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The determinants of life insurance companies profitability in South Africa: new evidence from a dynamic panel threshold estimation technique

Sylvester Senyo Horvey and Jones Odei-Mensah
Wits Business School, University of the Witwatersrand, Johannesburg, South Africa, and
Albert Mushai
School of Business Sciences, University of the Witwatersrand, Johannesburg, South Africa

Abstract

Purpose – Insurance companies play a significant role in every economy; hence, it is essential to investigate and understand the factors that propel their profitability. Unlike previous studies that present a linear relationship, this study provides initial evidence by exploring the non-linear impacts of the determinants of profitability amongst life insurers in South Africa.

Design/methodology/approach – The study uses a panel dataset of 62 life insurers in South Africa, covering 2013–2019. The generalised method of moments and the dynamic panel threshold estimation technique were used to estimate the relationship.

Findings – The empirical results from the direct relationship reveal that investment income and solvency significantly predict life insurance companies' profitability. On the other hand, underwriting risk, reinsurance and size reduce profitability. Further, the dynamic panel threshold analysis confirms non-linearities in the relationships. The results show that insurance size, investment income and solvency promote profitability beyond a threshold level, implying a propelling effect on life insurers' profitability at higher levels. Below the threshold, these factors have an adverse effect. The study further points to underwriting risk, reinsurance and leverage having a reduced effect on life insurers' profitability when they fall above the threshold level.

Practical implications – The findings suggest that insurers interested in boosting their profit position must commit more resources to maintain their solvency and manage their assets and returns on investment. The study further recommends that effective control of underwriting risk is critical to the profitability of the life insurance industry.

Originality/value – The study contributes to the literature by providing first-time evidence on the determinants of life insurance companies' profitability by way of exploring threshold effects in South Africa.

Keywords Life insurance, Profitability, Solvency, Underwriting risk, Threshold

Paper type Research paper

1. Introduction

The ability of insurance companies to continue covering risk and provide financial security to organisations is grounded on their ability to generate profit (Morara and Sibindi, 2021). Hence, exploring the factors accounting for the performance of insurance companies is essential. More importantly, the insurance industry is an important conduit to the development of every country. Insurers provide financial services which ensure stability and economic development (Wosti and Pradhan, 2023). Insurers provide underwriting services that cover the risks of individuals and organisations. This provides peace and

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stability for the financial market and promotes trade and development (Camino-Mogro and Bermúdez-Barrezueta, 2019). Vojinović *et al.* (2022) add that a well-developed insurance industry benefits economic growth by providing risk management services and indemnity to organisations on an insured loss. This allows firms to continue running without concern for an unforeseen occurrence restricting their production capacity. Given this, several regulatory changes have occurred within the insurance industry, particularly in South Africa, to ensure a well-developed and financially sound insurance market (PwC, 2018).

Risk and uncertainties are inevitable in the business environment; hence, insurance is undoubtedly important for sustainability. Without insurance, the business world will remain unsustainable because risky businesses may not retain all the risks amid uncertainties and globalisation (Ahmed *et al.*, 2011; Sasidharan *et al.*, 2023). Therefore, insurers' profitability is very significant as it determines business growth. Insurers' ability to insure risk and enhance shareholders' value depends on their ability to make higher profits. Without growth, insurers may be unable to create the business required to ensure effective and efficient underwriting services on which insurance operation is built (Batool and Sahi, 2019).

Although a plethora of prior studies suggest several determinants of insurance profitability (see Pjanić *et al.*, 2023; Msomi, 2023; Sasidharan *et al.*, 2023), there are issues of divergence in the empirical findings. For instance, some scholars argue that insurance size, underwriting risk, leverage, reinsurance premium and solvency ratio have a positive impact on profitability (Boadi *et al.*, 2013; Zainudin *et al.*, 2018; Morara and Sibindi, 2021), whereas others suggest a negative relationship for these factors (Lee and Lee, 2012; Hussain, 2015; Siopi and Poufinas, 2023). The conflicting results could be due to differences in the sample size, estimation techniques, regulatory environment and contexts, as depicted in Table A4 in Appendix. Also, despite the aforementioned linkages, there are still issues which remain unanswered. One of these is the level at which these factors heighten insurance profitability. This is very important since an inapt level of the determinants has diverse effects on insurance profitability. Admittedly, empirical studies have been less informative, given their failure to determine the threshold levels and the non-linear effect of the determinants on profitability. This study attempts to fill this gap by taking cues from Chowdhury *et al.* (2017), who assert that the determinants enhance or weaken profitability at a certain threshold. Hence, identifying these factors could help the insurance industry make the quantum leaps it needs. Therefore, the dynamic panel threshold helps solve this puzzle by showing the optimal level at which the determining factors affect profitability. Consequently, this study bridges essential gaps in the literature by investigating the level at which the determinants enhance or weaken insurance profitability in South Africa, which other studies have ignored. Specifically, the study examines whether threshold levels exist in the determinants of insurance profitability.

Again, so far, the context of studies on this topic has been mainly confined to Asia (Hussain, 2015; Zainudin *et al.*, 2018; Sasidharan *et al.*, 2023; Wosti and Pradhan, 2023), Europe (Burca and Batrinca, 2014; Alarussi and Alhaderi, 2018; Vojinović *et al.*, 2022; Ahmeti and Iseni, 2022; Pjanić *et al.*, 2023; Siopi and Poufinas), and the US (Batool and Sahi, 2019) with less empirical research from the African contexts (Boadi *et al.*, 2013; Odira, 2018; Morara and Sibindi, 2021). Also, to the best of our knowledge, studies on the determinants of insurance profitability in South Africa remain non-existent. We, therefore, focus on this context because it has a strong appeal in the internationalisation context of its firms. The selection of the life insurance market in South Africa is further motivated by its high penetration, which is not seen elsewhere in Africa. The life insurance sector is a good context for this study because it provides financial security to individuals, households, and employees. As of 2019, the market consisted of about 74 primary insurers with a penetration rate of about 10.7%. The life insurance sector has seen tremendous growth over the period. The total assets grew from R2.1 billion in 2013 to R3.1 billion in 2019 (see Table A1 in Appendix). The insurance industry in South Africa is highly competitive and mature compared to other African markets. It has

various multi-channel distribution options, such as technology and digitisation of insurance markets aided by solid institutions and significant regulatory changes. Hence, there are many lessons that could be drawn from this context. Further, despite their high penetration level, most life companies are struggling for stable profitability, with the top five having more than half of the industry's total assets and premiums. There are issues of overregulation in several inefficient legacy systems, which are likely to affect their performance (PwC, 2018). In this light, this study seeks first to explore the linear and then the non-linear impacts of the determinants on the life insurance industry in South Africa.

This paper contributes to the literature in several ways. To the best of our knowledge, this is the first study to explore the non-linear effects and threshold levels at which the determining factors affect insurance profitability. The paper provides new evidence on the threshold level of these factors by employing the dynamic panel threshold technique developed by Seo and Shin (2016) and Seo *et al.* (2019). This technique helps identify the regimes at which the determinants heighten or reduce profitability. The results inform the various stakeholders regarding the threshold levels at which these factors influence insurance profitability. Also, the study provides insight into this issue from a developing country perspective in Africa, particularly the life insurance industry in South Africa, given that no study has been conducted on this subject in this context. By so doing, we provide new evidence on the possible direct and non-linear effects of the determinants. Since the South African industry is the most advanced and developed in Africa, several lessons could be drawn from this study by other African countries relating to the determinants of insurance profitability. This will help strengthen our understanding of the critical factors driving insurance profitability. The study also provides information to policymakers to address the key factors hurting insurance profitability. This will be a good incentive for investors since they prefer more resilient companies. The key findings suggest a significant positive relationship between investment income, solvency and life insurers' profitability, whereas underwriting risk, reinsurance, and size reduce profitability. The threshold regression results reveal that insurance size, investment income, and solvency promote profitability above a certain threshold, implying a propelling effect on life insurers' profitability.

The rest of the paper is structured as follows. Section 2 discusses the theories and empirical literature on the factors determining insurance profitability. Section 3 explains the data, methodology and empirical strategies. Section 4 analyses and discusses the empirical result, and Section 5 provides a conclusion and policy implications.

2. Literature review

2.1 Theoretical underpinnings

According to the theory of business, a company's profitability is determined by its income and expenditure (Drucker, 1994). These factors can be influenced by several organisational characteristics stalking from its internal and external environment. This study focuses on the internal factors because they are directly under the control of management rather than the external factors, which are mostly beyond the firm's control (Zainudin *et al.*, 2018). Additionally, the external factors are well-researched (Camino-Mogro and Bermúdez-Barrezueta, 2019; Sasidharan *et al.*, 2023; Siopi and Poufinas, 2023) than the internal factors, which need more attention in the literature. Also, the internal factors are internally driven and demonstrate the quality and efficiency of the company's senior management. This assertion aligns with the resource-based theory of competitive advantage, which stresses that the firm's internal resources and capabilities, rather than the external environment, provide a stronger platform for developing long-term plans and attaining a competitive edge (Collins, 2021). Davis and Dewitt (2021) add that resources owned and deployed by an organisation are significantly important. Hence, organisations must focus on these factors to develop their

competencies. This study concentrates on seven main determining factors in light of the above argument. These include insurance size, underwriting risk, leverage, reinsurance premium, investment income, solvency, and premium growth.

2.2 The determinants of insurance profitability

2.2.1 Insurance size. Insurance size, which reveals the extent of insurance growth, is considered a determinant for this study. It is believed that the size of an insurance company significantly affects its profitability and has been used in many studies that sought to examine the determinants of insurance profitability (Vojinović *et al.*, 2022). This variable is measured as the natural logarithm of total assets. Kumar *et al.* (2022) explain that an increase in the size of an insurance company, such as the opening of new branches and the use of new technologies, helps insurers underwrite more policies, hence improving their profit situation. Larger insurers are believed to experience cost reduction due to economies of scale.

There are various arguments regarding the relationship between insurance size and profitability. Ahmeti and Iseni (2022) argue that an insurer's size correlates with profitability. They explain that larger insurers have more capabilities and resources to employ the right expertise, improving business success. They grow quicker than smaller businesses because they benefit from economies of scale and earn more money. Öner Kaya (2015) adds that larger insurers have enough capacity to diversify and respond to environmental changes. Kristanti *et al.* (2023) found a positive relationship between insurance size and profitability, explaining that larger insurers can attract more financial resources, which reduces the cost of capital and increases their returns. Contrarily, Wosti and Pradhan (2023) and Siopi and Poufinas (2023) found a negative relationship. They explain that when insurers acquire new assets to underwrite their policies but fail to achieve their desired outcome due to inefficient management, it may result in poor performance. Kumar *et al.* (2022) found a similar result and indicated that the negative impact would be overcome when it interacts with other factors such as volume of capital and market share. Based on the above arguments, this study hypothesises that:

H1. Insurance size has a statistically significant positive relationship with life insurance profitability.

2.2.2 Underwriting risk. This is one of those factors specific to the insurance company, which defines the effectiveness of insurers' underwriting operations. Underwriting risk occurs when claims exceed the premiums received (Akotey *et al.*, 2022). The financial performance of insurance companies is dependent on their risk appetite; thus, sound underwriting rules and guidelines are critical (Siopi and Poufinas, 2023). Underwriting risk is commonly proxied as the loss ratio and is a performance metric that reflects the appropriateness of an insurance company's underwriting performance. This is measured as the ratio of incurred claims to earned premiums (Zainudin *et al.*, 2018). According to Öner Kaya (2015), sound underwriting activities and rules are critical in assessing insurance businesses' financial success to limit the additional risk associated with underwriting operations and optimise shareholder returns by creating excellent management standards.

Zainudin *et al.* (2018) found that underwriting risk positively and significantly determines insurance performance in Asia. Adams and Buckle (2003) suggested that Bermuda insurers with high gearing and low liquidity perform better and that their underwriting risk is strongly tied to a stable financial performance. They reveal that when underwriting risk is appropriately managed, it enhances the financial performance of insurance companies. On the other hand, Wosti and Pradhan (2023) found a significant negative relationship. Akotey *et al.* (2013) found similar results and explained that offering more riskier insurance leads to higher claims payments and, as a result, lower profits. A study by Burca and Batrinca (2014) in the Romanian insurance industry also revealed an inverse relationship. They expound that

higher underwriting risk can reduce insurers' profits because of management expenditures like loss adjustment and claims investigation. According to Kumar *et al.* (2022), the negative impact will be curbed when insurers comply with underwriting policies provided by regulators. Against this backdrop, we hypothesise that:

H2. Underwriting risk has a statistically significant negative relationship with life insurance profitability.

2.2.3 Leverage. Financial leverage assesses the diverse relationship between market evaluation and capital structure. This is important because the relationship between debts and equity necessitates a trade-off between business and risk (Morara and Sibindi, 2021). They further argue that insurance companies relying more on debt are exposed to greater risk, whereas insurers with more equity tend to operate more conservatively by depending on internally generated funds. Leverage is defined as the ratio of total debts/liabilities to total equity (Sasidharan *et al.*, 2023). An insurance firm's leverage comprises unearned premiums, a contingency reserve or life fund, outstanding claims, deferred tax, unpaid dividends, trade and other payables (Alhassan *et al.*, 2015). Öner Kaya (2015) argues that as leverage increases to an ideal level, so does insurance value; however, if this optimum level is exceeded, insurance value declines and the chance of insolvency increases, depending on the increased leverage.

The literature reveals an ambiguity in the relationship between financial leverage and profitability. For instance, Boadi *et al.* (2013) suggest a positive relationship between leverage and profitability amongst insurance companies in Ghana. Akotey *et al.* (2013) also found similar results, but this was insignificant. Alhassan *et al.* (2015) argue that highly leveraged firms lead to higher shareholder returns and boost profitability because leverage helps generate more cash flow to satisfy their obligations. On the contrary, Pjanić *et al.* (2023) and Kumar *et al.* (2022) found a negative relationship, arguing that leverage is associated with higher interest payments which reduce a company's net income, thereby lowering its profitability. Ahmeti and Iseni (2022) also discovered that leverage negatively affects the performance of insurance companies in Kosovo. Therefore, the study hypothesises that:

H3. Financial leverage has a statistically significant negative relationship with life insurance profitability.

2.2.4 Investment income. Income on investment is an important factor in insurance companies' financial stability. Insurance companies generate revenue from two main sources – underwriting and investment activities. Also, short-term insurance companies hardly make underwriting profits. The overall profitability of these companies is dependent on investment income. Things may be different for life companies due to the long-term nature of their liabilities and better estimation methods of mortality risk. Hence, assessing their overall impact on life insurers' performance is necessary. Investment income indicates insurers' earnings from their investment activities (Camino-Mogro and Bermúdez-Barrezueta, 2019). Insurers invest in different portfolios of assets to earn higher income to improve their performance. This is because the premiums received may not cover all the obligations incurred due to claims made against the policies they underwrite; therefore, insurers invest part of their premiums in several asset classes to boost their returns. The returns on investment are believed to contribute to the growth of insurance companies (Ahmeti and Iseni, 2022). This variable is proxied as the total income on investment. The empirical study by Morara and Sibindi (2021) found a positive relationship between investment income and the return on assets of insurance companies. Pjanić *et al.* (2023) found a positive relationship between investment income and the return on assets of insurance companies. They deduced from their research that most insurers with good investment returns reduce their risk of loss by reinsuring a portion of their goods, hence improving insurance profitability. Thus, we hypothesise that:

H4. Investment income has a statistically significant positive relationship with life insurance profitability.

2.2.5 Reinsurance ratio. Reinsurance is the transfer of risk from a primary insurer to a reinsurance company (Sasidharan *et al.*, 2023). This factor is fundamental in the insurance industry, representing one of the risk financing techniques for cushioning loss experience (Wosti and Pradhan, 2023). Insurance businesses with higher underwriting risk operations must seek additional reinsurance to mitigate the impact of unexpected underwriting losses, maintain profit stability, grow underwriting capabilities, and avoid insolvency. However, reinsurance comes with its own cost. The reinsurance markets are less concentrated, meaning there is less competition, thus allowing reinsurers to dictate the price they charge insurers' buying reinsurance. For instance, Munich Re and Swiss Re account for over 40% of global reinsurance capacity. Chang and Jeng (2016) argue that the use of reinsurance may be costly, inefficient, and have a long-term impact on the profitability of insurance companies. More so, reinsurance transactions are linked to underwriting risk and capacity, impacting the profitability and growth of ceding insurers (Lee and Lee, 2012). Vojinović *et al.* (2022) advise that insurance companies must identify an adequate retention level and strike a balance between lowering the risk of insolvency and possible profits.

This variable is proxied as the ratio of ceded reinsurance premium to total premium (Morara and Sibindi, 2021). Siopi and Poufinas (2023) reveal that reinsurance negatively influences profitability. Similarly, Lee and Lee (2012) found a negative relationship, stating that insurers earning higher profits purchase less reinsurance and vice-versa. Berger *et al.* (2002) argue that reinsurance transactions affect primary market profit and demonstrate that ceding reinsurance improves current profitability. Again, Chen *et al.* (2001) say that frequent reinsurance reliance indicates that an insurance firm is not performing adequately and, as a result, faces insolvency, which could have a long-term impact on its operations. Morara and Sibindi (2021) and Wosti and Pradhan (2023) found a positive relationship between reinsurance premiums and the performance of Kenyan insurers. This relationship is supported by Ahmeti and Iseni (2022), who states that companies that purchase more reinsurance have more consistent performance, resulting in higher risk-adjusted returns. Choi and Weiss (2005) suggest no clear relationship between reinsurance and profitability. Despite the varied arguments, we hypothesise that:

H5. Reinsurance has a statistically significant negative relationship with life insurance profitability.

2.2.6 Solvency ratio. Solvency refers to the ability of an insurance company to meet its financial obligations as they fall due. It is a metric that assesses a company's long-term financial viability (Morara and Sibindi, 2021). A solvency margin is a buffer in a company's assets that cushions one or more of the theoretical solvency standards specified by regulators (Sandström, 2016). In South Africa, insurers must hold assets that are more than their liabilities. When managing capital and solvency, insurance company management must ensure that regulatory solvency limitations are satisfied, liquidity is maintained, and attempts are made to maintain net income growth. Solvency is measured as the ratio of net income to total liabilities (Morara and Sibindi, 2021). Empirical studies have confirmed a positive association between insurance solvency and profitability (Morara and Sibindi, 2021). Odira (2018) found similar results but indicated that the relationship is statistically insignificant. Against this backdrop, the study hypothesises that:

H6. Solvency has a statistically significant positive relationship with life insurance profitability.

2.2.7 Premium growth. This variable measures how much a company's premium has increased over time. An increase in the growth rate of life insurance premiums indicates that the company is growing and expanding its market share (Sasidharan *et al.*, 2023). It is

measured as the rate of increase in gross written premiums (Akotey *et al.*, 2022). The literature explains that insurers who cannot maintain sustainable premium growth are more vulnerable to decreased profits. The literature reveals mixed findings on the impact of premium growth on insurance profitability. This argument is supported by Kristanti *et al.* (2023), who show that high premium growth creates financial distress. Öner Kaya (2015) found a significant positive association between premium growth and profitability amongst non-life insurance companies in Turkey. This is supported by Pjanic *et al.* (2023), who assert that premium growth leads to higher profit because insurers invest some of the premiums received, which generates higher returns. However, Charumathi (2012) claimed that premium growth significantly and negatively impacts profitability. Scholars narrate that rapid premium growth can result in insolvency. Being excessively focused on premium growth can lead to self-destructive behaviour, as other vital goals, such as investment, may be overlooked. Akotey *et al.* (2013) add that premium growth without sufficient price validation can harm insurers' performance. Zainudin *et al.* (2018) also found a negative relationship, which was statistically insignificant, suggesting that premium growth does not have a meaningful impact on insurance companies. This finding is supported by the fact that in life business, high premium growth implies higher costs since the cost structure of life policies is such that the first years of policy inception tend to be where transaction costs are concentrated. These costs include commissions paid to agents and fees for medical examinations used in underwriting. The study, therefore, hypothesises that:

H7. Premium growth has a statistically significant negative relationship with life insurance profitability.

So far, literature on the determinants of insurance profitability has typically been studied using linear models. Table A4 in Appendix provides comprehensive information on insurance profitability determinants, as scholars revealed. The literature has shown that insurance size, leverage, underwriting risk, investment income, reinsurance, solvency and premium growth are critical to the development of the insurance industry. Nevertheless, the empirical findings reveal divergent views on these factors, suggesting that the impact of the determining factors on insurance profitability may be achieved or subdued at a certain threshold level. However, scholars are yet to explore whether there exist certain threshold levels these factors must attain before they can promote insurance profitability. In the case of South Africa, this is crucial, given the renewed interest in developing the insurance industry amidst the inefficiencies and high competition. This is further motivated by the financial security provided by the life insurance industry to individuals and organisations. In light of the foregoing, this study fills these gaps by examining these factors' linearity and non-linear relationship on life insurance companies' profitability in South Africa.

3. Methodology

3.1 Data, source and measurement

This study investigates the determinants of the profitability of life insurance companies in South Africa. Data were drawn from the annual report of the Financial Sector Conduct Authority (FSCA) database from 2013–2019. The data begins in 2013 because, for previous years, this information was not publicly available, and the last year is 2019 as the dataset's cut-off year to eliminate the COVID-19 pandemic's confounding effects on financial data and any potential biases in its skewing of the paper's major result. We selected 62 out of the 74 primary insurers of the life insurance industry in South Africa, representing 84% of the total life insurers. The sample size and sample period are motivated by data availability constraints during the study period. A balanced panel data was used in this study to gain insight into the factors affecting life insurance companies' profitability. The use of panel data

has advantages. It helps manage omitted factors and insurance-specific effects and allows for long- and short-run consequences, overcoming the constraints of cross-sectional and time-series estimating methodologies (Wooldridge, 2009). These data present a set of variables such as return on assets, insurance size, leverage, investment income, insurance solvency reinsurance premium, underwriting risk and premium growth. Section 3.2 explains the chosen variables, which are further summarised in Table 1.

3.2 Description of variables

3.2.1 Dependent variable. Return on assets (ROA): ROA, the dependent variable, measures insurance profitability and is proxied as the ratio of net profit to total assets. This is one of the widely used measures of profitability and is preferred over return on equity (ROE) because it can capture the leverage effect that ROE ignores (Vojinović *et al.*, 2022). It also represents the company's ability to generate profit in relation to the total number of assets; hence, it gauges its operational efficiency in asset management. In other words, it explains how well the company generates profits with its current assets.

3.2.2 Independent variables. Insurance size: This explains the extent of growth within the insurers' business operations and is measured as the natural logarithm of insurance total assets (Ahmeti and Iseni, 2022). The logarithmic transformation helped to reduce data with extreme values (Adams and Buckle, 2003).

Underwriting risk: The loss ratio is used to proxy for underwriting risk. Underwriting risk highlights the efficiency of insurers' underwriting activities. This is measured as the ratio of total claims to earned premiums (Sasidharan *et al.*, 2023). Insurers expect an increase in the premiums they receive while the number of claims they have to pay out decreases (Öner Kaya, 2015).

Financial Leverage: This variable captures the ability of insurers to handle unexpected losses. This is captured as the ratio of total debts/liabilities to total equity. Financial leverage assesses the diverse relationship between market evaluation and capital structure (Horvey and Ankamah, 2020).

Investment income: It shows how much money the insurance firm makes by investing (Ahmeti and Iseni, 2022). It is comparable to premium earnings in that it is considered the

Variable	Symbol	Measurement	References
Dependent variable			
Return on assets	ROA	Net profit/total assets	Vojinović *et al.* (2022)
Determinants			
Insurance size	Size	Natural logarithm of total assets	Öner Kaya (2015), Ahmeti and Iseni (2022)
Underwriting risk	UR	The ratio of total claims to premiums	Sasidharan *et al.* (2023)
Financial leverage	LEV	Debts/total equity	Horvey and Ankamah (2020), Ahmeti and Iseni (2022)
Investment income	INV	Natural logarithm of total assets	Ahmeti and Iseni (2022)
Reinsurance	REINS	Ceded reinsurance premium/total premium	Morara and Sibindi (2021)
Solvency	SOLV	Net income/total liabilities	Öner Kaya (2015), Morara and Sibindi (2021)
Premium growth	PG	$\frac{GWP_t - GWP_{t-1}}{GWP_{t-1}}$	Akotey *et al.* (2022)

Table 1.
Summary of variables

output of an insurance company. The performance of its investments largely determines its financial stability. Investment income was log-transformed for the regression analysis.

Reinsurance ratio: Insurance companies with higher underwriting risk activities are required to obtain additional reinsurance to offset the impact of unexpected underwriting losses, maintain profit stability, expand underwriting capabilities, and prevent insolvency. This is measured as the reinsurance premium ceded divided by the total premium (Morara and Sibindi, 2021).

Solvency ratio: Solvency is a vital element in the financial performance of an insurance company. Regulators impose a minimal excess on an insurer's assets over its liabilities, known as solvency. This is calculated as net income divided by total liabilities (Öner Kaya, 2015; Morara and Sibindi, 2021).

Premium growth (PG): This variable captures the changes in a company's premium increase. An increase in the growth rate of life insurers' premiums suggests growth and an increase in their market share (Akotey *et al.*, 2022). It is measured as:

$$Premium\,Growth\,(PG) = \frac{GWP_t - GWP_{t-1}}{GWP_{t-1}} \tag{1}$$

where GWP represents the gross written premium.

3.3 Estimation technique

The empirical analysis for this study is divided into two parts. First, the study investigates the direct impact of the determining factors on life insurance profitability. Second, the research investigates the precise effect of the determinants when they are below or above the threshold level. As a result, two estimation techniques are used in the study: a linear system GMM and a dynamic panel threshold.

3.3.1 Dynamic panel estimation technique. The generalised method of moments (GMM) estimator developed by Arellano and Bond (1991) was used for estimating the panel data. From the econometric literature, the GMM provides more advantages than the static model. It is used in controlling endogeneity problems by exploiting the data's time series variations and controlling for unobserved firm-specific effects. Using this method, we created a model in which the dependent variable relies on its lag and a vector of independent variable observations. It is important to note that incorporating the lagged term of the dependent variable in the regression model may cause endogeneity problems since the lagged dependent variable depends on the lagged error term, which is a function of the firm-specific fixed effects. Another endogeneity concern arises due to the possible simultaneity between ROA and the independent variables, therefore validating the use of the GMM model. For instance, while the literature argues that underwriting and insurance solvency affect profitability (see Morara and Sibindi, 2021; Ahmeti and Iseni, 2022; Msomi, 2023), other scholars also suggest that profitability can also affect insurers' underwriting and solvency (see Moreno *et al.*, 2020; Akotey *et al.*, 2022). Another caveat for choosing GMM is that the number of firms (i.e. N) is greater than the time (i.e. T). To assess the consistency of the system GMM estimator, the Hansen and Sargan test of over-identifying restrictions was evaluated to test the overall validity of the instruments (Arellano and Bond, 1991). Furthermore, instead of using a one-step GMM estimator, a two-step GMM estimator was used to control heteroscedasticity and autocorrelation while also capturing omitted variable problems and measurement errors. In other words, the two-step GMM estimator is more robust than the one-step system GMM and more efficient in treating whatever patterns of heteroscedasticity and autocorrelation. Therefore, our model is specified as:

$$ROA_{it} = \beta_1 ROA_{it-1} + \beta_2 SIZE_{it} + \beta_3 UR_{it} + \beta_4 LEV_{it} + \beta_5 REINS_{it} + \beta_6 SOLV_{it} + \beta_7 INV_{it} + \beta_8 PG_{it} + \mu_i + \partial_t + \varepsilon_{it} \quad (2)$$

Where ROA represents the return on assets; ROA_{it-1} represents the one-period lag of return on assets; SIZE represents the insurance company's size; LEV represents financial leverage; REINS represents reinsurance premiums; UR represents underwriting risk; SOLV represents insurance solvency; INV represents investment income; PG represents insurance premium growth. Insurance size and investment income are measured in log form to eliminate extreme values. The subscripts i and t represent individual company and time dimensions, respectively; β represents the parameters to be estimated; μ_i represents the unobserved firm-specific fixed effects; ∂_t represent the time fixed-effect and ε_{it} is the idiosyncratic error term.

3.3.2 Dynamic panel threshold. To gain additional insights into the determinants, the study employs the dynamic panel threshold model initiated by Seo and Shin (2016) and Seo *et al.* (2019) to investigate the non-linearities of the determining factors. The motivation for choosing this model is to explore the impact of the determinants on profitability at their disaggregated levels, which is a major gap this study addresses. This technique helps establish the determinants' threshold effects on insurance profitability. We do so by treating each determining factor as a threshold variable. The dynamic panel threshold technique explained by Seo *et al.* (2019) allows for only one threshold variable to be treated in a model. As a result, we estimate seven models to allow each determinant to be treated as a threshold variable while controlling for the other factors. Another reason for using the dynamic panel threshold model is that it is built on the principles of GMM, which helps to address any endogeneity issues, as discussed in 3.3.1. Employing the dynamic threshold effects gives the following model:

$$y_{it} = x'_{it}\beta + \left(1, x'_{it}\right)\delta 1\{q_{it} > \gamma\} + \mu_i + \varepsilon_{it}\, \mathrm{i} = 1, \ldots, \mathrm{n};\ \mathrm{t} = 1, \ldots, \mathrm{T} \quad (3)$$

Such that y_{it} is the dependent variable (i.e. profitability), q_{it} is the threshold variable (determinants) and x_{it} may include the lagged dependent variable. $1\{.\}$ is the indicator function specifying the regime. γ is the threshold parameter in the model. The sample size n grows to infinity, whereas T is assumed to be fixed. Hence, the fixed effect μ_i is eliminated using the first difference procedure, and the unknown parameters are then estimated using GMM. As a result, $\theta = (\acute{\beta}, \acute{\delta}, \acute{\gamma})$.

4. Results

4.1 Empirical results and discussion

Before investigating the empirical findings, we first sought to assess the descriptive statistics. The results of the descriptive statistics are reported in Table 2. The average value for return on assets was 0.833, implying that 83% of life insurers' earnings are generated from their assets. The standard deviation indicates the variation from the mean was 8.003, suggesting extreme variations in the profitability level of life insurers used for the study. The life insurance industry had a total positive assets (Size) average of about R41 billion. Underwriting risk recorded a positive mean value of 0.430, ranging between 0.009 and 19.457, with a standard deviation of 1.928, showing large variations in life insurers' underwriting capacity riskiness. The mean value for reinsurance was 0.186, and the standard deviation was 0.335. The mean value suggests that the use of reinsurance amongst the sampled firms is relatively low. This implies that most life insurers want to retain the risk they insure due to the low premiums. Leverage

Table 2.
Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Return on assets	434	0.833	8.003	0.024	158.247
Insurance size	434	40,700,000	111,000,000	12,380	653,000,000
Underwriting risk	434	0.430	1.928	0.009	19.457
Leverage	434	0.787	0.852	0.002	9.948
Reinsurance ratio	434	0.186	0.335	0.318	0.999
Investment income	434	3,590,000	10,400,000	168.00	71,000,000
Solvency ratio	434	26.582	496.508	0.595	10316.95
Premium growth	434	3.903	70.775	−0.998	1473.766

Source(s): Results were generated from Stata

presents a mean value of 0.787, showing fewer variations amongst life insurers (Std. Dev. = 0.852). The mean shows that the life insurers' debts are about 78% of their equity, which is relatively high. The total investment income was about R3.5 billion rand. The results further reveal solvency amongst life insurers, averaging 26.582, showing that their assets are far beyond their liabilities. The growth rate of premiums was positive (3.903), displaying an increase in the growth rate of life insurance premiums over the sample period.

Table 3 further presents the results of the correlation matrix amongst the variables. The study reveals a high correlation between the solvency ratio and the dependent variable. One possible reason could be that solvent insurance companies typically have enough capital reserves to cover losses. This gives them the freedom to invest in more lucrative investments or pursue more lucrative businesses, which can result in higher asset returns. The results show no high correlations because the coefficient values amongst the independent variables are less than 0.5, apart from the correlations between insurance size and investment income, which was 0.598. This shows that investment income strongly correlates with the size of life insurance companies. The variance inflation factors (VIFs), as presented in Table 3, are far below the critical value of 10 (Ayyangar, 2007), which shows that multicollinearity does not appear to be a concern in the regression analysis.

4.2 Regression results

4.2.1 System GMM panel regression analysis. The result in Table 4 reports the direct impact of the determinants on life insurance profitability in South Africa. A dynamic model was used for the analysis due to its ability to control for endogeneity problems. The system GMM estimator was preferred because it takes care of the unit root property, resulting in more precise findings. The model shows that first-order serial correlation is present; however, the AR(2) test is not statistically significant, indicating no second-order serial correlation in the model (Arellano and Bond, 1991). The Prob > *F* statistics reveal the joint significance of the variables used in the regression model. The Hansen test of overidentifying restrictions is statistically insignificant, confirming the overall validity of the instruments and the reliability of the regression results. The coefficient value of the lagged dependent (L.ROA) variable is statistically significant, affirming the regression model's dynamic nature. The results imply that the profitability of life insurance companies in the previous year is more likely to affect their current profitability, providing evidence of the persistence of the return on assets.

Focussing on the system GMM, we find that some determinants react more rigorously than other factors. The estimated results reveal that insurance size negatively and significantly affects profitability. This relationship was consistent across the different models. This confirms the findings of Siopi and Poufinas (2023) and Kumar *et al.* (2022). Pjanić *et al.* (2023) report similar results of an inverse relationship between insurers' assets and income. They highlight that when insurers acquire new assets to underwrite their policies but

Table 3.
Correlation matrix

Variables	VIF	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) ROA		1.000							
(2) Insurance size	1.63	−0.030	1.000						
(3) Underwriting risk	1.01	0.006	0.010	1.000					
(4) Leverage	1.06	−0.041	0.072	−0.021	1.000				
(5) Reinsurance ratio	1.02	−0.004	0.019	0.032	−0.007	1.000			
(6) Investment income	1.67	−0.002	0.598***	0.068	0.208***	0.112	1.000		
(7) Solvency ratio	1.00	0.944***	−0.019	0.011	−0.048	0.010	0.007	1.000	
(8) Premium growth	1.05	−0.004	0.205***	−0.010	0.005	−0.016	0.096**	−0.003	1.000

Note(s): (**) and (***) highlight significance at 5 and 1%, respectively
Source(s): Results were generated from stata

Variables	SYS-GMM (1)	DIFF-GMM (2)	POLS (3)
L.ROA	0.036**	0.030**	
	(0.020)	(0.013)	
Size	−0.486***	−0.389***	−0.203
	(0.066)	(0.011)	(0.159)
Underwriting risk	−3.191*	0.188	−0.0190**
	(1.857)	(0.377)	(0.008)
Leverage	0.197	−1.636	0.106**
	(0.155)	(4.114)	(0.051)
Reinsurance ratio	−0.503*	−0.235**	−0.370
	(0.268)	(0.103)	(0.298)
Investment income	0.457***	0.126**	0.135
	(0.058)	(0.049)	(0.149)
Solvency ratio	0.173*	0.017	0.015***
	(0.201)	(0.019)	(0.001)
Premium growth	−0.385	0.019	−0.001
	(0.361)	(0.170)	(0.002)
Observations	368	306	430
Time dummies	Yes	Yes	Yes
No. of groups	62	62	62
No. of instruments	12	10	
R-Squared			0.8918
Prob > *F*	0.000	0.000	0.000
AR(1)	0.0396	0.002	
AR(2)	0.323	0.536	
Sargan	0.993	0.833	
Hansen	0.527	0.365	

Note(s): Standard errors are in parentheses; values above the standard errors are the coefficient estimates, showing the direction of the relationship; Significant levels are expressed as ***$p < 0.01$, **$p < 0.05$ and * $p < 0.1$, respectively

(Dep Var: ROA)

Source(s): Results were generated from stata

Table 4.
Regression results

fail to achieve their desired outcome due to inefficient management, it may result in poor performance. Underwriting risk, which measures the riskiness of life insurance companies, had a negative relationship with return on assets, showing statistical significance at 10%. The negative relationship may relate to the poor underwriting performance of life insurance companies due to the market structure and high concentration level in South Africa. The results contrast with Öner Kaya (2015) but confirm the findings of Siopi and Poufinas (2023) and Sasidharan *et al.* (2023), who discovered a significant negative relationship with profitability. The negative relationship reveals that when life insurance companies underwrite high-risk policies, the possibility of a large claim payout reduces underwriting earnings, resulting in a lower return on life insurers' assets. Financial leverage presents an insignificant positive impact on return on assets. The positive result shows that insurers who depend on debts to finance their business are profitable because leverage helps generate more cashflows to enhance their business operations. Batool and Sahi (2019) argue that leverage can maximise insurers' returns and take full advantage of the tax benefits linked to borrowing. Contrarily, Ahmeti and Iseni (2022) explain that leverage can hurt insurance performance because firms with high debt run the risk of going bankrupt and being unable to find new lenders in the future.

The results for reinsurance indicate a significant negative effect on return on assets. The same pattern is also observed with the difference GMM and the POLS models. This implies

that the high cost of reinsurance is likely to have an adverse impact on the performance of life insurance companies. Sasidharan *et al.* (2023) and Chang and Jeng (2016) validate this result and explain that the use of reinsurance may be costly, inefficient, and have a long-term impact on the profitability of insurance companies.

In terms of investment income, a significant positive relationship is established. This is consistent with the other models. The results show that a higher return on investment improves the profitability of life insurers (Pjanić *et al.*, 2023). Compared with underwriting risk, the result implies that life insurance companies rely more on investment income to generate profit than underwriting. Morara and Sibindi (2021) also found a positive relationship. They narrated that most insurers with strong investment returns reduce their risk of loss by reinsuring a portion of their goods, improving insurance profitability. Similarly, the solvency ratio exhibits a positive relationship with profitability. This relationship was significant at 10%. The findings indicate that solvency is an important factor in enhancing life insurance profits (Siopi and Poufinas, 2023), hence, this study suggests that life insurers should increase and maintain their solvency levels to gain a competitive edge. According to Sandström (2016), a solvency margin is a buffer in a company's assets that cushions one or more of the theoretical solvency standards specified by regulators.

The results for premium growth exhibit an inverse relationship with profitability. This was statistically insignificant, implying that premium growth does not directly impact life insurers. This could result from the excessive focus on marketing to boost their premiums without a corresponding allocation of resources to manage their portfolio. The insignificant result is consistent with Zainudin *et al.* (2018), who reveal that premium growth does not have a meaningful impact on insurers. This is because premium growth without sufficient price validation can harm insurers' performance (Kristanti *et al.*, 2023). As already discussed, the return on investment and solvency are more influential in enhancing the profitability of life insurance companies than underwriting factors. This suggests that life insurers should not concentrate too much on premium growth due to its statistical insignificance but focus on other factors, such as solvency and investment income, which are more likely to improve profitability. This is because higher premium growth can expose the firm to higher risks, resulting in insolvency (Vojinović *et al.*, 2022).

4.3 Estimated results of the dynamic panel threshold analysis

While the previous section provides a report on the direct impact of the determining factors, this section expands our knowledge of the literature by reporting on the non-linearity of these factors. To properly understand the threshold level for the determining factors, each determinant was treated as a threshold variable while controlling for the other factors. As a result, seven different models were estimated, with each model providing a precise estimation of the threshold level for the determinants. Table 5 presents the result of this relationship while revealing the threshold levels at which each determinant influences the profitability of life insurance companies. We estimate seven models, Models (4)–(10), to provide information on the threshold levels for each determinant. Table 5 shows that the bootstrap p-values (0.000) are statistically significant, therefore rejecting the null hypothesis of no threshold effect in all the models, confirming the non-linearity of the determining factors. Hence, the samples can be split into two. The various factors are divided into upper regime/lower regime when the threshold value is greater than/less than or equal to the threshold indicator. Also, the study investigates whether there are kinks in the models by imposing the kink option. The kink slope reveals the actual pattern of the relationship when the threshold level is reached. This implies the presence of continuity in the regression function and not necessarily a jump or discontinued relationship (Seo *et al.*, 2019). This indicates that our model was sufficiently

Table 5.
The threshold dynamics on the determinants of life insurance profitability

Variables	Size (4)	Underwriting risk (5)	Leverage (6)	Reinsurance (7)	Investment income (8)	Solvency ratio (9)	Premium growth (10)
Lower regime							
Lag of ROA	−1.639***	−0.285***	3.238***	20.50***	−0.174***	1.783***	−0.166***
	(0.0252)	(0.00673)	(0.0356)	(0.325)	(0.0099)	(0.0226)	(0.0398)
Threshold variables	−15.150***	19.88***	7.155***	1.939***	−0.025***	−6.242***	−0.203***
	(0.105)	(1.067)	(0.00784)	(0.146)	(0.0048)	(0.0882)	(0.0380)
Upper regime							
Lag of ROA	1.655***	0.106***	−3.323***	−20.78***	−4.155***	−2.059***	0.203***
	(0.0245)	(0.00672)	(0.0355)	(0.308)	(0.5480)	(0.0226)	(0.0136)
Threshold variables	15.321***	−19.62***	−5.509***	−4.748***	3.603***	6.240***	0.103***
	(0.118)	(1.054)	(0.0166)	(0.234)	(1.911)	(0.0883)	(0.0312)
Constant	−117.7***	−4.298***	−21.09***	32.01***	−50.830***	26.73***	0.208***
	(1.649)	(0.210)	(0.0347)	(0.544)	(2.642)	(0.0908)	(0.0226)
Post-estimation tests							
Threshold point (r)	13.932***	0.249***	0.852***	0.0279***	13.739***	1.014***	−0.0287
	(0.0059)	(0.00467)	(0.000122)	(0.00101)	(0.013)	(0.00519)	(24.30)
Linearity (*p*-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
kink_slope	26.262***	10.282***	27.327***	−29.840***	1.289***	11.275***	−2.864***
Observations	62	62	62	62	62	62	62

Note(s): Standard errors are in parentheses; Significant levels are expressed as ***$p < 0.01$, **$p < 0.05$ and * $p < 0.1$, respectively; *P*-values are obtained from 100 bootstrap replications
Dependent variable: ROA
Source(s): Results were generated from stata

specified. This demonstrates that, after accounting for the possibility of a kink, the threshold levels indicated by (r) in the models are true threshold points. The negative coefficient of the kink slope for premium growth shows that life insurers who attain higher growth in their premium cannot sustain it over time. Similarly, the negative kink slope for reinsurance premiums indicates a deterioration in the trend of reinsurance amongst life insurers.

Insurance size and investment income were estimated to identify the threshold level for life insurers. The estimated threshold value for insurance size was about 13.932, while investment income was about 13.739. These were statistically significant at 1%. The empirical results for the threshold variables in the lower regime show a significant negative relationship with return on assets for both variables, suggesting that smaller insurance size and lower return on life insurance investment have a declining effect on their profitability. In the upper regime, the coefficient estimates for the threshold variables are positive and statistically significant. The reasons are not implausible. The results show that firms that are large and receive higher returns on their investments experience higher profitability (Vojinović *et al.*, 2022). As discussed earlier, large insurers may have a stronger ability to acquire the right expertise and conduct business more efficiently, giving them a competitive advantage over smaller insurers in profit generation and enhancing their return on assets. This argument is supported by Ahmeti and Iseni (2022), who recommend a high consideration of increasing insurers' assets, explaining that large insurers have a competitive advantage, which makes it easier for them to excel in a highly competitive market. More so, larger insurers benefit from economies of scale; they grow faster and generate more money than smaller businesses (Camino-Mogro and Bermúdez-Barrezueta, 2019; Sasidharan *et al.*, 2023). Regarding investment income, the study deduces that higher returns on investment reduce the chances of losses, promoting higher profitability (Morara and Sibindi, 2021).

Also, the threshold levels for underwriting risk and reinsurance premiums were 0.249 and 0.0279, respectively. These factors reveal a significant positive impact on return on assets in the lower regime while revealing a significant negative relationship above the threshold level. The results suggest that life insurers with low reinsurance levels experience higher profit margins than those with higher reinsurance levels. In addition, the higher cost of underwriting may negatively influence the profitability of life insurers, revealing that high underwriting risk may harm insurers' profitability. This validates existing studies (Wosti and Pradhan, 2023; Siopi and Poufinas, 2023). This will probably occur when insurers reduce their premiums to entice more customers, which will impact their performance (Kristanti *et al.*, 2023). Hence, the study suggests that life insurers must not lower their premium due to competition but must abide by the regulatory pricing policy to improve their underwriting performance. Kumar *et al.* (2022) also indicate that insurers must comply with underwriting policies issued by regulators to curb the negative influence of underwriting risk.

Regarding reinsurance, Siopi and Poufinas (2023) discuss that frequent reinsurance reliance indicates that an insurance firm is not performing adequately and faces insolvency, which could have a long-term impact on its operations. Again, premium growth has a negative, statistically insignificant threshold level. We also find that premium growth diminishes profitability in the lower regime and increases profitability in the higher regime. According to Sasidharan *et al.* (2023) and Pjanić *et al.* (2023), premium growth positively impacts profitability. In particular, if insurers maintain rigorous underwriting practices and appropriately assess and rate risks, a larger premium base offers greater potential for producing underwriting profits, which also improves the overall profitability of the insurance company.

Leverage presents a significant threshold of 0.852, representing a lower debt-to-equity ratio. The results indicate a significant positive result in the lower regime. This means that leverage exerts a statistically significant effect on return on assets when they fall below the threshold level. More so, leverage reveals a significant negative relationship above the threshold level. The negative relationship means that leverage leads to lower returns on assets at higher levels. This aligns with Pjanić *et al.* (2023) findings, which revealed that

financial leverage negatively affects the performance of life insurance companies in Serbia. This suggests that life insurers must not rely too much on debt to finance their business to improve profitability (Kumar *et al.*, 2022). This supports the notion that higher-leverage firms face higher financial distress because companies relying more on debts are exposed to greater risk (Morara and Sibindi, 2021). In contrast, firms with more equity tend to operate more conservatively by depending on internally generated funds (Alhassan *et al.*, 2015). Therefore, firms that depend more on leverage to survive must adopt risk management techniques to overcome any cost of financial distress.

Furthermore, the threshold value for solvency was 1.014, indicating that the excess of life insurers' assets over liabilities must be more than 100%. The coefficient estimate for solvency in the lower regime is negative and significant. This indicates that insolvency may have a reduction effect on profitability at lower levels. In the upper regime, the coefficient estimate for solvency is positive and statistically significant, suggesting that a significant increase in the solvency of life insurance companies may yield positive results for life insurers (Siopi and Poufinas, 2023). This implies that life insurers must maintain their solvency levels because they are more likely to enjoy higher profits, thereby sustaining their long-term viability. This agrees with extant studies (Odira, 2018), which assert that when a company's solvency level is high, it can lower leverage risk, which can help it improve its financial performance.

In summary, this study contributes significantly to the literature by exploring the linear and threshold dynamics of the determinants of life insurance companies' profitability in South Africa. Evidence from the linear regression indicates that investment income and solvency positively induce life insurers profitability. On the other hand, the study discovered that underwriting risk, reinsurance, and size weaken profitability. Again, the dynamic threshold regression estimates affirm non-linearity in the relationships. The findings indicate that insurance size, investment income, and solvency all promote profitability above the threshold level, implying a propelling effect on life insurers profitability at higher levels. These factors have a negative impact below the threshold. The study also indicates that underwriting risk, reinsurance, and leverage have a negative impact when life insurers' profitability exceeds a certain threshold.

4.4 Robustness checks

We check for the robustness of our estimates using two approaches. First, we modified the estimation technique by employing the difference GMM and pooled OLS. In most cases, the coefficient values of the two-step difference GMM (Diff-GMM) and the POLS estimations are mainly consistent with the system GMM, indicating the reliability and consistency of the linear regression results. Second, we introduce another key measure employed in the literature to determine the profitability of companies, namely return on equity (ROE). ROE captures a company's profit from shareholders' equity (Horvey and Ankamah, 2020; Sasidharan *et al.*, 2023). The results are presented in Tables A2 and A3 (See Appendix) for the threshold and linear regression, respectively. The result in Table A2 affirms that reinsurance and underwriting weaken insurers' profitability beyond a certain threshold. Contrarily, insurance size, investment income, solvency and premium growth were significantly positive at higher threshold levels. The notable difference is that financial leverage shows a significant positive impact on profitability above the threshold and an adverse impact below the threshold. The result indicates that high leverage can increase firm profitability when the company effectively uses it and the cost of debt is low. Again, the result in Table A3 is similar to the linear regression estimates in Table 4.

Interestingly, investment income is negative, but this was insignificant. We also found a significant positive relationship with insurance size. The underwriting risk and reinsurance results are consistent with our previous findings, appealing to the logic that high underwriting risk and heavy reliance on reinsurance will weaken insurers' profitability. The

results from our robustness analysis mostly confirm the coefficient estimates of the linear and threshold regression analysis, showing that the models are well specified. Therefore, well-informed inferences can be made from our findings.

5. Conclusions and recommendations

This study contributes to the existing literature by examining the linear and non-linear effects of firm-specific factors that determine life insurance companies' profitability in South Africa, based on a sample of 62 life insurers from 2013–2019. This is motivated by the fact that studies have failed to assess the threshold levels at which the determinants propel profitability. This is based on the argument that there is a certain threshold level at which the determining factors enhance or reduce profitability. The study adopted the system GMM and the dynamic panel threshold estimation techniques to examine these relationships. A dynamic model accounts for potential endogeneity problems arising from the lagged dependent variable. The significance of the lagged dependent variable justifies using the dynamic model and shows the persistency of return on assets over time.

Highlighting the key findings, the linear regression reveals that investment income and solvency are crucial to the performance of life insurers in South Africa. The significant positive results support this. Leverage was also positive but insignificant. The study further discovered that underwriting risk, premium growth, reinsurance, and insurance size reduce profitability, suggesting that the South African life insurance industry relies more on investment than underwriting activities to ensure profitability.

The evidence from the dynamic panel threshold regression indicates non-linearities in the relationships. This is supported by the bootstrap p-value (0.000), which rejects the null hypothesis of no threshold effect in all the models, implying a significant threshold effect for the determinants. The empirical result suggests threshold levels of 13.932 and 13.739 for insurance size and investment income. Beyond the threshold level, we find that these factors were significantly positive, concluding that large insurers with a higher return on investment experience higher profitability. The threshold for solvency was established at 1.014, implying that a life insurer's assets must exceed its liabilities by more than 100%.

The study further revealed underwriting risk and reinsurance threshold values of 0.249 and 0.027, respectively. Below the threshold level, these factors have a significant positive relationship but are significantly negative when they fall beyond the threshold level. The results indicate that life insurers must not rely more on underwriting activities to fund their business due to their reduction effect at higher levels. More so, too much reliance on reinsurance may have a decreasing effect on their profitability. For leverage, the threshold was at 0.85, suggesting that life insurers' debt must be lower than their equity. Premium growth presents a negative threshold point, but this was statistically insignificant. In conclusion, we suggest the threshold levels estimated in this paper to the life insurance industry. Considering these threshold levels will help them achieve the desired profitability outcome.

Following the findings emanating from this study, the following recommendations are provided. For the efficient use of insurance resources and to increase the profitability of insurance businesses in South Africa, regulators must strongly emphasise these determinants. The FSCA must monitor the underwriting activities of life insurers and enforce policies that cap reinsurance and leverage to maintain insurance over time. Again, life insurers must have the right personnel for underwriting. The actuarial department must validate all policies by insurance agents and ensure that insurers comply with the regulatory pricing to avoid high underwriting risk. This will help reduce price undercutting by insurance agents. We further recommend that life insurers not concentrate too much on underwriting and premium growth due to their reduction effect on profitability but implement strategies focused on improving their investment income and solvency. Such will boost their profitability. More so, life insurers

can grow their premiums through product development and innovation without compromising underwriting policies. Furthermore, large insurers should give importance to their growth. This can be done by employing the right experts and being abreast with current issues to take proactive measures to improve their profitability.

Despite the contribution of this study, it is not free from limitations, which provide avenues for further research. First, the study is limited to the life insurance industry in South Africa without considering the non-life sector. In this regard, it will be interesting to compare the findings of this study with the non-life insurance industry in future studies. This will help to understand the dynamics within both sectors for improved policy decisions. Again, since this study explores only internal factors, scholars should extend the study to include macroeconomic factors and how they affect insurance profitability at different thresholds. In addition, other insurance-specific profitability ratios could be considered. Also, the internal factors are not exhaustive; hence, scholars can consider other factors such as liquidity, age, asset tangibility and ownership structure, amongst others. It is important to note that the study did not cover all life insurers in South Africa; however, the sample size is large enough to make generalisable conclusions. This could serve as a basis for further research.

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Corresponding author
Jones Odei-Mensah can be contacted at: jones.odei-mensah@wits.ac.za

Appendix

Year	Total assets	Total liabilities	Premiums	Investment income	Claims	Size	Penetration
2013	2,121,847	1,993,320	403,309	290,927	13,725	74	11.4%
2014	2,414,726	2,273,451	447,442	283,834	14,998	73	11.8%
2015	2,567,147	2,416,090	468,595	198,593	16,073	74	11.6%
2016	2,652,277	2,498,443	485,610	164,206	16,521	72	11.1%
2017	2,914,534	2,757,373	475,935	16,343	415,388	71	10.4%
2018	2,993,436	2,630,845	134,362	76,999	106,426	65	9.6%
2019	3,054,223	2,786,406	504,567	673,003	306,576	74	10.7%

Note(s): All monetary values are in the South African Rand (millions)
Source(s): Extracted from the annual reports of the FSCA between 2013–2019; insurance penetration rates were extracted from the Swiss Re institute; Results from Table A1 compiled by authors

Table A1. Stylised facts of the life insurance industry in South Africa

Variables	Size (4)	Underwriting risk (5)	Leverage (6)	Reinsurance (7)	Investment income (8)	Solvency (9)	Premium growth (10)
Lower regime							
Lag of ROE	−0.323***	0.509***	−2.927***	−0.412***	−0.466***	−0.268***	−0.223***
	(0.00255)	(0.000447)	(0.0661)	(0.00191)	(0.000250)	(0.0130)	(0.0615)
Threshold variables	−11.14***	6.004***	−12.07**	1.428***	−0.0026***	−4.612***	−5.274***
	(0.0575)	(0.0817)	(5.705)	(1.204)	(0.0001)	(0.0384)	(0.815)
Upper regime							
Lag of ROE	0.927***	−0.665***	2.755**	0.299***	0.610***	−3.480***	0.377***
	(0.00150)	(0.000294)	(0.0660)	(0.00374)	(0.000762)	(0.0848)	(0.00513)
Threshold variables	50.85***	−5.982***	11.66***	−1.430***	0.0028***	4.599***	5.377**
	(0.338)	(0.0812)	(5.726)	(1.184)	(0.0001)	(0.0387)	(0.252)
Constant	−87.17***	4.488***	−83.19***	31.02**	−12.91***	17.89***	−4.505***
	(5.739)	(0.0136)	(2.834)	(0.806)	(0.105)	(1.126)	(0.113)
Post-estimation test							
Threshold point (r)	16.60***	0.187***	0.482**	0.0611**	12.17***	2.290	0.0798
	(0.0173)	(0.00209)	(0.000592)	(0.000482)	(6.484)	(2.055)	(2.036)
Linearity (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
kink_slope	15.831***	0.074***	0.573***	0.049***	13.162***	1.014***	0.084***
Observations	62	62	62	62	62	62	62

Note(s): Standard errors are in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
(Dependent Variable: ROE)
Source(s): Results were generated from Stata by authors

Table A2. Robustness check for threshold regression

Variables	(1) SYS-GMM	(2) DIFF-GMM	(3) POLS
L.ROA	1.208***	0.015	
	(0.175)	(0.325)	
Size	0.003	−0.105*	0.0281***
	(0.010)	(0.059)	(0.0105)
Underwriting risk	−0.032	0.439	0.0742
	(0.229)	(0.295)	(0.145)
Leverage	−5.813***	−7.390***	−2.487
	(1.519)	(0.834)	(1.739)
Reinsurance ratio	−0.028	−0.107	0.0708*
	(0.043)	(0.081)	(0.0418)
Investment income	−0.004	0.009	−0.0171*
	(0.006)	(0.006)	(0.00880)
Solvency ratio	0.013***	0.006*	0.0146***
	(0.001)	(0.003)	(0.000519)
Premium growth	0.190	0.223	0.186
	(0.226)	(0.197)	(0.167)
Observations	368	310	430
Time dummies	Yes	Yes	Yes
No. of groups	62	62	62
No. of instruments	12	10	
R-Squared			0.724
Prob > *F*	0.000	0.000	0.000
AR(1)	0.134	0.0510	
AR(2)	0.232	0.0754	
Sargan	0.633	0.646	
Hansen	0.633	0.599	

Note(s): Standard errors are in parentheses; values above the standard errors are the coefficient estimates, showing the direction of the relationship; Significant levels are expressed as ***$p < 0.01$, **$p < 0.05$ and * $p < 0.1$, respectively
(Dep Var: ROE)
Source(s): Results were generated from Stata by authors

Table A3.
Robustness check for linear regression results

Table A4.
A literature review on the determinants of insurance profitability

Author(s)	Purpose	Country	Methodology	Dependent variable	Determinants	Findings
Adams and Buckle (2003)	The study explores the determinants of corporate financial performance of Bermuda's insurance market	Bermuda	Common Effects model/ 1993–1997	Underwriting and Investment	Size, underwriting risk, leverage, liquidity, company type and scope	Companies with high leverage and low liquidity perform better. performance had a positive relationship with underwriting risk. Size and the range of activities were significant explanatory factors
Chen and Wong (2004)	Determinants of the financial health of insurers	Asia	Multiple regression/ 1966–1999	Financial stability	Size, leverage, premium growth, operating margin, liquidity, combined ratio, surplus growth, change in asset and product mix, investment and competition	Firm size, investment performance, liquidity ratio, surplus growth, combined ratio and operating margin are major determinants of the financial stability of general insurers in Asian nations. Second, the company size, change in asset mix, investment performance and change in product mix have key influences on the financial health of life insurers
Shiu (2004)	Determinants of general insurance performance	UK	OLS/1986–1999	Investment yield, percentage change in shareholders fund and return on shareholders fund	Size, leverage, investment, solvency, underwriting stability, liquidity, asset structure, underwriting profit, insurer type	This study indicates that the performance of UK general insurers is statistically significantly influenced by liquidity, unexpected inflation, interest rate level and underwriting profits
Ahmed *et al.* (2011)	Determinants of life insurance profitability	Pakistan	OLS/2001–2007	ROA	Size, leverage, risk, age, liquidity and growth	Size and risk show a positive impact, whereas leverage was negative
Olaosebikan (2013)	Determinants of micro-life determinants	Nigeria	GMM/2004–2009	Net profit	Ownership structure, size, age, leverage, reinsurance and product mix	Ownership structure has a positive impact. Size, leverage and age were significantly negative. Reinsurance and product mix show significant negative effects

(*continued*)

Table A4.

Author(s)	Purpose	Country	Methodology	Dependent variable	Determinants	Findings
Boadi *et al.* (2013)	Explore the determinants of insurance profitability in Ghana	Ghana	OLS/2005/2010	ROA	Leverage, tangibility, liquidity, risk, size and growth	The study found a positive relationship between leverage, liquidity and profitability of insurance firms
Burca and Batrinca (2014)	Explore the determinants of insurance profitability in Romania	Romania	Fixed and Random Effects/2008–2012	ROA	Leverage, size, age, premium growth, loss ratio, equity, market share, diversification, investment, reinsurance, risk retention, solvency, GDP	Leverage, size, premium growth, underwriting risk, risk retention ratio and solvency margin are the factors that determine the financial performance
Öner Kaya (2015)	To investigate factors affecting non-life profitability	Turkey	POLS/2006–2013	Technical profitability and sales profitability ratios	Size, age, loss ratio, leverage, current ratio, premium growth and retention ratio, motor insurance	Size, age, loss ratio, current ratio and premium growth are significant determinants
Odira (2018)	To examine the determinants of the general insurance company's profitability	Kenya	Multiple regression/2011–2016	ROA	Size, leverage, underwriting factor, liquidity, solvency	Size was significantly positive, but solvency was insignificant, while leverage, liquidity, leverage and underwriting risk had negative effects
Zainudin *et al.* (2018)	To explore the internal determinants of life insurance profitability	Asia	Random effect/2008–2014	ROA	Size, volume of capital, asset tangibility, premium growth, liquidity and underwriting risk	Profitability of life insurers is highly associated with size, volume of capital and underwriting risk. However, premium growth, asset tangibility and liquidity are insignificant determinants

(*continued*)

Table A4.

Author(s)	Purpose	Country	Methodology	Dependent variable	Determinants	Findings
Camino-Mogro and Bermúdez-Barrezueta. (2019)	To examine the main determinants of life and non-life insurance profitability	Ecuador	POLS/FE/ 2001/2017	ROA/Investment income/net profit	Net premium, technical reserve, liquidity, leverage, equity to asset, capital and labour intensity, claims, size, technical efficiency, HHI, market share, credit volume, cyclical output, interest rate, inflation, multinational investment, business segment	In the life insurance sector, net premiums, technical reserves, capital ratio, and score efficiency, HHI are significant determinants, while in the non-life sector, claim level and liquidity ratio are significant determinants. Interest rate has a significant impact on both sectors
Batool and Sahi (2019)	To examine the determinants of financial performance of US and UK insurers during global financial crises	USA/UK	Fixed and Random Effects/2007/ 2016	ROA/ROE	Size, liquidity, leverage, asset turnover, GDP, inflation, interest rate	Liquidity, leverage, asset turnover, GDP and WTI positively affect US companies, but CPI and interest rates have negative impacts. Liquidity, GDP, CPI, and WTI have positive effects on UK firms, whereas leverage, asset turnover, and interest rates were significantly negative
Killins (2020)	Aim to investigate how macroeconomic, industry-specific and firm-specific factors affect the performance of life insurance firms	Canada	FE/GMM/ 1996–2018	ROA/ROE	Size, liquidity, productivity growth, risk exposure, expense management, concentration, GDP, yield curve and equity market	According to this study, life insurers' size, liquidity, risk exposure, GDP and equity market are significant determinants, whereas industry concentration was negative

(*continued*)

Table A4.

Author(s)	Purpose	Country	Methodology	Dependent variable	Determinants	Findings
Meher and Zewudu (2020)	Micro and macro determinants of insurance performance	Ethiopia	2002–2016	ROA	Size, asset growth rate, underwriting risk, volume of capital, leverage, liquidity, market share, GDP, inflation rate	GDP per capita and company size show a significant positive impact, but leverage, liquidity, and underwriting risk show a significant negative significant impact. The management of capital structure with little reliance on borrowed capital, the reduction of underwriting risk by shifting surplus risk to reinsurers, and the use of premiums gained in return-earning investments all help insurance businesses perform financially faster
Ambaw and LiJuan (2021)	Micro determinants of Insurance profitability	Ethiopia	Fixed effect/ 2005–2020	ROA	Size, leverage, liquidity, premium growth, loss ratio, market, age and assets tangibility	The findings demonstrated the significance of firm's size, leverage, liquidity, market share premium growth, tangibility of assets, and age
Morara and Sibindi (2021)	Examine the drivers of insurance financial performance	Kenya	Fixed and Random Effects/2009–2018	ROA/ROE	Solvency, combined ratio, debt ratio, size, age, leverage, reinsurance and investment ratio	Size shows a positive impact, whereas age reveals negative effects. Also, highly-leverage firms perform better than low-leverage firms
Ahmeti and Iseni (2022)	Investigates company-specific factors on profitability	Kosovo	Multiple regression/ 2015–2018	ROA/Net profit margin	Leverage, age, size, premium growth, liquidity, tangible assets, capital	Size, leverage, and firm age significantly affect ROA, whereas firm size and growth have a significant impact on NPM
Kumar *et al.* (2022)	To explore the determinants of insurance profitability in Fiji	Fiji	Fixed effect/ 2010–2015	ROA/ROE	Leverage, premium income, contingent liability, underwriting expenses and provisions, administration expenses and HHI	Insurance profitability is determined by premium income, underwriting and administrative expenses, and volume of capital, but leverage and contingent liability are inversely related to profitability

(*continued*)

Table A4.

Author(s)	Purpose	Country	Methodology	Dependent variable	Determinants	Findings
Vojinović *et al.* (2022)	To examine the determinants of sustainable profitability of insurance companies	Serbia	GMM and Mixed Effects/ 2008–2019	ROA/Return on total premium	Size, risk, specialisation, HHI, GDP, inflation, wage, population, life expectancy, regulation quality and political stability	They discovered that size, GDP, population growth rates, political stability, and level of specialisation enhance profitability. On the other side, we see that inflation and excessive risk-taking are inversely connected to profitability. Also, regulatory quality, average wage, or life expectancy did not show any significant effect
Pjanić *et al.* (2023)	Determinants of life insurance companies	Serbia	Fixed effects/ 2015–2021	ROA	Size, premium growth, expense ratio, operating margin, investment ratio, leverage, liquidity and market share	The study shows that operating margin and liquidity ratio have a statistically significant positive impact on ROA, whereas expense ratio and financial leverage have a statistically significant negative impact on ROA.
Msomi (2023)	Determinants of listed non-life insurance profitability in Africa	Africa	POLS/GMM/ 2008–2019	ROA	Claims ratio, leverage, liquidity, equity capital, investment capability, age, size, underwriting risk and operational efficiency, GDP, interest rate, inflation, exchange rate and money supply	Although equity capital, operational efficiency, and leverage are inversely significant, lagged ROA, investment capability, and gross domestic product are the statistically significant determinants of financial performance in African non-life insurance companies

(*continued*)

Table A4.

Author(s)	Purpose	Country	Methodology	Dependent variable	Determinants	Findings
Sasidharan *et al.* (2023)	To determine the micro and macro determinants of the general insurance company's profitability	India	2010–11/2019–2020	ROA/ROE	Size, leverage, retention ratio, liquidity, premium growth, loss ratio, reinsurance, market share, GDP and inflation	Results showed that market share, premium growth, and retention rate have a significant positive impact on ROA. While loss ratio, liquidity and inflation, on the other hand, show a significant negative impact. Size, reinsurance, debt ratio, and GDP were insignificant on ROA. Financial leverage and market share are other important factors that have a significant impact on ROE, while size was negative
Siopi and Poufinas (2023)	To examine the impact of internal and external factors on insurance profitability	Europe	2007–2021	ROA/ROE/Equity/assets	Size, market share, GDP, inflation, penetration, solvency, crisis period and reinsurance	The acquisition of reinsurance, size, market structure, and inflation all have a negative impact, whereas GDP and long-term interest rates have a positive impact
Wosti and Pradhan (2023)	Effect of firm specific factors on insurance profitability	Nepal	2013–2021	ROA/ROE	Size, liquidity, reinsurance, net claim ratio and net commission ratio	Reinsurance and asset tangibility present a positive relationship, whereas firm size, liquidity ratio and net claim ratio reveal an inverse relationship

Source(s): Table made by authors