly observations, equivalent to 90,025.75 policy years of exposure, and 3,717 surrender events. The total insurance savings as of 30 June 2016 are 447.06 EUR million. Only policyholders aged 18 or older are included in the sample, as they have the legal right to decide on their policies and their characteristics are well documented.

Most empirical analyses examine the factors that affect policyholders' decisions to surrender their insurance policies. A dummy variable indicates whether the policy was surrendered during the observed quarter. The main covariate is a dummy variable indicating whether the policy's holding period return (total return) is positive or negative. The quarterly return of an insurance policy is calculated using the simple Dietz method (Dietz, 1966)

$$r(t_0, t_1) = \frac{S_{t_1} - S_{t_0} - C(t_0, t_1)}{S_{t_0} + 0.5 \cdot C(t_0, t_1)},$$

where (t_0, t_1) is a period for which the return is calculated, S_t is savings at time t and $C(t_0, t_1)$ is the net cash inflow into the policy during period (t_0, t_1) . $C(t_0, t_1)$ is negative when savings flow out from the policy (death claim, surrender claim, maturity claim) and positive when savings flow into the policy (premiums). Quarterly returns are accumulated to compute 6-month, 12-month, and holding-period returns from the policy's inception. The positive return dummy is then constructed using the holding-period return. For example, if the policy's period-to-period returns are 8.0%, -4.0%, and -10.0%, then the holding period returns are 8%, 3.7%, and -6.7%, and the positive return dummy receives values 1, 1, and 0. The 12-month excess return variables are calculated as the difference between the policy's 12-month return and the 12-month return of the market variables (e.g., a stock market index).

While continuous return measures are evaluated in Section 3.2, the primary analyses use a dummy variable for positive returns. A positive return dummy is chosen because empirical studies on stock investor behavior have observed that investors' selling behavior changes at 0% returns (Kaustia, 2010b; Ben-David and Hirshleifer, 2012), suggesting that investors are especially interested in whether investments are

in the money or out of the money.

The surrender value equals the insurance savings minus any possible surrender fees. One of the firms does not charge a surrender fee, whereas the other applies a stepwise fee. The stepwise surrender fee starts at 3% of savings and decreases by 1 percentage point each year as the policy age increases. After three years, the surrender fee is 0%, so no surrender fee is charged. A dummy variable indicating the first quarter of the calendar year serves as a proxy for policyholders receiving their annual account statements. Other covariates include policy age, policyholder age, and policyholder sex (where female is coded as 1). Policies are grouped into yearly cohorts, and cohort fixed effects are included to control for cohort-specific variation in the econometric models.

Four interest rate variables are used to test the IRH: 3-month Euribor, the 5-year Finnish government bond yield, the 10-year Finnish government bond yield, and the 10-year euro area corporate bond yield (ECB benchmark, all issuers). The equity indices are the OMX Helsinki 25, Eurostoxx 600, and MSCI World Stock Index. Finnish inflation, unemployment, and GDP growth rates are used as controls in the regression models examining the effects of policy returns on surrender behavior.

Table 1 presents the summary statistics of the key variables. The mean quarterly surrender rate is 1.03%. Converted to a yearly surrender rate, it is 4.13%. The average age of the policyholders is 64.69 years, with a median age of 66.87 years. Of the policyholders, 58.96% are female (41.04% male). Most policy-level observations (71.66%) have a positive holding-period return. The mean total savings per policy is 25,636.75 EUR, and the median is 12,736.22 EUR. The average policy age is 5.13 years, and the mean surrender fee during the observation period is 0.45%.

2.3 Econometric methods

I use the Cox proportional hazards model and logistic regression to test how policy return, among other covariates, affects surrender behavior. The proportional hazards model incorporates time-varying covariates and uses cluster-robust standard errors for the regression coefficients. The logistic regression model also uses cluster-robust

Table 1: This table has descriptive statistics on the surrender dummy variable and covariates used in the regression models. The policyholder age is expressed in 10 years, and policy savings in 10 000 euros to have similar order of magnitude for later estimated coefficients.

	Mean	Median	Std.Dev	Min	Max
Surrendered	0.010	0	0.101	0	1
Positive return	0.717	1	0.451	0	1
Policyholder age (10 years)	6.469	6.687	1.560	1.800	9.907
Policyholder sex	0.590	1	0.492	0	1
Savings (10 000 EUR)	2.564	1.274	4.100	0	209.917
Policy age	5.133	4.540	3.742	0	17.490
Surrender fee (%)	0.446	0	0.959	0	3
Quarter 1	0.247	0	0.431	0	1
3-month Euribor (%)	0.248	0.097	0.541	-0.330	1.536
5-year gov bond yield (%)	0.612	0.290	0.900	-0.550	2.890
10-year gov bond yield (%)	1.478	1.090	1.039	-0.020	3.820
10-year corp bond yield (%)	2.326	1.999	1.212	0.655	4.467
1-year return EUROSTOXX (%)	5.699	7.824	13.201	-28.875	49.365
1-year return OMXH25 (%)	9.422	11.448	18.413	-35.109	76.523
1-year return World index (%)	12.301	11.777	12.224	-21.366	50.434
1-year inflation (%)	1.191	1.057	1.182	-0.209	3.440
Unemployment rate (%)	7.888	7.933	0.866	5.800	9.433
GDP growth rate (%)	0.488	0.500	2.612	-8.600	5.500

standard errors for the regression coefficients. In all policy-level models in sections 3.1 and 3.2, the clustering is performed at the policy level, which is identical to the policyholder level, as all policyholders hold a single policy. The policy-level models in Section 3.3, have two-way clustering by policy and calendar year. In the proportional hazards model, the surrender rate is of the form $\lambda(t, x) = \lambda(t)e^{x_t \cdot \beta}$, where $\lambda(t)$ is the baseline surrender rate at time t and

$$\begin{aligned}
x_t \cdot \beta = & \beta_0 \text{Positive return}_t + \beta_a \text{Policy covariates}_t + \beta_b \text{Policyholder covariates}_t \\
& + \beta_c \text{Cohort FEs}_t + \beta_d \text{Macroeconomic covariates}_t,
\end{aligned} \tag{1}$$

where betas are regression coefficients. Policy and policyholder covariates are policyholder sex, policyholder age, firm dummy, the first quarter dummy, and policy savings. The surrender fee is omitted from the proportional hazards model specification because it does not satisfy the proportional hazards assumption.

The proportional hazards models include cohort fixed effects and either macroeconomic

covariates or calendar year fixed effects. The logistic regression models include calendar year fixed effects and in some model specifications macroeconomic covariates. The policy age is not included in the proportional hazards model as it is included in the baseline hazard rate that depends on policy age.⁵

In the proportional hazards model, if the i th component of vector x_t increases by one, the surrender intensity changes by a multiplier

$$\frac{\lambda(t, (x_{1t}, \dots, x_{it} + 1, \dots, x_{kt}))}{\lambda(t, (x_{1t}, \dots, x_{it}, \dots, x_{kt}))} = \frac{\lambda(t) e^{(x_{1t}, \dots, x_{it} + 1, \dots, x_{kt}) \cdot \beta}}{\lambda(t) e^{(x_{1t}, \dots, x_{it}, \dots, x_{kt}) \cdot \beta}} = e^{\beta_i}.$$

A logistic regression is used to test the robustness of the proportional hazards model and estimate the effect of the surrender fee and policy age on surrender probability. The logistic regression models also examine how macroeconomic variables and other policy-level return covariates affect surrender behavior. In the logistic regression, the probability of surrendering a policy during a given time is $\mathbb{P}(\text{SURR} = 1 | X = x_t) = 1/(1 + e^{-x_t \cdot \beta})$, where $x_t \cdot \beta$ is given by Equation 1. However, the logistic regression model also includes policy age, surrender fee, and their coefficients. In the logistic regression, if the i th component of the vector x_t increases by one, the odds of surrender change by a multiplier e^{β_i} . However, because $\mathbb{P}(\text{SURR} = 1 | X = x_t)$ is relatively close to zero, the relative surrender risk also changes approximately by e^{β_i} .

3 Results

3.1 Surrender rate and policy return

Table 2 presents the coefficients of proportional hazards and logistic regression models specified in subsection 2.3. In this section, the text primarily refers to Model 2, the logistic regression (logit) model, although the coefficients are nearly identical across all models. It is worthwhile to emphasize that the article primarily analyzes the relative risk of how various factors affect the surrender probability, assuming all other factors

⁵The proportional hazard assumption means that the effect of a specific factor does not depend on the age of the policy. I have also omitted models that include both macroeconomic covariates and cohort FEs, because their combination breaks the PH model and leads to different results than the corresponding logistic regression model.

remain constant.

The coefficient for the positive return dummy is -0.472 and statistically significant ($p < 0.001$). This implies that policies with a positive return have a 37.6% lower surrender rate than policies with a negative return, calculated as $e^{-0.472} - 1$ (see Section 2.3 for details).⁶ The other models show coefficient values ranging from -0.468 to -0.519, implying the surrender rates are 37.4% to 40.5% lower for policies with positive return than those of policies with negative return. For example, if a specific policy with a negative return has a surrender rate of 4%, an identical policy with the only difference that the policy has a positive return has a surrender rate of 2.5%. The result is the opposite of the disposition effect observed in most stocks and many other asset classes (see, e.g., Kaustia, 2010a for a literature review), but similar to that observed in mutual funds by Ivković and Weisbenner (2009) and Chang et al. (2016). The impact of the positive return on the surrender rate is also economically significant, as the aggregate surrender rate is 4.13% and large relative changes to it are material, especially in the long run, when the surrenders compound.

The surrender rate is 16.2% higher in the first quarter than in other quarters ($p < 0.01$). The first-quarter dummy variable serves as a proxy for policyholders receiving an annual account statement, so policyholders who receive salient information and are reminded of their policies are more likely to surrender their policies. Policies with larger savings have a lower surrender rate ($p < 0.001$). If a policy's savings increase by 10,000 euros, the policy's surrender rate decreases by 10.1%. Policyholder age and sex are also statistically significant covariates in estimating the surrender rate. If the policyholder's age increases by ten years, the surrender rate decreases by 8.8% ($p < 0.001$). The surrender fee nearly completely prevents policyholders from surrendering their policies: a 1 percentage point increase in the surrender fee decreases the surrender rate by 36.2% ($p < 0.001$).⁷

The observations that men have higher surrender rates than women and that older

⁶The term surrender rate is used throughout this section, although the logistic regression model results are interpreted as surrender probabilities.

⁷The effect of the positive return dummy on surrender behavior is statistically significant when examined for both firms separately (Appendix Table 8). However, for the policyholders in Firm 2, the effect of positive return is considerably stronger than for the policyholders in Firm 1. The surrender behavior with respect to other policy-level factors is rather similar between the firms.

Table 2: This table examines how different covariates affect the surrender behavior. The sample consists of quarterly observations of policies from June 2009 to June 2019. In the logistic regression models, the dependent variable is a dummy variable for whether the policyholder surrendered the savings policy, and in the proportional hazards model, the dependent variable is the duration to surrender. The covariates are policyholder age, policyholder sex, policy savings at the observation date (if the policy ends, then prior to payout), policy age, and surrender fee. The models also include macroeconomic variables as controls and fixed effects for cohorts and calendar years, depending on the model specification. Standard errors are clustered at the policy level.

	PH	Logit	PH	Logit
	(1)	(2)	(3)	(4)
Positive Return	−0.519*** (0.042)	−0.472*** (0.039)	−0.519*** (0.042)	−0.468*** (0.039)
Policyholder age (10y)	−0.154*** (0.015)	−0.092*** (0.011)	−0.153*** (0.015)	−0.092*** (0.011)
Policyholder sex	−0.212*** (0.033)	−0.206*** (0.033)	−0.212*** (0.033)	−0.206*** (0.033)
Savings (10 000 EUR)	−0.104*** (0.012)	−0.106*** (0.012)	−0.104*** (0.012)	−0.106*** (0.012)
Quarter 1	0.299*** (0.044)	0.150** (0.057)	0.158*** (0.037)	0.160*** (0.037)
Policy age		0.008 (0.006)		0.009 (0.006)
Surrender fee (%)		−0.450*** (0.030)		−0.451*** (0.030)
Firm	0.300*** (0.050)	0.226*** (0.048)	0.256*** (0.051)	0.228*** (0.048)
Constant		−5.101*** (0.555)		−4.593*** (0.138)
Cohort FEs	Yes	No	Yes	No
Macro controls	Yes	Yes	No	No
Year FEs	No	Yes	Yes	Yes
Observations	360,103	360,103	360,103	360,103
Max. Possible R ²	0.174		0.174	

Note:

*p<0.05; **p<0.01; ***p<0.001

policyholders have lower surrender rates are consistent with previous studies. Many studies report men having higher lapse or surrender rates than women (e.g., Pinquet et al., 2011; Eling and Kiesenbauer, 2013). Barber and Odean (2001) find that in stock markets, men trade more often than women and link this finding to men being more overconfident than women. Many studies have found that older policyholders have lower lapse or surrender rates (e.g., Milhaud et al., 2011; Eling and Kiesenbauer, 2013). However, contrary evidence also exists, proposing that older policyholders have higher lapse or surrender rates (Knoller et al., 2015). For savings policies, it is rational for older policyholders to have a lower surrender rate because an increase in the mortality rate increases the expected inheritance tax benefit, making the policy more valuable.

Policies with small insurance savings are often policies with regular payments and payment plans. Previous findings show that policies with regular payment plans have significantly higher surrender rates than those without (Eling and Kiesenbauer, 2013). A likely explanation for the surrender fee preventing most surrenders is that policyholders surrender their policies when a surrender fee is charged only out of necessity, which aligns with previous studies (e.g., Dar and Dodds, 1989; Nolte and Schneider, 2017).

Figure 2 presents the graphs of empirical survival functions relative to the surrender event. The survival curves are plotted for all policies and for policies with positive and negative returns. The survival probability of policies with a positive return is higher than that of those with a negative return. The survival analysis demonstrates how the difference in the surrender rate between policies with positive and negative returns accumulates over time. For example, the probability that the policy survives to 5 years (the mean age) is about 83% for policies with positive return and about 75% for policies with negative return. The 11% difference (calculated as $83\%/75\% - 1$) in portfolio size is material for insurance firms, as a large share of fee income from policies and underlying funds is often proportional to insurance savings.

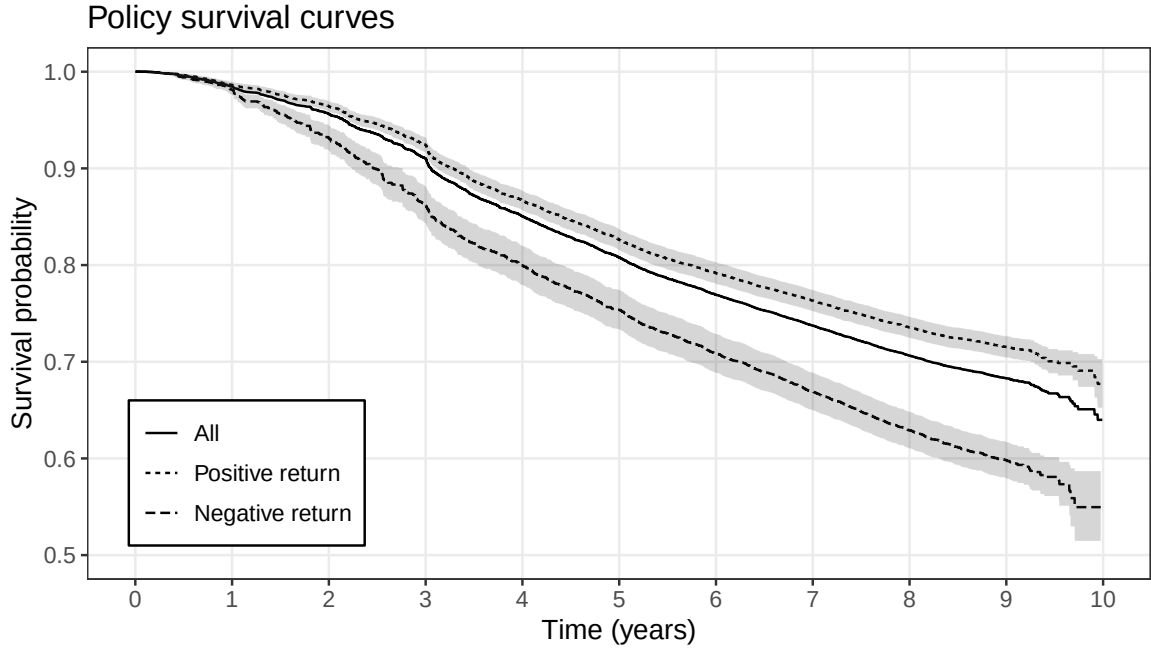


Figure 2: This figure shows the graphs of empirical survival functions for all policies (solid), policies with positive return (dashed), policies with negative return (dotted), and 95% confidence intervals (shaded areas) for survival curves with positive and negative returns. The survival functions are estimated using the Kaplan-Meier method for right-censored data.

3.2 Different performance measures and surrender behavior

Many studies in mutual fund literature examine how different mutual fund performance measures affect the mutual fund investors' behavior and, hence, mutual fund flows (e.g., Ben-David et al., 2021; Sirri and Tufano, 1998, Chevalier and Ellison, 1997, Barber et al., 2016).

Table 3 shows the percentiles of the policy-level return variables to illustrate the distribution. A key point is that a longer return period yields a wider return distribution. For example, the difference between the 75th and 25th percentiles of the 3-month return is 3.4%, while for the 12-month return it is 7.6%, and for the holding-period return it is 14.0%.

Table 4 presents the regression results of models that are similar to Model 2 in Table 2, but where the performance measure is different from the positive return dummy. All performance variables are statistically significant and negative, indicating that higher returns are associated with lower surrender rates. Looking only at the coefficients, shorter returns appear to have a more significant economic impact on the surrender

Table 3: This table shows percentiles of the different policy-level return and excess return variables.

	5%	10%	25%	50%	75%	90%	95%
12-month return (%)	−9.2	−5.6	−0.6	2.5	7.0	12.2	16.9
6-month return (%)	−7.7	−4.3	−0.6	1.5	4.1	8.1	12.1
3-month return (%)	−5.6	−3.4	−0.8	0.7	2.6	5.7	8.2
Holding period return (%)	−15.7	−7.4	−0.8	4.3	13.2	26.9	38.8
Excess return w.r.t. OMXH25 (%)	−28.5	−24.5	−14.7	−5.8	2.1	11.8	19.7
Excess return w.r.t. Euribor (%)	−10.0	−6.0	−1.0	2.2	6.7	11.7	16.5

rate. However, as Table 3 shows, the return distribution narrows as the return period shortens. For example, a policy with a 3-month return of 2.6% (75th percentile) has 19.0% lower surrender probability than a policy with a 3-month return of -0.8% (25th percentile). Examining the same percentiles, a policy with a 12-month return of 7% (75th percentile) has 19.8% lower surrender probability than a policy with a 12-month return of -0.6% (25th percentile).

Table 4: This table examines how different policy-level return variables affect surrender behavior. The sample consists of quarterly observations of policies from June 2009 to June 2019. The policy-level return variables are 3-month, 6-month, and 12-month policy return, holding-period return, and positive return dummy. The models include all basic policy-level and policyholder-level covariates and macroeconomic controls. Standard errors are clustered at the policy level.

	Logit (1)	Logit (2)	Logit (3)	Logit (4)	Logit (5)
Positive return					−0.387*** (0.039)
3-month return (%)	−0.062*** (0.003)				−0.046*** (0.005)
6-month return (%)		−0.041*** (0.003)			−0.005 (0.004)
12-month return (%)			−0.029*** (0.003)		−0.008** (0.003)
Holding-period return (%)				−0.010*** (0.001)	
Cohort FEs	No	No	No	No	No
Basic covariates	Yes	Yes	Yes	Yes	Yes
Observations	360,103	360,103	360,103	360,103	360,103

Note: *p<0.05; **p<0.01; ***p<0.001

In a model (Model 5) with all different time-period rolling returns as well as positive

return dummy, the positive return dummy remains highly significant with coefficient being -0.387 ($p < 0.001$). In this model specification, the 6-month and 12-month returns coefficients go to near zero. This suggests that policyholders consider especially the sign of the return, is the policy making a gain or a loss, and not so much the size of the return.

In Appendix Table 7, the model coefficients of 12-month rolling excess returns are shown. The effect of the 12-month rolling excess return on the surrender rate is nearly identical to the 12-month rolling unadjusted return. The results indicate that any return-based performance measure affects the policyholder’s decision to surrender.

3.3 Interest rate, stock market return and surrender behavior

Studies that use macroeconomic variables primarily examine the IRH and the EFH. IRH posits that an increase in the general interest rate level or a decrease in the policy’s credited guaranteed rate increases the lapse rate. Empirical findings mainly support IRH (e.g., Kuo et al., 2003; Kim, 2005; Kiesenbauer, 2012; Yu et al., 2018). EFH posits that a decrease in households’ income or wealth increases the lapse rate. The empirical results on EFH are consistent: negative shock in household wealth or income increases the lapse or surrender rate (e.g., Dar and Dodds, 1989; Outreville, 1990; Kuo et al., 2003; Nolte and Schneider, 2017). A few studies have examined IRH and EFH in unit-linked policies (Yu et al., 2018; Kiesenbauer, 2012).

This section first examines how interest rates and stock market returns affect surrender rates of unit-linked policies. I do this to corroborate previous findings on the IRH in unit-linked policies and to show that this sample has properties similar to those of previously studied unit-linked policies, so that the main focus is then turned to what causes the observed IRH.

Prior studies have proposed that a higher opportunity cost of investing in an alternative asset induces the IRH (e.g., Kuo et al. 2003; Yu et al. 2018), which is later referred to as the *opportunity cost effect*. This explanation is especially appealing for traditional life

insurance with a savings component and a guaranteed rate credited to the insurance savings. In such products, a change in the general interest rate would not affect the insurance policy's expected return, thereby increasing the opportunity cost of holding the policy.⁸

For unit-linked policies, the opportunity cost effect is more complex. It is common for all or part of the unit-linked savings to be linked to fixed-coupon bonds or bond funds. In such policies, a change in the interest rate level affects the policy's expected future return because bond funds roll over their holdings and can reinvest at the new rate. Therefore, a policyholder who understands how bond funds function compares the policy's expected future return with the expected return she believes she can obtain by investing outside the insurance policy.

In unit-linked policies, there is an additional explanation for IRH. When the general interest rate level rises, the value of fixed-coupon bonds and bond funds decreases, resulting in a negative policy return. As the results in section 3 suggest, the decrease in policy returns increases the surrender rate. This effect is later referred to as *return effect*. The return effect could be caused, for example, by an investor updating her beliefs about the fund manager's skill or the insurance firm's being poor, expected future returns to be low, and therefore surrendering the policy.

Figure 3 plot A shows the aggregate surrender rate and its Hamilton decomposition into trend and cycle components, as in Koijen et al. (2024). The aggregate annual surrender rate ranges from 0.95% to 6.46% over the sample period, with no discernible trend. Also, no clear pattern for the cyclical component emerges from the decomposition.

Panel B of Figure 3 plots the time series of the 10-year Finnish government bond yield and the 10-year euro area corporate bond yield (all issuers). The sample period is characterized by a prolonged low-interest-rate environment, with the 10-year corporate bond yield remaining near 1% for several years. Low variation in interest rates during the sample period poses challenges for studying IRH.⁹ Also, the low-

⁸Many traditional policies are subject to the firm's profit participation, so an increase in the general interest rate might also have some effect on the policy return.

⁹Low variation in explanatory variables can lead to high standard errors, making coefficient estimates imprecise, unreliable, and statistically insignificant.

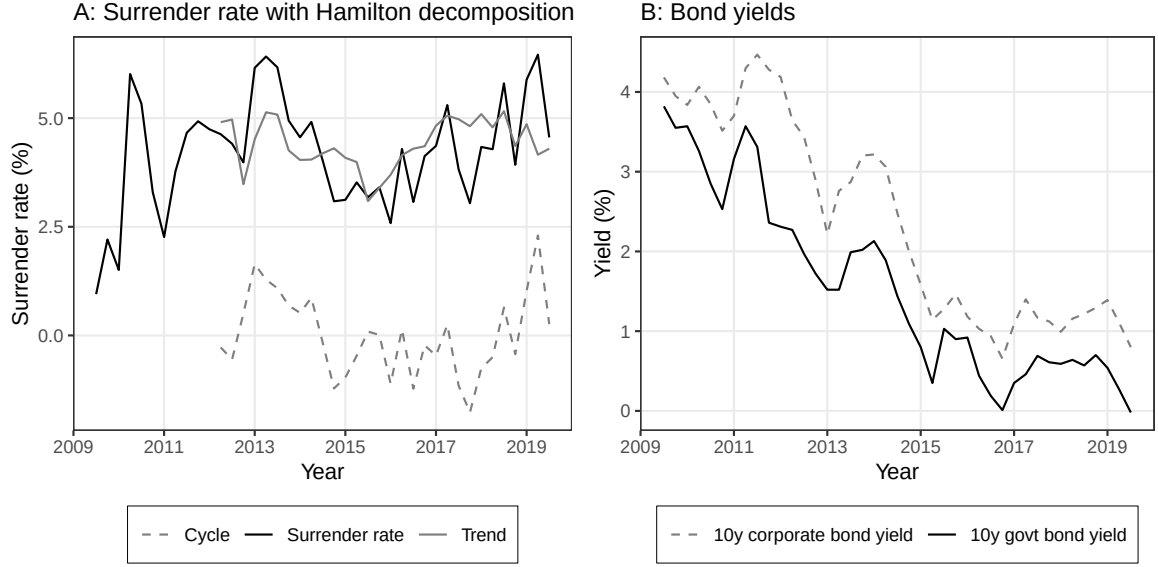


Figure 3: The plot A shows the time series of the aggregate surrender rate and its Hamilton decomposition into trend and cycle components. The Hamilton decomposition uses a look-ahead of 8 quarters and 4 quarterly lags. Hence, the first value for the Hamilton decomposition is in March 2012. Plot B shows the time series of the 10-year Finnish government bond yield and the 10-year euro area corporate bond yield.

interest-rate environment limits how well the results generalize to increasing or higher interest-rate level environments. However, the mutual funds in unit-linked policies consist of equity funds, bond funds, money market funds, and alternative investment funds, and the opportunity cost of holding these investments through a unit-linked policy versus holding them directly should not be affected by the interest rate level. Keeping this in mind, the main idea is not to study IRH, but rather to show that the sample in this article also exhibits properties similar to those of previously studied unit-linked samples, and hence it is worthwhile to use the sample to better understand what causes IRH.

First, I estimate a set of linear regressions in which the interest rate is treated as a covariate, and the aggregate surrender rate is the dependent variable. The regression model specification is

$$\text{surrender rate}_t = \beta_0 + \beta_1(\text{financial variable})_t + \beta c_t,$$

where c_t includes macroeconomic factors depending on the model specification. The model also includes calendar year (not as fixed-effect dummies but as a continuous

variable) and a dummy for the year 2009, which is an outlier because surrender rates are extremely low while interest rates are high. This may be due to the end of the financial crisis, and the increased lapse rates prior to the beginning of the sample period may have led to lower surrender rates thereafter.¹⁰ In Appendix 5.4, models with the cycle and trend components as the dependent variables are examined. Koijsen et al. (2024) also examine how interest rate affects lapse trend and cycle components.

Table 5: Aggregate surrender rate and macroeconomic factors. The dependent variable is the quarterly aggregate surrender rate (in percentage points). All models control for calendar year (continuous) and a financial crisis dummy (2009), not reported. Newey-West standard errors with 4 lags in parentheses.

	(1)	(2)	(3)	(4)	(5)
10-y gov. bond yield (%)	0.145 (0.115)				
10-y corp. bond yield (%)		0.224** (0.079)			0.229** (0.084)
Change in 10-y corp. yield (pp)			0.140 (0.117)		0.018 (0.132)
1-q return OMXH25 (per 10pp)				-0.032 (0.027)	0.009 (0.022)
Observations	41	41	41	41	41
Adjusted R ²	0.317	0.419	0.172	0.286	0.286
<i>Note:</i>			*p<0.05; **p<0.01; ***p<0.001		

Table 5 examines whether financial variables explain aggregate surrender rate variation. The coefficients on the 10-year government and corporate bond yields are positive, with the corporate bond yield's coefficient being statistically significant ($p < 0.01$). This is consistent with the interest rate hypothesis and previous studies (Kiesenbauer, 2012; Yu et al., 2018): higher interest rates are associated with higher surrender rates. The stock market return coefficient is negative (-0.032), suggesting that lower market returns are associated with higher surrenders.

Although none of the effects of government bond yield and stock market returns are statistically significant, this may be attributable to the limited time-series sample ($N = 41$ quarters) rather than to the absence of an economic relationship. With only 41 observations and substantial quarter-to-quarter volatility in surrender rates,

¹⁰Notice that the financial crisis indicator (dummy for 2009) is included in the basic models (Section 3) with calendar year fixed effects.

statistical power to detect moderate effects is limited. The Hamilton decomposition in Appendix Table 9 further reveals that most macroeconomic variation is absorbed by the long-run trend rather than the business-cycle component, making identification challenging in a single-economy setting with a relatively short sample period.

Table 6 shows similar regression model results with policy-level data. All models in Table 6 include a calendar year (continuous) and a financial crisis dummy variable as controls.¹¹

Panel A examines the effect of interest rate (10-year Euro area corporate bond yield). Model 1 includes only interest rate and time controls, while Model 2 also includes additional basic policy-level covariates but not any policy performance measures. Model 3 also includes a 3-month policy return. Panels B and C follow the same logic, but instead of the interest rate, they examine the change in interest rate and stock market return. Panel D presents the results of models with all three financial variables.

Panel A shows that the coefficient of the 10-year corporate bond yield is positive ($p < 0.05$, for Model 1) as IRH suggests. However, when controlling for policy performance by including the 3-month policy return, the coefficient on the 10-year corporate bond yield is close to zero and statistically insignificant. Without return control the corporate bond yield is statistically significant, and with return control it becomes near zero and statistically non-significant. This indicates that the interest rate influences surrender behavior in unit-linked policies through the policy's return. Panel D shows this pattern in a model that includes all three financial variables. The coefficient of the corporate bond yield falls from 0.222 to 0.123 and is no longer significant at the 5% level once the policy return is controlled for, while the 3-month policy return remains highly significant.

The results in panel C show that the coefficient of the 1-quarter OMXH25 return is negative (models 1 and 2), indicating that negative stock market returns are associated with increased surrenders and vice versa. However, when controlling for the policy return, the coefficient surprisingly changes sign and becomes statistically significant

¹¹Even if the data is policy-level panel data, still the variables of interest, the financial variables, vary only over time, i.e., have no cross-sectional variation, and hence fixed calendar year effects would capture too much of the variation between years and attribute all variation within a calendar year to the variation of the macroeconomic variable.

Table 6: Policy-level regression results on macroeconomic factors. The dependent variable is the quarterly surrender indicator (logit model). Panel A: 10-year corporate bond yield level. Panel B: Change in 10-year corp. yield. Panel C: OMXH25 quarterly return. Panel D: Combined model. All models control for calendar year (continuous) and a financial crisis dummy (2009). Basic covariates include policyholder age, sex, savings, quarter 1 dummy, policy age, surrender fee, and firm. Two-way clustered SEs (policyholder, year) in parentheses.

Panel A: 10-y corp. bond yield			
	(1)	(2)	(3)
10-y corp. bond yield (%)	0.227*	0.145*	0.049
	(0.090)	(0.060)	(0.091)
3-month policy return (%)			-0.048**
			(0.018)
Basic covariates	No	Yes	Yes
Observations	360,103	360,103	360,103
Panel B: Change in 10-y corp. yield			
	(1)	(2)	(3)
Change in 10-y corp. yield (pp)	0.162	0.095	-0.107
	(0.171)	(0.120)	(0.219)
3-month policy return (%)			-0.050**
			(0.017)
Basic covariates	No	Yes	Yes
Observations	360,103	360,103	360,103
Panel C: OMXH25 1-q return			
	(1)	(2)	(3)
1-q return OMXH25 (%)	-0.002	-0.005	0.017*
	(0.002)	(0.003)	(0.007)
3-month policy return (%)			-0.063***
			(0.019)
Basic covariates	No	Yes	Yes
Observations	360,103	360,103	360,103
Panel D: Combined IRH model			
	(1)	(2)	(3)
10-y corp. bond yield (%)	0.222**	0.131*	0.123
	(0.085)	(0.054)	(0.064)
Change in 10-y corp. yield (pp)	0.043	0.020	-0.102
	(0.172)	(0.138)	(0.145)
1-q return OMXH25 (%)	0.001	-0.002	0.018**
	(0.002)	(0.002)	(0.006)
3-month policy return (%)			-0.063**
			(0.019)
Basic covariates	No	Yes	Yes
Observations	360,103	360,103	360,103

Note: *p<0.05; **p<0.01; ***p<0.001

($p < 0.05$). A possible interpretation of this result is that stock market return affects surrender behavior in two ways. Through the policy return effect, where a positive stock market return leads to a positive policy return and hence a lower surrender rate. The other effect is that a high past stock return likely leads, through extrapolative expectations, policyholders to expect high future stock market returns (Greenwood and Shleifer, 2014; Da et al., 2021). If the expected stock market return exceeds the expected policy return, the opportunity cost of holding the insurance policy increases, thereby leading to a higher surrender rate.

Panel B shows that the coefficient of the change in corporate bond yield is positive, but statistically non-significant. However, when controlling for the policy return, the coefficient becomes negative but is statistically non-significant. This indicates similar but weaker behavior to that observed in stock market returns. A positive change in corporate bond yields leads to negative returns in corporate bond funds and indices. The policyholder compares the expected return of her policy with that of the outside option, i.e., investing outside the policy. If the outside option has a lower expected return than the insurance policy, the policyholder is less likely to surrender her policy. In contrast to the stock market case, the coefficient on the change in corporate bond yield is not significant. A possible explanation is that bond and equity investors form expectations differently: equity investors have been observed to have extrapolative expectations, whereas bond investors exhibit contrarian expectations, i.e., believe in mean reversion (Ilmanen, 2025).

4 Conclusions

This study reveals a practical finding: the primary analysis shows that policies with a positive return have a relative surrender rate approximately 40% lower than those with a negative return (Table 2). This finding contradicts the disposition effect observed in many asset classes but aligns with the behavior of mutual fund redemptions. This study demonstrates that, even with macroeconomic controls, policy returns remain economically and statistically significant in explaining surrender behavior. The results indicate that macroeconomic variables used in IRH and EFH, together with non-

dynamic covariates (e.g., policyholder age, sex, policy age), are insufficient to capture surrender behavior in unit-linked investment-type insurance policies.

Another contribution of this study is its examination of how different policy-level return variables affect surrender behavior. The finding is that all policy-level return variables are statistically significant predictors of surrender rate, and the choice of which return variable to use in surrender behavior estimation might not be a key factor, as long as some policy return variable is considered.

I also examine whether the IRH is prevalent in unit-linked investment-type insurance policies. The findings are consistent with the IRH.

The key takeaway from this study is the important role of policy return in explaining surrender behavior in unit-linked policies. This understanding is crucial for modeling policyholder behavior realistically for regulatory or other purposes. Furthermore, the study highlights empirical findings and theories in behavioral finance that can enrich actuarial practice, particularly in the interpretation of observed results.

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5 Appendix

5.1 Excess return and surrender behavior

Table 7 shows the results of the basic model with the rolling 12-month excess return relative to the OMXH25 index return and the return from 3-month Euribor. The results are similar to how the 12-month policy return affects surrender behavior (Table 4). Modeling-wise, this is not surprising as the OMXH25 index return and the 3-month Euribor are already included in the macroeconomic controls, and the excess return is just the difference between the 12-month return and the corresponding index return.

Table 7: This table examines how different policy-level excess return variables affect surrender behavior. The sample consists of quarterly observations of policies from June 2009 to June 2019. The policy-level excess return variables are 12-month rolling excess return with respect to the OMXH25 index return and 3-month Euribor. The models include all basic policy-level and policyholder-level covariates and macroeconomic controls. Standard errors are clustered at the policy level.

	Logit (1)	Logit (2)
Excess return w.r.t. OMXH25 (%)	-0.029*** (0.003)	
Excess return w.r.t. Euribor (%)		-0.029*** (0.003)
Cohort FEs	No	No
Basic covariates	Yes	Yes
Observations	360,103	360,103

Note: *p<0.05; **p<0.01; ***p<0.001

5.2 Is surrender behavior firm dependent?

Table 8 shows each firm's basic regression model results separately. Both models show that the positive return dummy is a statistically and economically significant factor in explaining surrender behavior. However, for the other firm (Firm 2), the effect is considerably larger, with the coefficient being -0.573 ($p < 0.001$), while the other firm has a coefficient of -0.212 ($p < 0.01$). The surrender behavior is similar between the two firms regarding policyholder age, policyholder sex, and the first quarter dummy.

The aggregate surrender rates are 3.73% for Firm 1 and 4.31% for Firm 2.

Table 8: This table examines how different covariates affect the surrender behavior for each firm separately. The sample consists of quarterly observations of policies in the sample from June 2009 to June 2019. In the logistic regression models the dependent variable is a dummy variable for whether the policyholder surrendered the savings policy. The covariates are policyholder age, policyholder sex, policy savings at the observation date (if the policy ends, then prior to payout), policy age and surrender fee. The models also include macroeconomic variables as controls and fixed effects for calendar years, depending on the model specification. Standard errors are clustered at the policy level.

	Firm 1	Firm 2	Firm 1	Firm 2
	(1)	(2)	(3)	(4)
Positive Return	−0.212** (0.077)	−0.573*** (0.045)	−0.177* (0.077)	−0.574*** (0.045)
Policyholder age (10y)	−0.118*** (0.021)	−0.081*** (0.013)	−0.119*** (0.021)	−0.082*** (0.013)
Policyholder sex	−0.189** (0.063)	−0.216*** (0.040)	−0.190** (0.063)	−0.214*** (0.040)
Savings (10 000 EUR)	−0.099*** (0.022)	−0.108*** (0.013)	−0.099*** (0.022)	−0.109*** (0.013)
Quarter 1	0.357*** (0.102)	0.214*** (0.051)	0.371*** (0.071)	0.099* (0.044)
Policy age	−0.080** (0.025)	0.015** (0.006)	−0.076** (0.025)	0.013* (0.006)
Surrender fee (%)	−0.574*** (0.050)		−0.566*** (0.051)	
Constant	−3.127*** (0.912)	−2.544*** (0.267)	−2.647*** (0.188)	−4.631*** (0.144)
Cohort FEs	No	No	No	No
Macro controls	Yes	Yes	No	No
Year FEs	No	No	Yes	Yes
Observations	111,414	248,689	111,414	248,689

Note:

*p<0.05; **p<0.01; ***p<0.001

5.3 Financial and Macroeconomic variable correlations

Figure 4 shows the correlations between interest rate variables, equity return variables, and other macroeconomic indicators. The correlations between interest rate variables are high, ranging from 0.88 to 0.98. Similarly, correlations between stock market variables are also high, ranging from 0.76 to 0.85. The other key macroeconomic indicators include inflation, the unemployment rate, and GDP growth. The correlation between interest rate variables and inflation is moderate (e.g., the correlation between the 10-

year government bond yield and inflation is 0.45). Additionally, the unemployment rate exhibits a high negative correlation with interest rate variables and inflation. The GDP growth has a negative correlation with the EuroStoxx 600 return and the world index return, as indicated by -0.12 and -0.1, respectively. However, the correlation between OMXH25 return and GDP growth is positive, as shown by 0.18. The purpose of illustrating the correlations between different macroeconomic covariates is to suggest that the choice of stock return index, interest rate variable, or their combination is unlikely to alter the results, as their correlations with similar variables are relatively high.

Correlations between financial variables

	Euribor	Gov.bond.5y	Gov.bond.10y	STOXX.return.1y	OMXH.return.1y	World.return.1y	Inflation	Unemp.rate	GDP.growth
Euribor	1	0.91	0.88	0.04	0.06	0	0.48	-0.17	-0.29
Gov.bond.5y		1	0.98	0.19	0.19	0.09	0.45	-0.12	-0.31
Gov.bond.10y			1	0.21	0.21	0.09	0.45	-0.12	-0.27
STOXX.return.1y				1	0.85	0.84	-0.04	0.28	-0.12
OMXH.return.1y					1	0.76	-0.24	0.3	0.18
World.return.1y						1	-0.18	0.22	-0.1
Inflation							1	-0.46	-0.31
Unemp.rate								1	0.16
GDP.growth									1

Figure 4: This figure shows the correlations between economic variables.

5.4 Surrender rate trend and cycle components

Table 9: Surrender rate trend and cycle components and macroeconomic factors. The dependent variables are the trend and cycle components from Hamilton (2018) filter decomposition (in percentage points). Newey-West standard errors with 4 lags in parentheses.

Panel A: Surrender trend					
	(1)	(2)	(3)	(4)	(5)
10-y gov. bond yield (%)	-0.004 (0.031)				
10-y corp. bond yield (%)		0.008 (0.030)			0.012 (0.029)
Change in 10-y corp. yield (pp)			0.113 (0.061)		0.112* (0.049)
1-q return OMXH25 (per 10pp)				-0.016 (0.029)	-0.008 (0.029)
Observations	30	30	30	30	30
Adjusted R ²	-0.035	-0.033	0.034	-0.027	-0.032
Panel B: Surrender cycle					
	(1)	(2)	(3)	(4)	(5)
10-y gov. bond yield (%)	0.088 (0.073)				
10-y corp. bond yield (%)		0.079 (0.050)			0.081 (0.047)
Change in 10-y corp. yield (pp)			0.101 (0.106)		0.129 (0.093)
1-q return OMXH25 (per 10pp)				0.013 (0.037)	0.015 (0.035)
Observations	30	30	30	30	30
Adjusted R ²	0.033	0.062	-0.017	-0.033	0.022
<i>Note:</i>			*p<0.05; **p<0.01; ***p<0.001		