

UNDERSTANDING LAPSE & SURRENDER IN LIFE INSURANCE: A REVIEW OF THE MAIN DRIVERS AND HYPOTHESES

ENTENDIENDO LA ANULACIÓN Y EL RESCATE EN LOS SEGUROS DE VIDA: UNA REVISION DE LOS PRINCIPALES DETONANTES E HIPÓTESIS

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ABSTRACT

This article provides a comprehensive review of academic literature addressing policyholder behaviour in relation to lapses and surrenders in life insurance, covering 85 publications over recent decades, representing, to the best of our knowledge, the most extensive review conducted to date in terms of the number of documents examined, excluding purely bibliographic studies. The study examines the approaches used in the literature and incorporates a substantially broader set of hypotheses than those examined in previous review studies, encompassing more than 20 key hypotheses. As a distinguishing feature, the review classifies the findings, by publication date, by product type—particularly differentiating between contracts with and without surrender value—as well as by country, taking into account differences in market characteristics, legal frameworks, taxation, and the existence of secondary insurance markets. The objective is to offer a structured synthesis of current knowledge in life insurance lapse and surrender, tailored to specific insurance products and market contexts, thereby providing a framework for future researchers and practitioners which helps them to avoid misapplying empirical results. The paper concludes by identifying the main shortcomings and proposing potential new areas of future research in this field.



Keywords: Life insurance; surrender; policyholder behaviour; lapse behaviour; surrender risk; lapse risk.

RESUMEN

Este artículo ofrece una revisión exhaustiva de la literatura sobre el comportamiento del tomador en relación con el rescate y la cancelación de seguros de vida, analizando 85 publicaciones de las recientes décadas. Hasta donde alcanza nuestro conocimiento, esta constituye la revisión más amplia realizada hasta la fecha en términos del número de estudios analizados, excluyendo aquellos de naturaleza exclusivamente bibliográfica. El estudio analiza los enfoques propuestos en los diferentes análisis e identifica el mayor número de hipótesis consideradas en estudios previos, alcanzando un más de 20 hipótesis diferentes. Como característica distintiva, la revisión clasifica los hallazgos temporalmente, por tipo de producto - en particular diferenciando entre contratos con y sin valor de rescate- así como por país, teniendo en cuenta las diferencias en las características del mercado, los marcos legales, la tributación y la existencia de mercados secundarios de seguros. El objetivo es ofrecer una síntesis estructurada del conocimiento actual adaptada a cada tipo de seguro y contextos específicos, proporcionando así un marco para futuros investigadores y profesionales que les ayude a evitar la aplicación errónea de los resultados empíricos. El artículo concluye identificando las principales deficiencias identificadas y proponiendo nuevas áreas potenciales de investigación futura en este campo.

Palabras clave: Seguros de vida; rescate; comportamiento del tomador; comportamiento ante la cancelación; riesgo de rescate; riesgo de caída.

1. INTRODUCTION

Since the implementation of the Solvency II Directive in the European Union in 2016, the quantification of lapse risk has become fundamental requirement for life insurers operating under this regulatory regime. It is now recognised as one of the three most material risks faced by life insurance companies.

Interest in lapse risk extends beyond regulatory compliance. Industry practitioners, particularly actuaries, have devoted significant effort to identifying and quantifying its potential impact, as well as in designing strategies for monitoring and mitigating this risk. Policyholder behaviour—especially decisions to terminate contracts—affects nearly every aspect of insurance operations, including product design, underwriting, profit testing, and asset-liability management, among others. Accurate modelling of lapse and surrender behaviour requires a clear understanding of the factors driving such decisions. This requirement constitutes the main motivation for the present study.

Our review reveals several important limitations in the existing literature. In some influential studies—including (De Giovanni, 2010), (Russell et al., 2013), (Finke & Mulholland, 2014), (Giri, 2018), (Gemmo & Götz, 2016) y (Wei Zhenyu; Zheng Haitao; Zhang Wenrui, 2019)—the type of insurance product under analysis is not specified, which limits the generalisability of their findings.

In other studies, such as (Eling & Kochanski, 2012), (Kuo et al., 2003) and (Eling & Kiesenbauer, 2014), the concepts of lapse and surrender are used interchangeably, despite referring to distinct phenomena: lapse typically denotes contract termination (or cancellation) without surrender value (common in pure protection products), whereas surrender (also referred to as withdrawal) refers to termination accompanied by a surrender value, as observed in savings, mixed, or insurance-based investment products (IBIPs). Although the term "lapse" is often used generically to describe early termination, we argue that distinguishing between these two behaviours is essential when identifying their respective drivers. Throughout this paper, lapse will refer to termination without a surrender value, and surrender will denote termination with such a value.

Our analysis suggests that the underlying drivers of lapse and surrender differ significantly across product types.

In addition, few studies adequately consider contextual variables such as the existence and maturity of secondary insurance markets, applicable tax regimes, macroeconomic conditions, or the availability of public pension schemes. Therefore, we consider the classification of studies by country to be essential for the appropriate interpretation and comparison of their findings. As noted by (Dar & Dodds, 1989) drawing empirical conclusions without accounting for the specific product and country-specific contexts entails a risk of misinterpretation.

2. OBJECTIVE

The aim of this article is to consolidate existing knowledge on policyholder lapse and surrender behaviour, providing a structured foundation for future research. To this end, we identify and discuss the most relevant studies in each category while avoiding comparisons across fundamentally different contexts. By adopting this approach, we aim to reduce the risk of misapplying prior findings and to support practitioners in developing more robust, context-specific predictive models.

The remainder of this paper is structured as follows: Section 3 describes the methodology employed for the bibliographic review and presents the classification framework applied to the reviewed literature. Section 4 discusses the main findings of the study. Section 5 outlines the main conclusions, limitations, and proposes potential directions for future research. In addition, this section provides a brief overview of the main actuarial applications of the study. An appendix summarises the key hypotheses identified across the literature.

3. METODOLOGY

3.1.Data Collection

The research, was conducted through a systematic literature review, aimed at addressing the following research question: What are the determinants and triggers of life insurance termination?

The search strategy was initially implemented using the Web of Science database, employing the following search terms: "*Policyholder Behaviour*", "*Surrender*" and "*Lapse*". From the results obtained, only documents written in English and specially focused on life insurance were considered, irrespective of the country of origin or publication date.

The review was further restricted to publications classified within the following subject categories: Business Finance, Mathematics and Interdisciplinary Applications, Statistics and Probability, Mathematics and Behavioural Sciences.

This initial analysis identified a corpus of 113 publications, including scientific articles, theses, and other academic works. To ensure broader coverage of the literature, an additional 70 documents were subsequently incorporated, identified through their recurrent citation in the previously selected studies despite not having emerged in the initial search results. Following a preliminary assessment of 183 documents, a classification was carried out according to the primary focus of each study, with the aim of excluding those whose focus did not address the research question.

The excluded documents mainly addressed the economic valuation of surrender options (69 documents), optimal surrender modelling approaches (8 documents), behavioural analyses (9 documents), and miscellaneous topics outside the scope of the present study (12 documents).

After the aforementioned classification process, the final sample comprised 85 documents focused on identifying the determinants of life insurance policy terminations. These documents, developed for different purposes and across diverse products and markets, constitute the empirical foundation of the present study.

3.2.Methodology

Following, the final sample were classified according to the criteria outlined below:

- Chronological evolution of the publications, with particular emphasis on periods characterised by economic or financial conditions likely to have influenced policyholder behaviour, such as economic crises, prolonged low-interest-rate environments or the crisis caused by the COVID 19 pandemic.
- The analysis of the hypotheses examined in the studies.
- The type of life insurance product considered.
- The geographical distribution of the documents by country.

The analysis is further complemented by a synthesis of the principal variables incorporated in the models examined in the literature.

In addition, special attention is given to studies that do not clearly distinguish between types of insurance products or between the concepts of surrender and lapse. This distinction is particularly relevant in research addressing multiple products or mixed contracts.

All the hypotheses referenced in the analysis of results are described in the appendix.

4. RESULTS

4.1. Analysis by hypothesis and by product type. Temporal and geographic evolution

Period 1950-1990

The initial studies identified date back to the mid-twentieth century. Although limited in number, they are highly influential, as two of the most widely cited hypotheses in subsequent decades were formulated during this period. All studies identified prior to 1990 were conducted in either the United States or the United Kingdom. The study by (Richardson & Hartwell, 1951) presents one of the earliest analyses on termination rates, but it was not until the work of (Dar & Dodds, 1989) and (Outreville, 1990) that significant advances were achieved, as reflected in the sustained number of references these publications have received over time. Both studies focus on mixed insurance products and establish the main economic hypotheses explaining life insurance termination: the Interest Rate Hypothesis (IRH) and the Emergency Fund Hypothesis (EFH).

During the same period, the first study incorporating policyholder characteristics to predict the lapse rate was also developed. (Haberman S. & Renshaw A.E., 1986) analyses mixed products, with and without profit sharing, as well as Unit Linked products. Although they do not distinguish explicitly between surrender and lapse, they identify the most relevant explanatory factors for each product type. Age, policy duration and the existence of profit sharing are identified as the key determinants.

Period 1991-2010

During this period, studies from Europe and Asia began to appear.

With regard to protection and mixed products, the large majority of the studies carried out during this period are based on the United States market and predominantly support the Health Condition Hypothesis (HLH), as well as the Secondary Market Hypothesis (SCH). In this context, (Hendel & Lizzeri, 2003) and (Finkelstein et al., 2005) support the HLH while (Gatzert et al., 2009) provide evidence consistent with both hypotheses.

Additionally, (Bacinello et al., 2009) studies a mixed insurance product in Italy and links the HLH to the protection component and the IRH to the savings component.

During these two decades, studies on insurance-based investment products (IBIPs) began to emerge. Representative contributions include those by (Moore, 2009), (Mudavanhu et al., 2002), (Barbarin, 2005) and (Milevsky & Salisbury, 2006). Once again, the majority of the research has been carried out in the United States. The products most frequently analysed are Unit Linked contracts, and variable annuities, with the IRH representing the predominant explanatory framework.

In the context of variable annuities, (Moore, 2009) incorporates the policyholder behaviour as a variable within a utility function, whereas (Milevsky & Salisbury, 2006) propose two alternative behavioural scenarios: one in which the policyholder behaves entirely passive and the other in which decisions are made optimally. Similarly, (Mudavanhu et al., 2002) incorporate policyholder-specific variables and conclude that age and surrender fees exert a significant influence on termination (or cancelation) rates.

Furthermore, (Barbarin, 2005) presents an alternative model for surrender timing in Unit Linked products, stating that, unlike traditional approaches, policyholders are assumed to base their surrender decision on a broader set of information than that available to insurers.

None of the identified studies, refers to the impact of the tax implications of surrender decisions, whether due to omission or to the absence of relevant evidence.

With regard to traditional savings products, numerous studies have been conducted across a broad range of countries in Europe, Asia, and the United States. The vast majority of these studies support the Traditional IRH and EFH Hypotheses. One notable exception is the study by (Cerchiara et al., 2008), which relies exclusively on policy and policyholder data to predict surrender behaviour, identifying policy duration, years since inception, and product type as significant explanatory factors. Similarly, (Carson, 1996) in an analysis of Universal Life insurance, identifies policy-related charges—including administrative expenses, early surrender fees, and risk premium cost—as key factors, negatively associated with surrender rates. The study further finds that a clear relationship between surrender behaviour and interest rates emerges only after the policy has been in force for more than a decade.

Multiple studies support the Traditional Hypotheses, including those by: (Kent et al., 2009), (Albizzali & Geman, 1994) and (De Giovanni, 2010). Particularly noteworthy is the work of Changky Kim's on the Korean and United States markets (Kim, 2005a), (Kim, 2005b) and (Kim, 2010), which demonstrates that the gap between guaranteed interest rates and market rates, together with macroeconomic variables, such as economic growth (negative influence) or unemployment (direct relationship), explains policy surrender behaviour under the EFH. The author also identifies seasonal patterns in policy surrenders (SHE) and a higher probability of policy surrender among younger policyholders. Furthermore, (Kim, 2005a) emphasizes the need for product-specific analyses.

Similarly, (Kuo et al., 2003) apply cointegration techniques to mixed insurance products and identify potential long-term relationships among policy surrender, interest rates and unemployment rates.

(Albizzali & Geman, 1994) relate the surrender rate to the ratio between of surrender cash value and the cash value at maturity. When this ratio is below one, the surrender decision is interpreted as being driven by exogenous reasons. Conversely, the maximum value of the ratio is associated with an optimal surrender decision, assuming rational behaviour of the policyholder.

(De Giovanni, 2010) adopts a similar vision and introduces the concept of "irrationality", proposing its modelling through economic variables such as the unemployment rate or the policyholder's financial difficulties.

(Kagraoka, 2005) analyses an accident annuity in Japan, similar to a life annuity, identifying the EFH as well as variables such as sex, age and seasonality as influential factors.

None of these studies considers the impact of the potential loss of tax benefits resulting from surrender decisions. An exception is the survey conducted by (Kent et al., 2009) among insurers in six European countries regarding traditional savings products with profit-sharing features and guaranteed annuities. The study concludes that the dynamic policyholder behaviour, depends both on the level of the relationship between the guaranteed rate and market interest rates and on the policyholder's level of rationality. In this context, the policyholder rationality is modelled deterministically along a scale ranging from low to high rationality, under the assumption that, policyholders become more rational over time and

that more extreme scenarios could drive higher levels of rational behaviour.

Period: 2011- to the present

More than half of the total publications identified fall within this period, during which, contributions from both European and Asian countries become increasingly frequent.

This stage is characterised by two major global crises: The 2008 financial crisis, followed by a prolonged period of low interest rates, and the COVID-19 pandemic. Consequently, studies conducted during these years should be interpreted with caution, due to the potential short-term effects associated with the exceptional circumstances of the period. The references (Eling & Kiesenbauer, 2014) and (Belaygorod et al., 2014), explicitly state that their analyses were conducted in a context of global economic crisis. Likewise, other studies based on data from this period, should be treated cautiously when attempting to extrapolate lapse behaviour beyond crisis environments.

Additionally, the prolonged period of low interest rates prevailing throughout most of the analysed timeframe, may also have influenced the assessment of the IRH. For instance, (Barucci et al., 2020) in a study examining policyholder behaviour in savings insurance and Unit Linked products, support the EFH hypothesis over the IRH, as they found no evidence of correlation between interest rate rise and an increase of surrender rates during the period analysed, a result likely explained by the persistently low-interest rate environment.

Similarly, (Biagini et al., 2021) analyse the Solvency II mass lapse scenario and reject the IRH. However, they note that their analysis was developed under a low interest rate environment and conclude that policy terminations occurring during periods with different interest rate conditions, should also be analysed.

Studies conducted in the years immediately following the COVID-19 crisis have also been identified, and their findings may have been influenced by this context. For example, (Cheng, 2022) analyses the policyholder behaviour in traditional savings insurance in China after the COVID-19 crisis and argues that health crises may generate sudden liquidity needs arising from unexpected medical expenses, income loss or unemployment, thereby increasing surrender rates, as predicted by the EFH.

At the same time, the study suggests that widespread health crises increase policyholders' awareness of the protection provided by life insurance, which could encourage greater contract retention of the contract in in pursuit of improved returns. Given that the analysis focuses on savings insurance and rather than protection insurance, this behaviour is interpreted as being consistent with optimal decision-making.

The analysis of studies by product type reveals that research on policy termination in Traditional saving products continues to support the IRH and the EFH, sometimes in combination with other hypotheses. Some authors continue to assume optimal policyholder behaviour, as in (Barsotti et al., 2016) and (Dassios & Zhao, 2011). Others, incorporate policyholder confidence factors measured by national investor confidence surveys, and identify a relationship between declining confidence indicators and the increasing in surrender rates, as observed in (Poufinas & Michaelide, 2018) and (Kiesenbauer, 2013). To the best of our knowledge, no studies have explicitly modelled the degree of behavioural rationality exhibited by policyholders. Some exceptions include the incorporation of hypotheses related to financial knowledge (CAH), financial advice (FAH), and heuristic behaviour, using data from national household surveys. For example, (Nolte & Schneider, 2017) concludes that when behaviour is not rational, financial knowledge or advice reduces the probability of termination, whereas heuristic tendencies increase it. Similarly, (Giri, 2018) based on household surveys in the Indian market, finds that financial knowledge reduces the probability of surrender and also subsumes other hypotheses, such as Miss-Selling Hypothesis (MSH), which is also considered in the Slovak market study (Sakálová & Peller, 2015).

In the case of insurance-based investment products (IBIPs), the two Traditional Hypotheses continue to predominate, although the IRH is sometimes replaced by the Moneyness

Hypothesis (MNH), which posits that surrender rates increase when the market value of the product exceeds its value at maturity, as in (Knoller et al., 2016) and (Escobar et al., 2016).

This group of products also includes numerous studies that incorporate behavioural hypotheses accounting for policyholder behaviour that deviates from full rationality. Such deviations are modelled either through varying levels of rationality, as in (Li & Szimayer, 2013) or through risk or loss aversion using utility functions, as in (Moenig, 2021) and (Hilpert et al., 2016).

On the other hand, (Kang & Ziveyi, 2018) analyse the policyholder surrender behaviour under both optimal conditions —where policyholders maximise the value of their policy— or suboptimal conditions, in which financial constraints or personal circumstances prevent optimal decision-making, while still assuming fundamentally rational behaviour.

(Bauer et al., 2017) examines IBIPs in the United States market and conclude, that the value of the insurance contract alone is not sufficient to explain the policyholder's surrender decision. They argue that a structural understanding of the interactions between policyholder and insurer behaviour should be central to future research. The existence of a secondary insurance market is also identified as an influential factor (SCH). (Lombardi et al., 2012) proposes an approach of a simulation agent-based model, an ambitious framework that incorporates behavioural economics and artificial intelligence to capture the interactions between the policyholder and the different agents. The aim of the model is to generate simulations intended to create customer profiles that allows modelling of behaviour when purchasing, or fully or partially surrendering their insurance contract. The proposed model is eminently theoretical.

This period is also characterized by a growing number of studies that consider termination Hypotheses based on Policy and Policyholder Characteristics (PCH) and (PDH), both in traditional savings insurance and in IBIPs. This can be observed in (Giri, 2018), (Sakálová & Peller, 2015), (Milhaud, 2013), (Barucci et al., 2020), (Mall & Sahoo, 2015), (Eling & Kiesenbauer, 2014), (Azzone et al., 2022), (Kiesenbauer, 2013). In (Barucci et al., 2020), the IRH, EFH and PRH hypotheses are tested in profit-sharing insurance and Unit Linked products, using both microeconomic data on policies and policyholders as well as macroeconomic indicators. The study does not find evidence supporting the IRH in either product category, noting that the IRH is not always relevant in Unit Linked products unless they are invested in bonds or indices linked to interest rates. However, it does find empirical support for the EFH and PRH. The results also highlight the effects of the contract and the policyholder characteristics in both products, albeit in different ways. In traditional saving products, age (higher surrender rate among young people), insured capital (positive relationship with the surrender) and policy duration (more terminations in the first years) are significant determinants. The study does not address whether tax advantages in the Italian market may influence early terminations.

(Milhaud, 2013) analyses various insurance products in the Spanish market, providing differentiated analyses for each product type. In the case of savings insurance, it supports the IRH, the PCH and PDH, specifically: the duration of the contract, the policyholder age and the wealth. The studies (Eling & Kiesenbauer, 2014) and (Kiesenbauer, 2013), both focused on the German market, also highlight the effect of the PCH and PDH on policy terminations. These studies consider multiple products without differentiating between lapse and surrender, following a similar approach to earlier work by (Kuo et al., 2003) and (Haberman S. & Renshaw A.E., 1986).

Termination studies in Protection Insurance remain predominantly based in the United States. The Health Condition Hypothesis (HLH) is the most frequently analysed, as in (Gottlieb & Smetters, 2014) and (He, 2011). This hypothesis is also examined in a study conducted in Spain (Pinquet et al., 2011), in combination with the Financial Knowledge or Cognitive Ability Hypothesis (CAH). The consideration of the Secondary Insurance Market (SCH) is also common in countries where such markets exist, as in (Fang & Wu, 2020).

In (Belaygorod et al., 2014) a specific product typology is analysed in the context of the

United States market following the 2008 financial crisis: term protection insurance with level premiums. The study focuses on lapsation after the end of the fixed-premium period, when a substantial increase in lapse rates is observed, a phenomenon known as “shock lapse”. The analysis supports the EFH and links it to the premium amount and the policyholder age, arguing, —contrary to other studies—, that older policyholders experience greater financial need due to a more severe impact of stock and real estate market downturns. In our view, this is a clear example of results that are difficult to extrapolate to other periods, products or markets.

(Valla et al., 2024) also analyse the influence of the total premium amount on the probability of lapse in the French market. Although the product under study is not clearly specified, it appears to correspond to a protection insurance product. As a novel contribution, the study rejects the effectiveness of retention strategies based on the value that the customer brings to the insurer and instead, proposes considering the customer life cycle approach.

In the mixed insurance field, most studies continue to be conducted primarily in the United States. The Traditional Hypotheses, remain predominant. The EFH is supported by (Fang & Kung, 2012), (Liebenberg et al., 2012), (Fier & Liebenberg, 2013) and (Cole & Fier, 2021), with most of these studies identifying policyholder characteristics as key triggers of liquidity needs.

(Fang & Kung, 2012) find that the probability of experiencing an emergency fund shock is higher among younger policyholders, whereas for older policyholders, income level and bequest motives are more relevant. Similarly, (Liebenberg et al., 2012), in line with (Outreville, 1990), identify the policyholder’s or their partner’s job loss as the main trigger of the EFH. (Fier & Liebenberg, 2013) also highlight age as a determinant of the EFH, showing that younger policyholders are more likely experience an income shocks. In addition, they introduce the Policy Replacement Hypothesis (PRH) linked to the savings component of the mixed policy, which, like the IRH, assumes rational behaviour aimed at the policy value maximization.

(Cole & Fier, 2021) relate the EFH to the policyholder age and number of children. They also introduce the existence of a secondary market for policy loans, within the framework of the Alternative Fund Hypothesis (AFH). On the other hand, (Sirak et al., 2015) find no significant relationship between age and policy termination, although they identify policy duration, income level, and wealth as explanatory factors. Among the documents supporting the IRH we find (Milhaud & Dutang, 2018) which defends the IRH in combination with variables of the policy and the policyholder for Whole Life insurance, while (Russo et al., 2017), in the context of mixed insurance (endowment policies), argue that policyholder behaviour is not fully rational and includes a random component in the decision to terminate the policy. Additionally, (Koijsen et al., 2024) considers policy and policyholder characteristics as influential factors, concluding that younger policyholders with higher health risks in low-income areas, are more likely to terminate their policies during economic downturns.

Likewise, 3 documents were identified that provide a literature reviews related to the analysis of the life insurance termination. The most recent, (Shamsuddin et al., 2022) is predominantly focused on bibliographic analysis, identifying the main journals, countries, authors and keywords (which were also considered in the search strategy for the present study). However, it does not focus on identifying hypotheses or drivers of life insurance terminations. The other 2 studies, similarly to the present analysis, focus on identifying triggering factors and outlining future research directions.

(Eling & Kochanski, 2012) analyse terminations in savings and protection insurance without explicitly distinguishing between lapse and surrender. In their conclusions, they emphasise the need to incorporate contract characteristics (such as policy duration and tax implications) as well as macroeconomic factors, such as the unemployment rate to complement the widely used the IRH. They also highlight several avenues for future research, including the interaction between insurer and policyholder, the impact of adverse selection in risk insurance, and the policyholder behaviour in extreme scenarios. In addition, they stress the relevance of examining the evolution of secondary insurance markets.

(Bauer et al., 2017) review the state of research on policyholder behaviour in savings insurance and IBIPs, with a particular focus on variable annuities. They conclude that policyholders do not rely solely on the surrender value of the policy when making cancellation decisions, implying behaviour that is not fully rational or optimal. Accordingly, they suggest the need to complement the IRH, with additional factors derived insurer–policyholder interactions when modelling the surrender behaviour, as well as to further consider the development of secondary insurance markets, as also noted by (Eling & Kochanski, 2012). Finally, they emphasise the importance of incorporating behavioural and psychological biases into future research.

4.2. Summary Analysis by Time Evolution and Product Type

The earliest studies focused almost exclusively on mixed insurance products. Over time, however, the literature has progressively expanded to encompass a broader range of product categories. In recent years, IBIPs has emerged as the most frequently analysed product type within the academic literature.

Period/ Product Type	Protection	Mixed	Trad. Savings	IBIPs	Not specified	Various Products	Total
1950-1990		4				1	5
1991-2010	2	3	8	4	2	1	21
2011-2024	8	10	8	14	7	13	60
TOTAL	10	17	16	18	9	15	85

Table 1. Temporal Evolution of Publications by Product Type / Authors' Own Elaboration

Of the 85 documents analysed, 9 do not specify the product type and refer to life insurance in general. These include (De Giovanni, 2010), (Russell et al., 2013), (Finke & Mulholland, 2014) and the bibliographic research on life insurance terminations (Shamsuddin et al., 2022).

Similarly, 2 of the 15 studies analysing multiple product types, (Giri, 2018) and (Poufinas & Michaelide, 2018) do not differentiate their conclusions by product category.

Furthermore, within the 26 studies examining mixed insurance products or not explicitly identifying the product type (17 focusing on mixed products and 9 without product specification), 15 do not differentiate between lapse and surrender. In particular (Kiesenbauer, 2013) and (Eling & Kiesenbauer, 2014) citing (Kuo et al., 2003), note that the term "lapse" is used to refer to both surrender and lapse, considering it consistent with the standard measures of analysis of termination rates.

4.3. Summary Analysis by Hypothesis and Product Type

The most widely considered hypothesis is the IRH. It predominates primarily in studies on IBIPs and, to a lesser extent, in research on traditional savings and mixed products. It is generally not considered in studies focused exclusively on protection products, although it occasionally appears in analyses covering multiple product types.

The EFH is more prevalent in mixed insurance and in studies encompassing various product categories. This finding is consistent with its rationale, as the need for additional liquidity can explain both surrender decisions and lapses resulting from an inability to continue premium payments in protection policies.

The combination of both Traditional Hypotheses (IRH and EFH) predominates in studies analysing multiple product types, and is particularly frequent in products with surrender value.

Overall, 59 of the 85 studies incorporates at least one of the Traditional Hypotheses.

Product Type/Hypothesis	EFH	EFH PRH	IRH	IRH EFH	IRH EFH PRH	Non-Trad. Hyp.	Total
Protection	1					9	10
Mixed	3	2	5	2		5	17
Traditional Savings	1		6	3		6	16
IBIPs	1		12	3	1	1	18
Various Products	3		3	6		3	15
Unidentified	1		3	1	1	3	9
TOTAL	10	2	29	15	2	27	85

Table 2. Traditional and Non-Traditional Hypotheses by Product Type / Authors' Own Elaboration

Non-Traditional Hypotheses are more commonly observed in protection products. Within this category, as well as in mixed insurance, the Health Condition Hypothesis (HLH), and the Secondary Market Hypothesis (SCH) are the most prominent, particularly in the countries where a secondary insurance market exists.

In traditional savings insurance, the most frequently used alternative approaches combine the Level of Rationality Hypothesis (LRH), with the interest rate hypothesis (IRH) and Policy Data Hypotheses (PDH), especially those related to expenses and the presence or absence of profit sharing. The Seasonality Hypothesis (SEH) is also supported in three of the reviewed papers. IBIPs share a large proportion of the Non-Traditional Hypotheses applied in savings insurance, with particular emphasis on the policyholder Level of Rationality Hypothesis (LRH), which is modelled on the degree of risk aversion, although it does not account for other factors that may influence such aversion. The Tax Impact Hypothesis (TXH) has been identified in only three of the papers analysed.

Regarding the hypotheses in the 15 studies which analyses several product types, most adopt a combined framework incorporating both the IRH and the EFH. In products with surrender value, the IRH tends to predominate, whereas in protection products, the EFH is more prevalent.

Product Type/Hypothesis	EFH	IRH	IRH EFH	Non-Trad Hyp.	Total
Protection and Mixed	1				1
Protection and Savings			2		2
Savings and IBIPs	1	1			2
Mixed and Savings			1		1
Protection, Mixed and IBIPs	1			1	2
Protection, Mixed and Savings			1		1
Protection, Savings and IBIPs			1	1	2
Mixed, Savings and IBIPs		2		1	3
All Product Types			1		1
TOTAL	3	3	6	3	15

Table 3. Main Hypotheses in Studies Covering Multiple Product Types / Authors' Own Elaboration

4.4. Summary Analysis by Country and Product Type

The United States clearly dominates the existing body of research in this field. Specifically, 30 of the 85 articles analysed focus exclusively on the United States market, plus an additional 5 joint studies examine multiple markets that include the United States. Consequently, the characteristics of the United States market should be carefully considered when interpreting the literature in order to avoid potential misapplications of the findings.

Within Europe, Germany accounts for the highest number of publications, with 9 papers identified, in addition to one study conducted jointly with the United States. Germany is followed by Italy, the United Kingdom, France, and Switzerland in terms of research output. In the case of Spain, four papers were identified. Furthermore, no studies were found for 17 of the 27 European Union member states, including the Netherlands, Portugal, and Poland, among others. In Asia, China, India, and South Korea emerge as the leading contributors, with three papers each.

Region(*)	Protection	Mixed	Trad. Savings	IBIPs	Not Specified	Various Products	TOTAL
Europe	2	6	9	6	3	9	35
US & Canada	7	11	3	8	3	1	33
Asia	1	0	2	2	2	4	11
Australia	0	0	0	1	0	0	1
Intercont. Joint studies	0	0	2	1	0	1	4
Worldwide	0	0	0	0	1	0	1
TOTAL	10	17	16	18	9	15	85

Table 4. Studies Classified by Product Type and Geographic Region / Authors' Own Elaboration

(*)The number of studies reported for Asia and Australia corresponds exclusively to research conducted within a single country. In contrast, the figures for the United States and Canada, as well as for Europe, also include joint studies involving multiple countries within the same region. The remaining joint studies are based on intercontinental analyses.

4.5. Summary Analysis of Literature Review Research

Three papers reviewing the state of research on policyholder behaviour were identified. One of them presents a bibliometric analysis, while the other two focus on identifying the main drivers and hypotheses considered in the literature.

Publication Year	2012	2017	2022
Authors	Eling M. Kochanski M.	Bauer D. Gao J, Moenig T., Ulm E., Zhu N.	Shamsuddin S, Ismail N, Roslan N
Journal	Journal of Risk Finance	North American Actuarial Journal	Risks
Number of Papers considered	56 (44 theoretical+ 12 empirical)	N/A	178
Type of Product	All type of products (with product differentiation)	Products with surrender value: Savings and IBIPs	Life Insurance without product differentiation
Lapse and surrender differentiation	No	Only surrender	N/A
Conclusions	The IRH is the fundamental	Contract value in isolation is not enough	Bibliometric Analysis: Main Authors, Journals

	hypothesis, but it is to explain surrender. and Countries, as well necessary to Needs to incorporate as most recently complement it with market frictions and consulted keywords. characteristics of the consider cognitive and contract and behavioural biases. macroeconomic variables.
Future Research Areas	Impact studies on: Insurer-Policyholder interaction Adverse Selection Behaviour in extreme situations Ex ante policyholder behaviour analysis Impact of insurer-policyholder interactions and secondary market evolution Improving surrender and lapse prediction with the use of machine learning and predictive models as well as models based on customer clustering

Table 5. Summary of Literature Review Articles on Life Insurance Termination / Authors' Own Elaboration

4.6. Main Variables Considered

Variable Type	Common variables	Variables identified in some studies
Country-Specific Macroeconomic Factors	Inflation	Financial crises (dummy)
	Unemployment rates	GDP Per Capita
	Market volatility	Consumer Confidence Index
	Stock	(OECD)
	Interest rate volatility	
	Market performance Example: government bond yield Economic growth: GPD/GDP	
Other external factors	Tax considerations	Theoretical profitability of the competition
Contract Characteristics	Product type	Minimum guaranteed rate
	Policy duration	Surrender fees Y/N
	Policy seniority	Commission
	Premium frequency	Surrender value
	Total premium	
	Sum insured	
	Policy expenses and fees	
	Profit Sharing Y/N	
Policyholder Characteristics	Age	Children (S/N)
	Subscription age	Smoking (S/N)
	Sex	Type of household occupation
	Marital status	Educational Level
	Location	Job Category
	Income level	Health Status (used for HLH)
		Existence of other financial
		Life cycle: Dependent / Single and "rich" / Growing family / Pre-retired / Retired / New Generation (heirs)
Company Features	Type of insurance company	Company's Ranking Position
	Distribution channel	Solvency Ratio
		Negative publicity (proxy)
		Company Size

Table 6: Main Variables Considered / Authors' Own Elaboration

5. DISCUSSION AND CONCLUSION

This article provides a comprehensive review of academic literature addressing policyholder behaviour in relation to lapses and surrenders in life insurance, covering all product types across 85 publications over recent decades. To the best of our knowledge, this represents the most extensive review conducted to date in terms of product types and the number of studies examined, excluding purely bibliographic studies.

The study examines the approaches used in the literature and incorporates a substantially broader range of hypotheses than those considered in previous review studies, encompassing more than 20 key hypotheses.

In addition, the analysis differentiates the results by product type distinguishing between savings-and pure risk products, while also accounting for both geographic and temporal scope. This approach makes it possible to assess whether country-specific characteristics or particular economic conditions were considered when accepting or rejecting a given hypothesis. Furthermore, the review highlights the principal variables incorporated into the analysed models.

The main conclusions, areas for improvement, and potential areas for future research are presented below.

The results reveal a strong geographic concentration of studies in developed markets—particularly the United States, Germany, and Japan—while research focusing on Latin America and other emerging markets remains limited. This imbalance restricts the generalizability of findings and underlines the importance of expanding research to underrepresented regions.

Many papers provide insufficient contextualization regarding market conditions, legal environment, tax framework, or the existence of a secondary life insurance market, even though these factors that may have significant influence on surrender and lapse decisions. Furthermore, several studies do not clearly specify the type of insurance product under analysis or fail to disaggregate their conclusions by product type. Additionally, the concepts of lapse and surrender are often treated as interchangeable—a practice that may be acceptable when examining overall termination rates but problematic when identifying behavioural drivers, which can differ significantly between these two types of policy terminations.

These shortcomings have sometimes led to the misapplication of findings. It is therefore essential to consider that the conclusions of all these studies can only be extrapolated to similar situations; otherwise, they could mislead future researchers.

Regarding the hypotheses evaluated, the most widespread in general in all insurance types are the traditional hypotheses, namely the Interest Rate Hypothesis (IRH) and the Emergency Fund Hypothesis (EFH), which generally assume a rational policyholder seeking optimal termination timing. More recent studies, however, have challenged this assumption, introducing behavioural factors and alternative hypotheses. The inclusion of policy-level data and policyholder characteristics has proven particularly important, with many variables repeatedly identified as significant, although the set of significant variables varies according to the type of insurance product analysed.

Among the alternative hypotheses, the most frequently observed include the Inflation Impact Hypothesis (IH), mainly identified in mixed products; and the Tax Impact Hypothesis (TXH), primarily present in IBIPs products. Interestingly, neither of these hypotheses is commonly analysed in the context traditional savings products. Other relevant strands of literature include hypotheses related to the impact of the existence of the Secondary insurance Market (SCH), particularly in countries where this market is present, —most notably in the United States—, as well as the hypothesis of the impact of Health Conditions (HCH) which are mainly associated with risk and mixed products.

Several studies covering all product types also highlight the use of policy and policyholder

data either as direct predictors of surrender behaviour or as variables supporting the EFH framework.

Finally, hypotheses that consider a policyholder behaviour that is not perfectly rational (LRH) become increasingly prevalent, especially in recent studies and mainly related to insurance-based investment products (IBIPs). In these approaches, deviations from full rationality are typically modelled through utility functions or different degrees of risk aversion. Other approaches related to the rationality of the policyholder behaviour incorporate constant probabilities, random components, by segmentation into behavioural sections/levels or scenario-based modelling. Additionally, this component has sometimes been linked to cognitive ability, financial knowledge (CAH), or financial advice (FAH). The theoretical proposal by (Lombardi et al., 2012) of a simulation model based on interactions between agents constitutes the most comprehensive conceptual contributions, however, due to its highly theoretical nature there is limited empirical evidence of its practical implementation, and the extensive data requirements likely hinder its practical application.

In summary, an important direction for further research is to explore how individual characteristics and contextual interactions shape policyholder rationality, influencing their sensitivity to tax impacts, perceived product costs, investment preferences, or surrender timing. The extension of value-maximization models—such as the one by (De Giovanni, 2010) which incorporates an "irrationality" parameter based on economic indicators—like unemployment—could be enhanced using data on policyholders' financial distress, risk aversion, or investment behaviour. The practical implementation of models inspired by (Lombardi et al., 2012) also remains an open research frontier, with the potential to significantly improve surrender prediction in savings life insurance products.

The findings of this study have several important actuarial applications, particularly in improving the specification of policyholder behaviour assumptions used in the best estimate valuation of liabilities under both Solvency II and IFRS 17. The results may assist practitioners in identifying the key factors influencing specific insurance products, thereby enabling more targeted analyses and the adaptation of general assumptions to particular contexts, including a country's economic environment, legal and tax frameworks, the type of surrender value (i.e. market value or actuarial reserve), and the distribution channel. This approach may help avoid excessive reliance on broad standard assumptions, such as the IRH alone. Such considerations are especially relevant in the assessment of extreme scenarios, which may pose significant risks to insurance companies. Indeed, the occurrence of such an event constituted the primary motivation for this research.

Furthermore, the results of this study may contribute to other actuarial areas by enhancing the development of more effective policyholder retention strategies, as well as strengthening Asset–Liability Management (ALM) frameworks through improved liability estimation.

6. REFERENCES

- Albizzali, M.-O., & Geman, H. (1994). Interest Rate Risk Management and Valuation of the Surrender Option in Life Insurance Policies. *Journal of Risk and Insurance*, 61(4), 616–637. <https://doi.org/https://doi.org/10.2307/253641>
- Alonso-García, J., Sherris, M., Thirurajah, S., & Ziveyi, J. (2024). Taxation and policyholder behavior: the case of guaranteed minimum accumulation benefits. *ASTIN Bulletin: The Journal of the International Actuarial Association*, 54(1), 185–212. <https://doi.org/10.1017/asb.2023.38>
- Azzone, M., Barucci, E., Giuffra Moncayo, G., & Marazzina, D. (2022). A machine learning model for lapse prediction in life insurance contracts. *Expert Systems with Applications*, 191. <https://doi.org/10.1016/j.eswa.2021.116261>
- Babbel, D. F. (1979). Measuring Inflation Impact on Life Insurance Costs. *Journal of Risk and Insurance*, 46(3), 425–440. <https://doi.org/10.2307/252457>
- Bacinello, A. R., Biffis, E., & Millosovich, P. (2009). Pricing life insurance contracts with early exercise features. *Journal of Computational and Applied Mathematics*, 233(1), 27–35. <https://doi.org/10.1016/j.cam.2008.05.036>
- Barbarin, J. (2005). Stochastic surrender with asymmetric information. *An alternative approach for the fair valuation of life insurance contracts*. Institut d'Administration et de Gestion (IAG)
- Barsotti, F., Milhaud, X., & Salhi, Y. (2016). Lapse risk in life insurance: Correlation and contagion effects among policyholders' behaviors. *Insurance: Mathematics and Economics*, 71, 317–331. <https://doi.org/10.1016/j.insmatheco.2016.09.008>
- Barucci, E., Colozza, T., Marazzina, D., & Rroji, E. (2020). The determinants of lapse rates in the Italian life insurance market. *European Actuarial Journal*, 10(1), 149–178. <https://doi.org/10.1007/s13385-020-00227-0>
- Bauer, D., Gao, J., Moenig, T., Ulm, E. R., & Zhu, N. (2017). Policyholder Exercise Behaviour in Life Insurance: The State of Affairs. *North American Actuarial Journal*, 485–501. <https://doi.org/10.1080/10920277.2017.1314816>
- Belaygorod, A., Zardetto, A., & Liu, Y. (2014). Bayesian Modelling of Shock Lapse Rates Provides New Evidence for Emergency Fund Hypothesis. *North American Actuarial Journal*, 18(4), 501–514. <https://doi.org/10.1080/10920277.2014.938545>
- Bernard, C., MacKay, A., & Muehlbeyer, M. (2014). Optimal surrender policy for variable annuity guarantees. *Insurance: Mathematics and Economics*, 55(1), 116–128. <https://doi.org/10.1016/j.insmatheco.2014.01.006>
- Biagini, F., Huber, T., Jaspersen, J. G., & Mazzon, A. (2021). Estimating extreme cancellation rates in life insurance. *Journal of Risk and Insurance*, 88(4), 971–1000. <https://doi.org/10.1111/jori.12336>
- Carson, J. M. (1996). Determinants of Universal Life Insurance Cash Values. *Journal of Risk and Insurance*, 63(4), 673–681. <https://doi.org/10.2307/253477>
- Cerchiara, R. R., Edwards, M., Gambini, A., & Wyatt, W. (2008). Generalized Linear Models in Life Insurance: Decrements and Risk Factor Analysis Under Solvency II. *18th International AFIR Colloquium*.
- Chang, H., & Schmeiser, H. (2022). Life insurance surrender and liquidity risks. *Quantitative Finance*, 22(4), 761–776. <https://doi.org/10.1080/14697688.2021.1998586>
- Cheng, C. (2022). Beyond death: The impact of a population-wide health shock on life insurance. *North American Journal of Economics and Finance*, 63.

<https://doi.org/10.1016/j.najef.2022.101823>

- Cole, C. R., & Fier, S. G. (2021). An examination of life insurance policy surrender and loan activity. *Journal of Risk and Insurance*, 88(2), 483–516. <https://doi.org/10.1111/jori.12329>
- Cox, S. H., & Lin, Y. (2006). Annuity Lapse Rate Modelling: Tobit or not Tobit. *Society of Actuaries*.
- Dar, A., & Dodds, C. (1989). Interest Rates, the Emergency Fund Hypothesis and Saving through Endowment Policies: Some Empirical Evidence for the U.K. *Journal of Risk and Insurance*, 56(3), 415–433. <https://doi.org/10.2307/253166>
- Dassios, A., & Zhao, H. (2011). A Dynamic Contagion Process. *Advances in Applied Probability*, 43(3), 814–846. <https://doi.org/10.1239/aap/1316792671>
- De Giovanni, D. (2010). Lapse Rate Modelling: A Rational Expectation Approach. *Scandinavian Actuarial Journal*, (1), 56–67. <https://doi.org/10.2139/ssrn.1019630>
- Eling, M., & Kiesenbauer, D. (2012). Does Surplus Participation Reflect Market Discipline? An Analysis of the German Life Insurance Market. *Journal of Financial Services Research*, 42(3), 159–185. <https://doi.org/10.1007/s10693-011-0113-z>
- Eling, M., & Kiesenbauer, D. (2014). What policy features determine life insurance lapse? An analysis of the German market. *The Journal of Risk and Insurance*, 81(2), 241–269. <https://doi.org/http://doi.org/10.1111/j.1539-6975.2012.01504.x>
- Eling, M., & Kochanski, M. (2012). Research on Lapse in Life Insurance: What Has Been Done and What Needs to Be Done?. *Journal of Risk Finance*, 14, 392–413. <https://doi.org/https://doi.org/10.1108/JRF-12-2012-0088>
- Escobar, M., Krayzler, M., Ramsauer, F., Saunders, D., & Zagst, R. (2016). Incorporation of stochastic policyholder behavior in analytical pricing of GMABs and GMDBs. *Risks*, 4(4). <https://doi.org/10.3390/risks4040041>
- Fang, H., & Kung, E. (2012). Why Do Life Insurance Policyholders Lapse? The Roles of Income, Health and Bequest Motive Shocks. *Journal of Risk and Insurance*. <https://doi.org/https://doi.org/10.1111/jori.12332>
- Fang, H., & Wu, Z. (2020). Life insurance and life settlement markets with overconfident policyholders. *Journal of Economic Theory*, 189. <https://doi.org/10.1016/j.jet.2020.105093>
- Fier, S. G., & Liebenberg, A. P. (2013). Life Insurance Lapse Behavior. *North American Actuarial Journal*, 17(2), 153–167. <https://doi.org/10.1080/10920277.2013.803438>
- Finke, M. S., & Mulholland, B. (2014). Does Cognitive Ability Impact Life Insurance Policy Lapsation? *SSRN Electronic Journal*. <https://doi.org/http://dx.doi.org/10.2139/ssrn.2512076>
- Finkelstein, A., McGarry, K., & Sufi, A. (2005). Dynamic Inefficiencies in Insurance Markets: Evidence from Long-Term Care Insurance. *The American Economic Review*, 95, 224–228. <https://doi.org/10.1257/000282805774669808>
- Gad, K. S. T., Juhl, J., & Steffensen, M. (2015). Reserve-dependent surrender rates. *European Actuarial Journal*, 5(2), 283–308. <https://doi.org/10.1007/s13385-015-0111-x>
- Gatzert, N., Hoermann, G., & Schmeiser, H. (2009). The Impact of the Secondary Market on Life Insurers' Surrender Profits. *Journal of Risk and Insurance*, 76(4), 887–908. <https://doi.org/10.1111/j.1539-6975.2009.01320.x>
- Gemmo, I., & Götz, M. (2016). *Life Insurance and Demographic Change: An Empirical Analysis of Surrender Decisions Based on Panel Data*. <https://ssrn.com/abstract=3230274>
- Giri, M. (2018). A behavioral study of life insurance purchase decisions. *IIT Kanpur*.

- Gottlieb, D., & Smetters, K. (2014). Lapse-Based Insurance. *American Economic Review*. <https://doi.org/10.1257/aer.20160868>
- Haberman S., & Renshaw A.E. (1986). Statistical Analysis of Life Insurance Lapses. *Journal of the Institute of Actuaries*, 113, 459–497. <https://doi.org/https://doi.org/10.1017/S0020268100042566>
- He, D. (2011). Is there dynamic adverse selection in the life insurance market? *Economics Letters*, 112(1). <https://doi.org/10.1016/j.econlet.2011.03.038>
- Hendel, I., & Lizzeri, A. (2003). The Role of Commitment in Dynamic Contracts: Evidence from Life Insurance. *Quarterly Journal of Economics*, 299–327. <https://doi.org/10.1162/00335530360535216>
- Hilpert, C., Ankirchner, S., Chen, A., Cheng, C., Neinstell, K., Schaper, P., Schneider, J., & Szimayer, A. (2016). The Effect of Risk Aversion and Loss Aversion on Equity-Linked Life Insurance with Surrender Guarantees. *Journal of Risk and Insurance*. <https://doi.org/10.2139/ssrn.2765806>
- Huang, F. W., Chen, S., & Lin, J. H. (2022). Insurer Investment, Life Insurance Policy Choices, and Policy Surrender. *Emerging Markets Finance and Trade*, 58(9), 2637–2651. <https://doi.org/10.1080/1540496X.2021.2007879>
- Jia, B., Wang, L., & Wong, H. Y. (2023). Machine learning of surrender: Optimality and humanity. *Journal of Risk and Insurance*. <https://doi.org/10.1111/jori.12428>
- Jiang, S.-J. (2011). Voluntary Termination of Life Insurance Policies: Evidence from the U.S. Market. *North American Actuarial Journal*, 369–380. <https://doi.org/10.1080/10920277.2010.10597596>
- Kagraoka, Y. (2005). *Modelling Insurance Surrenders by the Negative Binomial Model*. <https://www.researchgate.net/publication/228481596>
- Kang, B., & Ziveyi, J. (2018). Optimal surrender of guaranteed minimum maturity benefits under stochastic volatility and interest rates. *Insurance: Mathematics and Economics*, 79, 43–56. <https://doi.org/10.1016/j.insmatheco.2017.12.012>
- Kent, J., Legrand, C., & Morgan, E. (2009). *Dynamic Policyholder Behaviour Survey*.
- Kiesenbauer, D. (2013). Main determinants of lapse in the German life insurance industry. *Journal of Risk and Insurance*. <https://doi.org/https://doi.org/10.1080/10920277.2012.10590632>
- Kim, C. (2005a). Modelling Surrender and Lapse Rates with Economic Variables. *North American Actuarial Journal*, 9(4), 56–70. <https://doi.org/10.1080/10920277.2005.10596225>
- Kim, C. (2005b). *Report to the Policyholder Behavior in the Tail Subgroups Project*. <https://www.researchgate.net/publication/237378532>
- Kim, C. (2010). Policyholder Surrender Behaviors under Extreme Financial Conditions. *Korean Journal of Applied Statistics*. <https://doi.org/10.5351/kjas.2010.23.4.635>
- Kling, A., Ruez, F., & Ruß, J. (2014). The impact of policyholder behavior on pricing, hedging, and hedge efficiency of withdrawal benefit guarantees in variable annuities. *European Actuarial Journal*, 4(2), 281–314. <https://doi.org/10.1007/s13385-014-0093-0>
- Knoller, C., Kraut, G., & Schoenmaekers, P. (2016). On the Propensity to Surrender a Variable Annuity Contract: An Empirical Analysis of Dynamic Policyholder Behavior. *Journal of Risk and Insurance*, 83(4), 979–1006. <https://doi.org/10.1111/jori.12076>
- Koijen, R. S. J., Lee, H. K., & Van Nieuwerburgh, S. (2024). Aggregate lapsation risk. *Journal of Financial Economics*, 155. <https://doi.org/10.1016/j.jfineco.2024.103819>

- Kueker, D., Tim Rozar, F., Michael Cusumano, M., Susan Willeat, F., & Richard Xu, M. (2014). *Report on the Lapse and Mortality Experience of Post-Level Premium Period Term Plans*. <https://www.soa.org/globalassets/assets/files/research/exp-study/research-2014-post-level-shock-report.pdf> -
- Kuo, W., Tsai, C., & Chen, W.-K. (2003). An Empirical Study on the Lapse Rate: The Cointegration Approach. *Journal of Risk and Insurance*, 70(3), 489–508. <https://doi.org/10.1111/1539-6975.t01-1-00061>
- Le Courtois, O., & Nakagawa, H. (2013). On surrender and default risks. *Mathematical Finance*, 23(1), 143–168. <https://doi.org/10.1111/j.1467-9965.2011.00487.x>
- Li, J., & Szimayer, A. (2013). *The effect of policyholders' rationality on unit-linked life insurance contracts with surrender guarantees*. 14(2), 327–342. <https://doi.org/https://doi.org/10.1080/14697688.2013.825922>
- Liebenberg, A. P., Carson, J. M., & Dumm, R. E. (2012). A Dynamic Analysis of the Demand for Life Insurance. *Journal of Risk and Insurance*, 79(3), 619–644. <https://doi.org/10.1111/j.1539-6975.2011.01454.x>
- Lombardi, L., Paich, M., & Rao, A. (2012). *Behavioral Simulations: Using agent-based modelling to understand policyholder behaviours*. www.pwc.com/us
- MacKay, A., Augustyniak, M., Bernard, C., & Hardy, M. R. (2017). Risk Management of Policyholder Behavior in Equity-Linked Life Insurance. *Journal of Risk and Insurance*, 84(2), 661–690. <https://doi.org/10.1111/jori.12094>
- Mall, S., & Sahoo, S. (2015). Determinants of lapsation of life insurance policies: an empirical investigation for the Indian market. *International Journal of Financial Services Management*, 8(2). <https://doi.org/10.1504/ijfsm.2015.074154>
- Milevsky, M. A., & Salisbury, T. S. (2006). Financial valuation of guaranteed minimum withdrawal benefits. *Insurance: Mathematics and Economics*, 38(1), 21–38. <https://doi.org/10.1016/j.insmatheco.2005.06.012>
- Milhaud, X. (2013). Exogenous and endogenous risk factors management to predict surrender behaviours. *ASTIN Bulletin: The Journal of the International Actuarial Association*, 43(3). <https://doi.org/10.1017/asb.2013.2>
- Milhaud, X., & Dutang, C. (2018). Lapse tables for lapse risk management in insurance: a competing risk approach. *European Actuarial Journal*, 8, 97–126. <https://doi.org/https://doi.org/10.1007/s13385-018-0165-7>
- Milhaud, X., Loisel, S., & Maume-Deschamps, V. (2011). Surrender triggers in life insurance: what main features affect the surrender behaviour in a classical economic context? *Bulletin Français d'Actuariat*, 5–48. <https://hal.science/hal-00450003>
- Moenig, T. (2021). Variable annuities: Market incompleteness and policyholder behaviour. *Insurance: Mathematics and Economics*, 99, 63–78. <https://doi.org/10.1016/j.insmatheco.2021.03.007>
- Moenig, T., & Zhu, N. (2018). Lapse and Reentry in Variable Annuities. *Journal of Risk and Insurance*, 85(4), 911–938. <https://doi.org/10.1111/jori.12171>
- Molent, A. (2019). Taxation of a GMWB Variable Annuity in a Stochastic Interest Rate Model. *ASTIN Bulletin: The Journal of the International Actuarial Association*. <https://doi.org/10.1017/asb.2020.29>
- Moore, K. S. (2009). Optimal surrender strategies for equity-indexed annuity investors. *Insurance: Mathematics and Economics*, 44(1), 1–18. <https://doi.org/10.1016/j.insmatheco.2008.08.006>

- Mudavanhu, B., Haas, W. A., & Zhuo, J. (2002). *Valuing guaranteed minimum death benefits in variable annuities and the option to lapse*.
- Nolte, S., & Schneider, J. C. (2017). Don't lapse into temptation: a behavioral explanation for policy surrender. *Journal of Banking and Finance*, 79, 12–27. <https://doi.org/10.1016/j.jbankfin.2017.02.011>
- Outreville, J. F. (1990). Whole-life insurance lapse rates and the emergency fund hypothesis. *Insurance Mathematics and Economics*, 9(4). [https://doi.org/10.1016/0167-6687\(90\)90002-U](https://doi.org/10.1016/0167-6687(90)90002-U)
- Pinquet, J., Guillén, M., & Ayuso, M. (2011). Commitment and Lapse Behavior in Long-Term Insurance: A Case Study. *Journal of Risk and Insurance*, 78(4), 983–1002. <https://doi.org/10.1111/j.1539-6975.2011.01420.x>
- Poufinas, T., & Michaelide, G. (2018). Determinants of Life Insurance Policy Surrenders. *Modern Economy*, 09(08), 1400–1422. <https://doi.org/10.4236/me.2018.98089>
- Richardson, C. F., & Hartwell, J. M. (1951). *Lapse Rates*.
- Russell, D. T., Fier, S. G., Carson, J. M., & Dumm, R. E. (2013). An Empirical Analysis of Life Insurance Policy Surrender Activity. *Journal of Insurance Issues* (Vol. 36, Number 1). <https://ideas.repec.org/a/wri/journal/v36y2013i1p35-57.html>
- Russo, V., Giacometti, R., & Fabozzi, F. J. (2017). Intensity-based framework for surrender modelling in life insurance. *Insurance: Mathematics and Economics*, 72, 189–196. <https://doi.org/10.1016/j.insmatheco.2016.11.001>
- Sakálová, K., & Peller, -František. (2015). Analyses of Factors Affecting the Withdrawal of Life Insurance Policyholders. *CEFE 2015 Central European Conference in Finance and Economics*.
- Shamsuddin, S. N., Ismail, N., & Roslan, N. F. (2022). What We Know about Research on Life Insurance Lapse: A Bibliometric Analysis. *Risks*, 10(5). <https://doi.org/10.3390/risks10050097>
- Sirak, Adjmal S, & Wolfgang, J. (2015). Income and Unemployment Effects on Life Insurance Lapse. Retrieved September. <https://www.researchgate.net/publication/299455763>
- Subashini, S., & Velmurugan, R. (2015). Lapsation in life insurance policies. *International Journal of Advance Research in Computer Science and Management Studies*, 3(4). <https://www.researchgate.net/publication/315527459>
- Valla, M., Milhaud, X., & Olympio, A. (2024). Including individual customer lifetime value and competing risks in tree-based lapse management strategies. *European Actuarial Journal*, 14(1), 99–144. <https://doi.org/10.1007/s13385-023-00358-0>
- Vasudev, M., Bajaj, R., & Alegre Escolano, A. (2016). *On the Drivers of Lapse Rates in Life Insurance*. Universidad de Barcelona. <https://hdl.handle.net/2445/115586>
- Wei Zhenyu; Zheng Haitao; Zhang Wenrui. (2019). Research on the Driving Factors of Life Insurance Companies' Surrender Risk under Economic Crisis. *Proceedings of 2019 China International Conference on Insurance and Risk Management (CICIRM)*.
- Yakob, R., Abdullah, M. H. S. B., & Mohd Baharom, N. (2018). Analisis Polisi Luput Pelan Takaful Keluarga. *Journal of Muamalat and Islamic Finance Research*, 109–124. <https://doi.org/https://doi.org/10.33102/jmifr.v15i1.103>
- Yu, L., Cheng, J., & Lin, T. (2019). Life insurance lapse behaviour: evidence from China. *Geneva Papers on Risk and Insurance: Issues and Practice*, 44(4), 653–678. <https://doi.org/10.1057/s41288-018-0104-5>

7. APPENDIX. HIPOTHESES CONSIDERED

A wide variety of hypotheses has been identified in this research area, according to which policyholder behaviour may be influenced when deciding to terminate an insurance contract.

7.1.Economic Hypotheses

These hypotheses are related to the economic value of the contract or to the policyholder's need for emergency funds. Their drivers are generally classified in the literature as either exogenous (e.g., unemployment rate, GDP, inflation) or endogenous (e.g., interest rates). Traditionally, the IRH and the EFH have been considered, although more recent studies have incorporated additional economic mechanisms into life insurance termination research. The main economic hypotheses considered in the literature are:

Derived from endogenous triggers:

Considered as rational, optimal behaviour or value maximization.

- **IRH Interest Rate Hypothesis**

Proposed by (Dar & Dodds, 1989), is the most widely adopted hypothesis in the literature. It states that policyholders terminate their contracts in response to increases in market interest rates or stock yields, in order to take advantage of higher yields available in other investment opportunities. The hypothesis can be found in isolation within an optimal behaviour framework, for example in (Huang et al., 2022), (Gad et al., 2015) as well as in combination with other hypothesis— largely with EFH—, in studies such as (Eling & Kochanski, 2012), (Kuo et al., 2003) and (Cox & Lin, 2006).

In traditional savings products with guaranteed, fixed or variable rates, —particularly in Universal Life insurance—, the hypothesis is often expressed in terms of the spread between crediting rates and the market interest rates. In this context, it is referred to as the **Crediting Rates Hypothesis** (CRH), as discussed by (Vasudev et al., 2016).

- **MNH Moneyness Hypothesis (or Hypothesis "in the money")**

This hypothesis considers the surrender as the exercise of a put option. It is generally applied to both variable and guaranteed annuities. It establishes the relationship between the surrender value and the value at maturity. Relevant contributions include (Escobar et al., 2016) (Kling et al., 2014)(Knoller et al., 2016)(Kent et al., 2009)(Alonso-García et al., 2024).

- **PRH Policy Replacement Hypothesis**

Based on empirical research by (Outreville, 1990) and (Russell et al., 2013), this hypothesis suggests that policyholders terminate an existing policy to replace it with another offering better prices or more favourable contractual conditions. Additional evidence can be found in (Bauer et al., 2017)(Fier & Liebenberg, 2013).

Derived from exogenous triggers:

- **EFH Emergency Fund Hypothesis**

Proposed by (Outreville, 1990), this hypothesis states that the policyholder decides to terminate the life insurance contracts when faced with adverse personal financial circumstances such as unemployment, health problems or long-term care needs. It appears frequently in the literature, both as a standalone explanation and in combination with other hypotheses. Representative studies include (Gemma & Götz, 2016)(Liebenberg et al., 2012)(Belaygorod et al., 2014)(Dar & Dodds, 1989).

- **TXH Tax Impact Hypothesis**

This hypothesis posits that the policyholders take into account the tax implications of the surrender amount when deciding whether to terminate a policy. It is not widely addressed in

the literature. It has been identified primarily in studies on insurance-based investment products (IBIPs), although it may also be relevant to other product types depending on the contractual design and the tax regime of the country under consideration. Relevant contributions include (Moenig, 2021), (Moenig & Zhu, 2018), (Molent, 2019) or (Alonso-García et al., 2024).

- **IH Inflation Impact Hypothesis**

Also referred to as the payment depreciation hypothesis, this approach is based on the concept of money illusion, according to which consumers may recognize the existence of inflation, but fail to perceive its real impact on their life insurance policies. For example, policyholders may interpret a constant premium as evidence that the policy maintains its value, even when the insured capital also remains unchanged in nominal terms.

An alternative interpretation establishes a positive relationship between inflation, household indebtedness and increased surrender activity. This perspective is based on the assumption that policyholders may require additional liquidity during periods of high inflation, thereby linking inflation to the EFH. Relevant contributions include (Wei Zhenyu; Zheng Haitao; Zhang Wenrui, 2019), (Cole & Fier, 2021) and (Babbel, 1979).

- **HSH Health Shock Hypothesis**

Proposed by (Cheng, 2022), this hypothesis combines two distinct effects depending on the type of insurance product considered: savings insurance with surrender value, and protection insurance. On the one hand, when a population-wide health crisis threatens, beyond death, unexpected medical expenses (particularly in countries without comprehensive public healthcare coverage), income reductions, and unemployment, produce an urgent need for liquidity. In this context, health shocks may contribute to higher surrender activity, acting as a trigger for the EFH.

On the other hand, a widespread health crisis increase policyholder's awareness of the cover provided by their protection insurance. Consequently policyholders may become more inclined to maintain their contracts rather than terminate them.

7.2.Hypotheses related to the policyholder's own characteristics, their ability to reason or their behaviour.

This set of hypotheses often serves as a catalyst for economic hypotheses, and is therefore seldom analysed in isolation. For instance, an individual who is starting a family (e.g., profile of a young married person with small children) may require emergency liquidity, which can act as a trigger for Emergency Fund Hypothesis (EFH). Similarly, a policyholder with higher Cognitive Ability or greater Financial Knowledge (CAH) may behave more rationally and identify the optimal moment to surrender the policy, thereby, acting triggering the IRH or the MNH.

- **PCH Policyholder Characteristics Hypothesis**

This hypothesis considers that certain policyholder characteristics—such as their age or marital status—as well as specific life events (e.g., retirement, divorce, transfer, death of a spouse, acquisition of a house, etc.) may influence the decision to terminate an insurance policy. For example, the reduced need for beneficiary provided by protection insurance, may lead to policy termination, an effect referred to as the **Legacy Hypothesis** by (Fang & Kung, 2012). These events may also act as triggers for additional liquidity needs under the EFH thereby, justifying surrender decisions in savings or mixed products, as discussed by (Liebenberg et al., 2012) and (Sirak et al., 2015).

In other studies, policyholder characteristics are analysed more generally in order to identify relationships between these attributes and the likelihood of early policy termination. Examples include (Mall & Sahoo, 2015) and (Milhaud et al., 2011).

This approach can be also found in combination with the policy data analysis, as illustrated

by (Kueker et al., 2014) and (Yakob et al., 2018).

- **LRH Level of Rationality Hypothesis**

This hypothesis examines the impact that the policyholder's level of rationality on the identification of the optimal moment to realize the profitability of the contract. It is commonly associated with utility functions or degrees of risk aversion, as in the studies (Moore, 2009) and (Moenig, 2021). In other approaches, rationality is modelled as a constant component as in (Jia et al., 2023), (Kim, 2005a) or (Kuo et al., 2003), as a random component, as proposed by (Russo et al., 2017). Other studies classify policyholders into different sections or levels of rationality as in (Le Courtois & Nakagawa, 2013), (Li & Szimayer, 2013) and (Kling et al., 2014). Additional contributions analyse alternative scenarios as proposed by (Albizzali & Geman, 1994) and by the simulation agent based theoretical approach proposed by (Lombardi et al., 2012). The hypothesis is also related to Cognitive Ability/Financial Knowledge Hypothesis (CAH).

This hypothesis appears in studies related to savings or mixed insurance; however, it is particularly prevalent in the analysis of insurance-based investment products (IBIPs), where it is typically combined with economic hypotheses involving endogenous triggers.

- **CAH Cognitive Ability/Financial Knowledge Hypothesis**

This hypothesis associates a higher level of financial knowledge or greater cognitive ability with an increased probability of identifying optimal moment to terminate the contract. Cognitive ability is measured through survey-based methodologies in the study by (Nolte & Schneider, 2017). Similar hypotheses are also considered by (Giri, 2018) and (Pinquet et al., 2011).

A related proposition is the **Financial Advice Hypothesis (FAH)**, also identified by (Nolte & Schneider, 2017). This hypothesis states that, in situations involving liquidity needs, access to financial advice reduces the likelihood of policy termination. Furthermore, it suggests that financial advice is particularly relevant when policyholder's level of financial education is low.

- **COH Hypothesis of Contagion between Policyholders**

Originally proposed by (Dassios & Zhao, 2011) and later considered by (Barsotti et al., 2016), this hypothesis states that the policyholder behaviour is not independent, contrary to the assumptions adopted in most traditional life insurance termination prediction models.

According to (Barsotti et al., 2016) conventional modelling techniques allow the incorporation of multiple risk factors as covariates including tax relief, contract and policyholder characteristics, company reputation, regulatory frameworks, and financial market conditions. These approaches, therefore, generate heterogeneous predictions depending on the policyholder's profile. However, from a global perspective, they fail to provide sufficiently accurate predictions in changing economic environments, as they assume independence in policyholder behaviours, and consequently, ignore potential contagion effects among policyholders.

- **HLH Health Condition Hypothesis**

Applicable to protection insurance and, due to their protection component, to mixed insurance products, this hypothesis states that some policyholders terminate their insurance policies because they perceive their level of risk to be lower than initially expected. Conversely policyholders tend to maintain their coverage after experiencing a health-related problem. Both effects imply that the remaining insured population presents a higher average level of risk than that considered in the initial underwriting assumptions. Consequently, the premium established for the original risk pool, may become insufficient for the redefined group, giving rise to what is known as reclassification risk. This hypothesis is analysed in several studies, including those by (Hendel & Lizzeri, 2003), (Finkelstein et al., 2005), (He, 2011), (Gottlieb & Smetters, 2014), (Pinquet et al., 2011) and (Bacinello et al., 2009).

7.3. Hypotheses related to contract characteristics

- PDH Policy Data Hypothesis

This hypothesis establishes a relationship between specific policy characteristics and the decision to terminate the contract. It is identified in studies covering a wide range of insurance types. Frequently analysed variables include the duration, the policy age, profit sharing mechanisms (see (Eling & Kiesenbauer, 2012)), as well as the expenses and charges applied to the policy. In the latter case, it is referred to as the **Charges and Expenses Hypothesis (CEH)**, as discussed by (MacKay et al., 2017) and (Bernard et al., 2014).

Other formulations of the hypotheses poses that high commissions, as well as long-term life protection policies and level-premium structures, —where the policyholder pays higher premiums at younger ages and lower premiums over time—reduce the probability of termination, as shown by (Hendel & Lizzeri, 2003).

7.4. Hypotheses related to the Insurer's Financial Situation and Reputation

- FSH Financial Situation or Reputation Hypothesis

Formulated in different variants, this hypothesis links policy termination to the financial or reputational situation of the insurer, establishing a positive correlation between increases in both magnitudes, essentially in crisis periods, as discussed by (Wei Zhenyu; Zheng Haitao; Zhang Wenrui, 2019)(Yu et al., 2019).

According to (Chang & Schmeiser, 2022) lapse risk increases when the insurer faces liquidity constraint. Moreover, extreme events may trigger a sudden increase in policy surrenders, which in turn can generate or exacerbate liquidity crisis for the insurer. As a result, both mechanisms may reinforce each other in a feedback loop.

7.5. Hypotheses related to the sale of insurance.

- MSH Miss-selling Hypothesis

This hypothesis is discussed in several studies, including , (Fang & Kung, 2012), (Giri, 2018), (Sakálová & Peller, 2015) and (Subashini & Velmurugan, 2015). It argues that higher termination rates are associated with policies sold where the policyholder with limited genuine interest in the contract, insufficient understanding of its characteristics or under pressure exerted by the salesperson.

In the literature reviewed, this hypothesis is more frequently associated with mixed insurance product, although, it may be considered applicable to a broad range of insurance product types.

7.6. Hypotheses related to the existence of a secondary insurance market.

This phenomenon is present only in countries where such markets exist, mainly in the United States, although it is increasingly observed in European countries such as Germany. The secondary insurance market typically operates through two main mechanisms: *Life Settlement* and *Policy Loans*.

A *Life Settlement* is a financial transaction in which the policyholder sells their mixed life insurance (typical in Whole Life insurance) to a third party for a one-time cash payment. This payment is lower than the policy's death benefit but generally higher its cash surrender value. The acquiring company assumes responsibility for future premiums and becomes the new beneficiary, collecting the insured capital if the insured person dies within the coverage period.

Policy Loans operate in permanent life insurance such as Whole Life or Universal Life insurance. In this mechanism the policyholder obtains a borrowed loan amount lower than the policy's insured capital without undergoing a credit check or formal loan approval process. The loan is secured by the policy's cash value. If the borrower fails to repay the agreed

amount, or in the event of the death of the insured person the lender becomes the beneficiary of the life insurance policy and would collect the cash value.

The Hypotheses related to the existence of a **Secondary Market (SCH)**, as discussed by (Bauer et al., 2017), (Gatzert et al., 2009) and (Fang & Wu, 2020) suggest that the presence of a secondary market, is associated with a lower rate of termination rates. This effect is also identified in (Jiang, 2011) where it is referred to as the *crowding out effect*.

The **Alternative Fund Hypothesis (AFH)**, closely related to the policy replacement hypothesis (PRH), argues that policyholders tend to rely on policy-backed loans on policies when alternative sources of credit are more expensive (Cole & Fier, 2021). Consequently, this mechanism is also associated with lower termination rates.

7.7.Other Hypotheses

- SEH Seasonality Hypothesis

Several studies including, (Kim, 2005b), (Kim, 2005a), (Kim, 2010) and (Milhaud, 2013), suggest the existence of a seasonal patterns in life insurance terminations.

The literature in which this where this hypothesis is identified focuses exclusively on traditional savings insurance products