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MODELING POLICY LAPSE RISK IN INVESTMENT-LINKED INSURANCE PRODUCTS (PAYDI) USING THE COX PROPORTIONAL HAZARDS MODEL

PEMODELAN LAPSE RATE NASABAH PRODUK ASURANSI YANG DIKAITKAN INVESTASI (PAYDI) MENGGUNAKAN COX PROPORTIONAL HAZARD MODEL

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ABSTRACT

The increasing number of policy lapses in Investment-Linked Insurance Products (PAYDI) has become a major concern for the Indonesian life insurance industry because it affects customer protection, insurer performance, and business sustainability. This study aims to model policy lapse risk using the Cox Proportional Hazard Model and identify the factors influencing lapse among PAYDI policyholders. Primary data were collected from 618 PAYDI customers across Indonesia using a structured questionnaire. The explanatory variables included product understanding, sales process compliance, information transparency, and claim experience, while the response variable was the time to policy lapse. Descriptive statistics, Kaplan–Meier survival estimation, and Cox Proportional Hazard regression were employed, and the proportional hazards assumption was evaluated using the Schoenfeld residual test. The results confirmed that the proportional hazards assumption was satisfied, validating the application of the Cox model. Multivariate analysis showed that information transparency significantly reduced lapse risk (HR = 0.496; 95% CI: 0.293–0.843; p = 0.009), whereas sales process compliance increased the hazard of lapse (HR = 2.351; 95% CI: 1.001–5.524; p = 0.050). Claim experience was the strongest predictor, increasing lapse risk by more than twenty-one times (HR = 21.540; 95% CI: 10.486–44.247; p < 0.001), while product understanding was not statistically significant. The final model demonstrated excellent predictive performance (C-index = 0.823). These findings emphasize the importance of enhancing information transparency and improving claims services to reduce policy lapse and strengthen customer retention in PAYDI products.

Keywords: *Cox Proportional Hazard Model; Survival Analysis; Investment-Linked Insurance Product (PAYDI); Policy Lapse; Hazard Ratio*

ABSTRAK

Meningkatnya jumlah pembatalan polis pada Produk Asuransi Jiwa Terkait Investasi (PAYDI) telah menjadi perhatian utama bagi industri asuransi jiwa Indonesia karena berdampak pada perlindungan pelanggan, kinerja perusahaan asuransi, dan keberlanjutan bisnis. Studi ini bertujuan untuk memodelkan risiko pembatalan polis menggunakan Model Bahaya Proporsional Cox dan mengidentifikasi faktor-faktor yang memengaruhi pembatalan polis di antara pemegang polis PAYDI. Data primer dikumpulkan dari 618 pelanggan PAYDI di seluruh Indonesia menggunakan kuesioner terstruktur. Variabel penjelas meliputi pemahaman produk, kepatuhan proses penjualan, transparansi informasi, dan pengalaman klaim, sedangkan variabel respons adalah waktu hingga pembatalan polis. Statistik deskriptif, estimasi kelangsungan hidup Kaplan–Meier, dan regresi Bahaya Proporsional Cox digunakan, dan asumsi bahaya proporsional dievaluasi menggunakan uji residual Schoenfeld. Hasilnya mengkonfirmasi bahwa asumsi bahaya proporsional terpenuhi, memvalidasi penerapan model Cox. Analisis multivariat menunjukkan bahwa transparansi informasi secara signifikan mengurangi risiko pembatalan polis (HR = 0,496; 95% CI: 0,293–0,843; p = 0,009), sedangkan kepatuhan terhadap proses penjualan meningkatkan risiko pembatalan polis (HR = 2,351; 95% CI: 1,001–5,524; p = 0,050). Pengalaman klaim merupakan prediktor terkuat, meningkatkan risiko pembatalan polis lebih dari dua puluh satu kali (HR = 21,540; 95% CI: 10,486–44,247; p < 0,001), sementara pemahaman produk tidak signifikan secara statistik. Model akhir menunjukkan kinerja prediktif yang sangat baik (indeks C = 0,823). Temuan ini menekankan pentingnya meningkatkan transparansi informasi dan memperbaiki layanan klaim untuk mengurangi pembatalan polis dan memperkuat retensi pelanggan pada produk PAYDI.

Kata kunci: Model Bahaya Proporsional Cox; Analisis Kelangsungan Hidup; Produk Asuransi Terkait Investasi (PAYDI); Pembatalan Polis; Rasio Bahaya

INTRODUCTION

Investment-Linked Insurance Products (PAYDI), commonly referred to as unit-linked insurance, have become one of the dominant products in Indonesia's life insurance industry since their introduction in 1999 [1]. By integrating life insurance protection with investment components, PAYDI offers policyholders dual financial benefits in the form of risk protection and long-term wealth accumulation [2]. Despite its rapid market growth, the increasing complexity of these products has raised concerns regarding product transparency, consumer understanding, and the sustainability of policy ownership.

To strengthen consumer protection and improve market governance, the Indonesian Financial Services Authority (OJK) has progressively enhanced the regulatory framework governing PAYDI. The general governance of insurance products is regulated under OJK Regulation No. 23/POJK.05/2015, which establishes standards for product design, marketing practices, and disclosure of policy benefits, charges, and premium allocation. In response to widespread concerns over mis-selling practices, inadequate disclosure of investment risks, and unrealistic return projections that generated substantial customer complaints [3], OJK introduced Circular Letter No. 5/SEOJK.05/2022 specifically governing Investment-Linked Insurance Products [4]. The revised regulation mandates greater transparency through standardized Product and Service Information Summaries (RIPLAY), tighter governance of investment fund management, enhanced sales documentation, mandatory customer suitability assessments, and professional certification requirements for insurance agents.

Although these regulatory reforms were designed to improve transparency and consumer protection, they may also alter policyholder behavior. More comprehensive disclosure requirements, stricter underwriting procedures, and changes in product administration may influence customers' decisions to maintain or discontinue their policies. Such behavioral changes are particularly important because policy lapse remains one of the most critical risks faced by life insurers. Premature policy termination directly affects premium income, reserve adequacy, cash-flow projections, profitability, and long-term solvency. Consequently, accurate estimation of lapse behaviour is essential for actuarial pricing, liability valuation, and enterprise risk management.

Policy lapse is inherently a time-to-event phenomenon influenced by multiple interacting factors, including customer characteristics, product features, service quality, investment performance, and market conditions [5]. Conventional statistical approaches that treat lapse as a binary outcome often ignore the timing of policy termination and cannot adequately accommodate censored observations arising from policies that remain active during the observation period. Survival analysis provides a more appropriate framework because it explicitly models the duration until an event occurs while accounting for right-censored data [6]. Among survival models, the Cox Proportional Hazards Model has become the most widely applied semi-parametric approach owing to its ability to estimate the effects of multiple covariates without specifying the baseline hazard function [7] [8].

Previous studies have identified several determinants of insurance lapse, including policyholder age, policy duration, premium level, and macroeconomic or financial market conditions [9]. Other studies demonstrate that the Cox Proportional Hazards Model provides robust estimates of lapse risk because it effectively handles censored observations while simultaneously evaluating multiple explanatory variables [10]. Nevertheless, empirical evidence on lapse behavior in Indonesia remains limited, particularly for PAYDI products operating under the post-SEOJK No. 5/2022 regulatory framework. Existing studies have largely focused on demographic and policy-related characteristics, with limited attention to regulatory compliance variables such as product transparency, policyholder understanding, sales process compliance, and claim experience, despite these factors being central objectives of the new regulation.

This study addresses these gaps by modelling PAYDI policy lapse using the Cox Proportional Hazards Model based on primary data collected from 618 PAYDI policyholders in Indonesia. Unlike previous studies, this research incorporates behavioral and regulatory compliance variables (including product understanding, transparency, compliance with the sales process, and claim experience) to evaluate their effects on lapse risk. The findings are expected to contribute by providing an empirical survival model for lapse prediction and to support insurers and regulators in developing evidence-based strategies to improve policy persistency and strengthen consumer protection under Indonesia's evolving regulatory environment.

RESEARCH METHODS

1. Research Design

This study employed a quantitative research design using survival analysis to investigate the factors influencing policy lapse in Investment-Linked Insurance Products (PAYDI). Survival analysis was selected because the outcome of interest is the time until a policy lapse occurs, allowing both the occurrence and timing of the event to be analysed while appropriately accommodating right-censored observations from policies that remained active throughout the study period. The primary analytical technique was the Cox Proportional Hazards Model, a semi-parametric regression model that estimates the effects of explanatory variables on the hazard of policy lapse without requiring specification of the baseline hazard function. This approach enables the identification of significant risk factors associated with policy lapse while providing interpretable hazard ratios for each explanatory variable. Descriptive statistical analysis was conducted prior to model estimation to summarize respondents' demographic characteristics and the distribution of the study variables.

2. Data Collection

Sample and Population

The target population of this study comprised all policyholders of Investment-Linked Insurance Products (PAYDI) in Indonesia. Respondents were recruited using quota sampling, a non-probability sampling technique in which participants were selected until the predetermined sample size was achieved based on the study objectives and eligibility criteria. Eligible respondents were individuals who (1) currently owned or had previously owned a PAYDI policy, (2) were the

purchaser or policyholder of the PAYDI policy, and (3) voluntarily agreed to complete the research questionnaire. Questionnaires with incomplete responses or respondents who did not satisfy these eligibility criteria were excluded from the analysis.

The adequacy of the sample for survival analysis was evaluated using the Events per Variable (EPV) criterion recommended for Cox proportional hazards regression. Previous studies suggest that a minimum of 10 events per predictor variable is generally sufficient to obtain stable parameter estimates [11] [12] [13]. Given the number of predictor variables included in the Cox model, the observed number of lapse events satisfied the recommended EPV criterion, indicating that the sample size was adequate for model estimation. A total of 618 valid responses were included in the final analysis. Among these, 56 policyholders (9.06%) experienced policy lapse, representing the observed events, whereas 562 policyholders (90.94%) remained active at the end of the observation period and were treated as right-censored observations. The presence of both event and censored observations provides an appropriate data structure for survival analysis using the Cox Proportional Hazards Model.

Variables

This study employed one outcome variable and four explanatory variables. Besides, the policy holder characteristics are asked in questionnaire. All variables were obtained from a structured questionnaire completed by PAYDI policyholders.

1. Policyholder Characteristics

Policyholder characteristics were included to describe the demographic profile of the respondents. These variables were analyzed descriptively and consisted of:

- Age, categorized into ≤20, 21–30, 31–40, 41–50, 51–60, and >60 years.
- Gender, classified as male or female.
- Educational attainment, categorized as elementary school or below, junior high school, senior high school, diploma, bachelor's degree, master's degree, and doctoral degree.
- Monthly income, categorized as IDR 0–5 million, IDR 5–10 million, IDR 10–15 million, IDR 15–20 million, IDR 20–50 million, and above IDR 50 million.
- Product type, categorized as Protection Unit Link, Education Unit Link, Pension Unit Link, and Health Unit Link.
- Distribution channel, categorized as insurance agent, bancassurance, and direct purchase from the insurance company.

2. Outcome Variable

The outcome variable was time to policy lapse, measured in years from the policy inception date until the occurrence of policy lapse or the end of the observation period. Policies that remained active at the end of the observation period were treated as right-censored observations.

The event indicator was defined as 1 mean the policy lapsed and 0 mean policy remained active (right-censored). These variables constitute the response variables used in both the Kaplan–Meier survival analysis and the Cox Proportional Hazards regression model.

3. Explanatory Variables

Four explanatory variables were included in the Cox Proportional Hazards Model, that are:

- Product Understanding represents the policyholder's understanding of PAYDI product features, including

insurance benefits, investment mechanisms, acquisition charges, investment risks, benefit illustrations, and the free-look period. The construct was measured using ten statements rated on a five-point Likert scale, and the average score was used in the analysis.

- Sales Process Compliance measures the extent to which the insurer and insurance agent complied with regulatory requirements during the sales process, including customer needs assessment, documentation of the sales process, customer declarations of understanding, video recording, and welcoming calls. The variable was measured using five Likert-scale items, and the average score was calculated.
- Information Transparency reflects the level of disclosure provided by insurers regarding investment projections, periodic investment value reports, premium allocation, fund-switching rights, and investment risks. This construct was measured using five Likert-scale items, and the average score was used in the analysis.
- Claim Experience indicates whether the respondent had previously submitted a PAYDI insurance claim. This variable was included as a binary explanatory variable, coded as 1 = had claim experience and 0 = no claim experience.

3. Data Analysis

The statistical analysis was conducted in five sequential stages using R statistical software.

1. Descriptive Analysis

The first stage involved descriptive statistical analysis to summarize the characteristics of the respondents and PAYDI policy ownership. Categorical variables, including age, gender, educational attainment, monthly income, product type, and distribution channel, were presented as frequencies and percentages. Continuous variables, namely Product Understanding, Sales Process Compliance, and Information Transparency, were summarized using the minimum, maximum, mean, and standard deviation.

2. Kaplan–Meier Survival Analysis

The second stage estimated the survival function using the Kaplan–Meier estimator to describe the probability that a PAYDI policy remained active over time. The survival curve illustrates the probability of policy survival at each annual observation period and provides a non-parametric description of policy persistence throughout the study period.

3. Cox Proportional Hazards Regression

The third stage examined the determinants of policy lapse using the Cox Proportional Hazards Model. The outcome variable consisted of the time until policy lapse together with the event indicator (1 = lapsed, 0 = active/right-censored). Four explanatory variables were evaluated: Product Understanding, Sales Process Compliance, Information Transparency, and Claim Experience.

Initially, each explanatory variable was analysed separately using univariable Cox regression to estimate its individual association with lapse risk. The univariable Cox model is expressed as:

$$h(t \mid X) = h_0(t)e^{\beta X}$$

where $h(t \mid X)$ denotes the hazard function at time t for an individual with characteristic $h_0(t)$ represents the baseline hazard, and β is the regression coefficient corresponding to the explanatory variable and one independent variable, which in this study was tested one by one, namely

Product Understanding, Sales Process Compliance, Information Transparency, and Claim Experience, respectively. Model estimates were reported as regression coefficients (β), hazard ratios (HRs), 95% confidence intervals (CIs), and p-values.

4. Model Assessment

The proportional hazards assumption was evaluated using the Schoenfeld residual test and graphical inspection of the scaled Schoenfeld residual plots. A non-significant test result ($p > 0.05$) indicated that the proportional hazards assumption was satisfied. Model discrimination was assessed using the Concordance Index (C-index), where values closer to one indicate better discrimination between policyholders experiencing earlier and later lapse events. Overall model significance was evaluated using the Likelihood Ratio Test, Wald Test, and Score (log-rank) Test, with statistical significance defined as $p < 0.05$.

5. Interpretation of Results

The final stage involved interpreting the estimated Cox regression coefficients and hazard ratios to identify the factors associated with policy lapse. A positive regression coefficient ($\beta>0$) or hazard ratio greater than one ($HR > 1$) indicates an increased hazard of policy lapse, whereas a negative regression coefficient ($\beta<0$) or hazard ratio less than one ($HR < 1$) indicates a reduced hazard of policy lapse. Statistical significance was determined based on the corresponding p-values and 95% confidence intervals.This section contains a complete and detailed description of the steps undertaken in conducting of research. In addition, the research step also needs to be shown in the form of flowchart of research or framework step in complete and detailed including reflected algorithm, rule, modeling, design and others related to system design aspect.

RESULTS AND DISCUSSIONS

1. Respondent Profile

Figure 1 presents the characteristics of 618 PAYDI policyholders. Most respondents were in the productive age group of 41–50 years (40.13%), followed by 31–40 years (28.48%), indicating that PAYDI is primarily owned by individuals with long-term financial planning needs. Respondents were generally well educated, with 52.75% holding a bachelor's degree and 22.82% a master's degree, while 37.22% reported monthly incomes between IDR 20–50 million, reflecting the predominance of middle- to upper-income policyholders. Female respondents accounted for 55.50% of the sample, showing a relatively balanced gender distribution. In terms of product distribution, 69.90% purchased PAYDI through insurance agents, substantially exceeding bancassurance, direct purchases, and online channels. This finding highlights the central role of agents in influencing customers' understanding of product features and purchasing decisions. Overall, the respondent profile suggests that lapse behavior is more likely to be associated with product understanding, transparency, and marketing quality than with demographic characteristics alone.

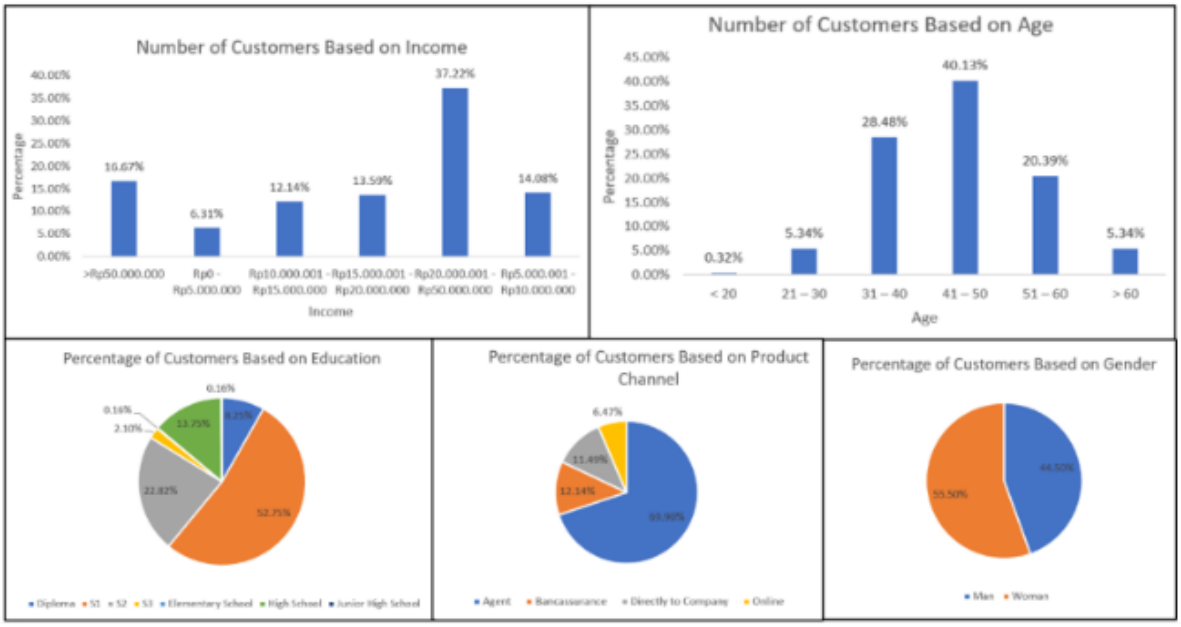

Figure 1. Descriptive Analysis of Respondent Profiles

2. Survival Analysis Kaplan-Meier

Survival analysis was performed using the Kaplan–Meier estimator to evaluate the probability of an Investment-Linked Insurance Product (PAYDI) policy remaining active throughout the observation period. This non-parametric approach estimates the survival function while appropriately accounting for right-censored observations. In this study, the survival function $S(t)$ represents the probability that a policy remains active (i.e., has not lapsed) beyond time t. The estimated survival probabilities are presented in Table 1.

Table 1 shows a gradual decline in survival probability over the observation period, indicating that the cumulative risk of policy lapse increased as policy duration became longer. At policy inception, the estimated probability of remaining active was 99.7%, decreasing slightly to 99.2% after one year. The decline became more pronounced between the second and third years, when survival probability decreased from 96.7% to 91.4%. This period also recorded the highest number of lapse events (22 policies), suggesting that the third policy year represents the period with the greatest lapse risk.

Beyond the third year, survival probability continued to decrease to 87.2% in the fourth year and 85.3% in the fifth year. Nevertheless, the survival probability remained above 85% throughout the five-year observation period, indicating that most PAYDI policyholders maintained their policies despite the gradual accumulation of lapse events. The widening confidence intervals over time are consistent with the declining number of policies remaining under observation, resulting in greater estimation uncertainty during later follow-up periods.

Table 1. Kaplan–Meier Estimates of PAYDI Policy Survival

Time (years)	n.risk	n.event	Survival Probability	Standard error	Lower 95% CI	Upper 95% CI
0	618	2	0.997	0.00228	0.992	1
1	616	3	0.992	0.0036	0.985	0.999

2	508	13	0.967	0.00779	0.951	0.982
3	404	22	0.914	0.01316	0.888	0.94
4	284	13	0.872	0.01692	0.84	0.906
5	139	3	0.853	0.01974	0.815	0.893

The Kaplan–Meier survival curve (Figure 2) exhibits the typical stepwise pattern characteristic of time-to-event data, where each downward step corresponds to the occurrence of a policy lapse. The absence of abrupt declines indicates that lapse events were distributed progressively rather than concentrated within a single observation period. Overall, the Kaplan–Meier analysis demonstrates that PAYDI policies exhibit relatively high retention during the first five years of ownership, while simultaneously revealing an increasing cumulative risk of lapse over time. These findings provide empirical justification for applying the Cox Proportional Hazard model to identify the determinants associated with policy lapse risk.

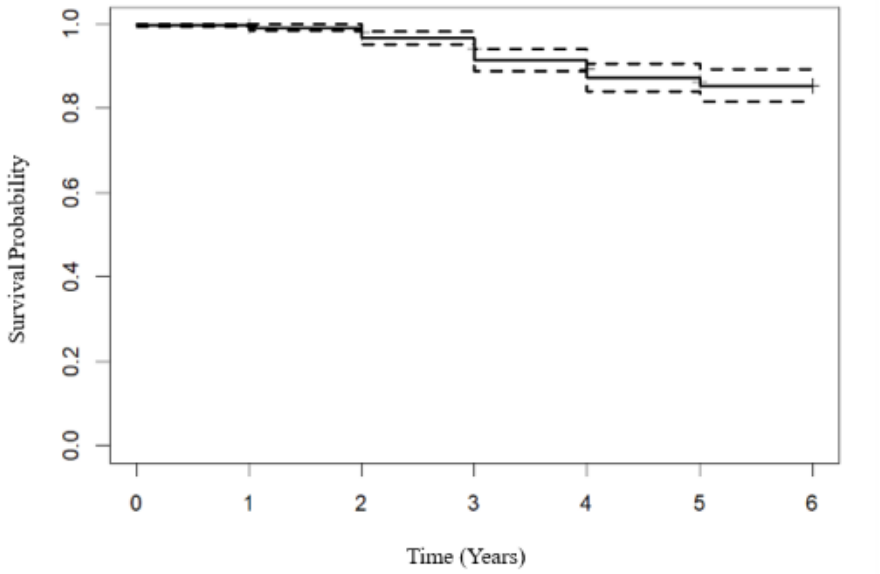

Figure 2. Kaplan–Meier Survival Curve of PAYDI Policies

3. Cox Proportional Hazard Model

To identify the individual contribution of each predictor to PAYDI policy lapse, univariate Cox proportional hazard models were estimated for Product Understanding, Compliance, Transparency, and Claims Experience. The regression coefficients (β), hazard ratios (HR), 95% confidence intervals, Wald test results, and Concordance Index values are presented in Table 2.

The Product Understanding variable produced a regression coefficient of $\beta = -0.3797$, indicating that greater understanding of PAYDI products tends to reduce the instantaneous risk of policy lapse. The estimated hazard ratio (HR = 0.684, 95% CI: 0.386–1.212) suggests that each one-unit increase in product understanding is associated with a 31.6% lower lapse hazard. However, the Wald test was not statistically significant ($p = 0.193$), and the confidence interval included the null value of one, indicating insufficient evidence that product understanding independently influences lapse occurrence. The model yielded a

Concordance Index of 0.590, reflecting modest discriminatory ability in distinguishing policyholders according to their lapse risk.

Table 2. Results of Univariate Cox Proportional Hazard Models

Variabel	Koefisien (β)	Hazard Ratio	95% CI	p-value (Wald)	Concordance Index	Decision
Product Understanding	-0,3797	0,6841	0,3862-1,212	0,193	0,59	Tidak signifikan
Sales Process Compliance	-0,2633	0,7685	0,4573-1,292	0,320	0,562	Tidak signifikan
Information Transparency	-0,4942	0,6101	0,4034-0,9226	0,019	0,612	Signifikan
Claim Experience	2,9862	19,809	9,704-40,440	<0,001	0,798	Signifikan

Similarly, the Compliance variable showed a negative regression coefficient ($\beta = -0.2633$) with a hazard ratio of 0.769 (95% CI: 0.457–1.292), implying that higher compliance with the prescribed sales process is associated with an estimated 23.2% reduction in lapse hazard. Nevertheless, this relationship was not statistically significant ($p = 0.320$), and the confidence interval crossed one. The corresponding Concordance Index of 0.562 indicates relatively weak predictive performance, suggesting that compliance alone provides limited information for discriminating lapse risk.

In contrast, the Transparency variable demonstrated a statistically significant protective effect. The estimated regression coefficient ($\beta = -0.4942$) corresponded to a hazard ratio of 0.610 (95% CI: 0.403–0.923), indicating that improved transparency reduces the hazard of lapse by approximately 39.0%. The Wald test confirmed statistical significance ($p = 0.019$), while the confidence interval remained entirely below one, providing robust evidence that transparency is an important determinant of policy retention. The Concordance Index of 0.612 further indicates moderate discriminatory ability, suggesting that transparency contributes meaningfully to distinguishing customers with different lapse risks.

The strongest association was observed for Claims Experience. This variable produced a positive regression coefficient ($\beta = 2.9862$) and a hazard ratio of 19.81 (95% CI: 9.704–40.440), indicating that policyholders who had previously submitted claims experienced an almost 20-fold higher hazard of lapse than those without claim experience. This effect was highly statistically significant ($p < 0.001$) and was supported by a narrow confidence interval that remained well above one. Moreover, the Concordance Index reached 0.798, demonstrating good discriminatory performance and indicating that claims experience is the most informative single predictor for ranking policyholders according to lapse risk.

To ensure that the model being examined meets the assumptions, the proportional hazards (PH) assumption was evaluated using both the Schoenfeld residual test and graphical inspection of the Schoenfeld residual plots. The corresponding residual plots are shown in Figure 3.

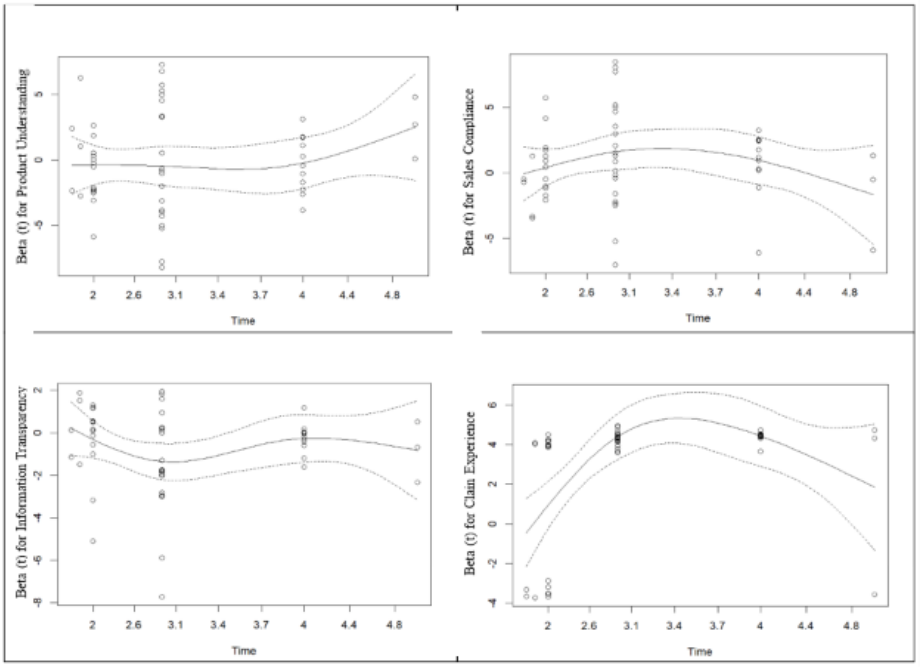

Figure 3. Schoenfeld Residual Test for the Proportional Hazards Assumption

Visual inspection of the Schoenfeld residual plots (Figure 3) supports these findings. For all predictors, the smoothed residual curves fluctuate randomly around the horizontal reference line without exhibiting systematic upward or downward trends. This pattern indicates that the estimated regression coefficients remained stable over time and that the effects of the explanatory variables on lapse hazard did not vary during the observation period.

The consistency between the graphical diagnostics and the statistical tests provides strong evidence that the proportional hazards assumption was satisfied. Consequently, the estimated regression coefficients and hazard ratios obtained from the Cox proportional hazards model can be interpreted reliably for evaluating the determinants of PAYDI policy lapse.

CONCLUSION AND SUGGESTION

This study aimed to model the lapse risk of Investment-Linked Insurance Products (PAYDI) using the Cox Proportional Hazard Model and to identify the factors influencing policy lapse. Based on data from 618 PAYDI policyholders, the Kaplan–Meier analysis showed that the survival probability declined gradually over time, indicating that the cumulative risk of lapse increased with policy duration. Nevertheless, the survival probability remained relatively high throughout the first five years of policy ownership, suggesting that most policyholders maintained their policies during the observation period.

The Cox Proportional Hazard Model proved to be an appropriate approach for modeling PAYDI lapse risk because it accommodates right-censored observations without requiring specification of the baseline hazard function. The proportional hazards assumption was satisfied for all predictor variables, as confirmed by both the Schoenfeld residual tests (all $p > 0.05$) and the corresponding residual plots, indicating that the estimated hazard ratios remained stable throughout the observation period.

Among the variables examined, Information Transparency emerged as the only factor that consistently reduced

lapse risk in both the univariate (HR = 0.610, p = 0.019) and multivariable (HR = 0.578, p = 0.042) Cox models. These findings demonstrate that clearer communication regarding product benefits, costs, investment risks, and policy features significantly improves policy retention. Conversely, Claims Experience showed the strongest positive association with lapse risk in the univariate analysis (HR = 19.809, p < 0.001), indicating that policyholders who had previously submitted claims were substantially more likely to terminate their policies. In contrast, Product Understanding and Sales Process Compliance exhibited protective effects but were not statistically significant, suggesting that their independent contributions to lapse risk remain limited after accounting for other explanatory variables.

From a practical perspective, these findings highlight the importance of strengthening information transparency throughout both the sales process and the policy lifecycle. Insurance companies should ensure that product information is comprehensive, accurate, and easily understood while simultaneously improving claims service quality to enhance customer experience and reduce policy lapse. Future studies are encouraged to incorporate additional determinants, such as premium affordability, investment fund performance, macroeconomic conditions, and customer behavioral characteristics, to improve the predictive performance and generalizability of lapse risk models for PAYDI products.

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