

Examining Market Competition and Financial Stability: An Econometric Analysis of India's Life and Non-Life Insurance Industry

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Abstract

Using the panel data analysis, this study investigates the evolution of competition over the study period and subsequently examines the relationship between competitiveness and financial stability within the Indian insurance segment. Adopting the methodology proposed by Boone (2008), competition is measured using the Boone indicator, while financial stability is quantified using the Z-score. Spanning over 15 years, i.e., 2009 to 2023, the study assesses both the life and non-life insurance segments within the Indian market. Throughout the study period, a decline in competition is observed across both segments, owing to the increased concentration among major insurers. Nevertheless, the study's results support the Boyd and De Nicolo (2005) competition-stability hypothesis, suggesting that which suggests that increased market competition is associated with increased financial resilience. Additionally, the results using the Boone indicator highlight efficiency as the main mechanism by which competition fosters better financial stability. With their insights into the dynamics of competition and stability within the Indian insurance landscape, these findings have important ramifications for insurance companies, academics, and policymakers alike.

Keywords: Boone Indicator; Z-score; Competition-Stability Relationship; Panel Data Analysis.

1. Introduction

The primary function of an insurance business is to provide security to the insured against the probable losses. Worldwide, the insurance business is experiencing a strong evolution over the years. With respect to the emerging economies, the premium growth of 14.3 per cent was observed for life insurers and 6.4 per cent for non-life insurers in 2022, while for developed economies, it was 2.9 per cent and 1.8 per cent, respectively (Swiss Re, 2023). The Indian market also offers huge potential for penetration of insurance sector. By 2025, it is expected that insurance business will account 47 per cent of the total savings of India (IBEF, 2023). The Indian insurance industry has witnessed a major regulatory change when the IRDA Bill, 2000 was passed in the parliament on the recommendation of 'Malhotra committee'. This IRDA Bill allowed private and foreign players to enter into the insurance market, which gave a new perspective to the Indian insurance industry. The basic objective of this liberalisation was to enhance competition among insurance firms which would enhance their efficiency and thus, ultimately benefiting consumers (Sinha, 2007).

Efficiency is commonly used as an indirect approach for measuring competition. In the insurance industry, empirical evidences have shown that efficiency of firm increases with higher level of competition due to

reallocation of profits from inefficient to efficient firms (Alhassan and Biekpe, 2016; Berry-Stolzle et al., 2011; Bikker and Gorter, 2011; Cummins and Rubio-Misas, 2006; Kaffash et al., 2020). Thus, if competition increases and reallocation of profits occur from inefficient firms to efficient ones, one would expect an increased financial soundness of the insurance market as a whole. The insurance firms need to ensure the financial soundness of their business so as to fulfil their policyholders' expectations (Cummins et al., 2017). Moreover, failures of the insurance businesses could potentially impede the financial system of a country and could negatively influence the economy (Das et al., 2003). Thus, policymakers also need to formulate regulations for reducing insolvency risk of insurers or ensuring their financial stability.

In consideration, this study has two main objectives: first, to apprehend the evolvement of competition in the Indian life as well as non-life insurance sector over the study period; second, to examine the competition-stability nexus in the Indian insurance market. For this purpose, analysis is done in two sections: (i) for measuring degree of market competition, the Boone (2008) indicator is used. The Boone (2008) indicator measures the influence of market competition in terms of profits and market share captured by the efficient firms at the expense of inefficient ones (Boone, 2008; Cummins et al., 2017; Olley and Pakes, 1996); (ii) the relationship between market competition and financial soundness is investigated through panel data regression analysis. Herein, the Z-score (proxy for financial stability) is considered as the dependent variable and the Boone (2008) index is taken as the independent variable. Interestingly, results of the study show weakening of competition in the Indian insurance industry over the study period, while a positive competition-stability relationship is observed.

The present research is an initionary attempt to evaluate competition-stability nexus in the Indian insurance industry. Among the extant literature, only three studies have used the Boone (2008) indicator for analysing the degree of competitiveness in the insurance industry (Kaffash et al., 2020). While Bikker and Van Leuvensteijn (2008) and Bikker (2016) have attempted only to measure competition in the Dutch life insurance sector, Cummins et al. (2017) have studied the competition-stability nexus in 10 European Union life insurance markets using the Boone indices. Further, the study significantly contributes to the literature by examining both segments i.e., life as well as non-life insurance segments to analyse the competition-stability relationship in an insurance sector.

Remainder of the paper is structured as follows: firstly, brief overview of the Indian insurance sector is provided. The next section presents theoretical framework of the study, followed by literature review section, on the basis of which research hypotheses are drawn. Next section gives the detailed description of research methodology used, after which results are presented and discussion is framed. Finally, the last section offers concluding remarks and provides managerial implications of the study.

2. Overview of the Indian Insurance Industry

The Indian insurance industry is segmented into two major sectors i.e., life insurance sector and non-life insurance sector. The history of the Indian life insurance firms dates back to 1870 when the Bombay Mutual Life Insurance Society was incorporated, while the beginning of the non-life insurance business can be traced down from the Tital (Triton) Insurance Company Limited, the first ever non-life insurance company incorporated in 1850 in Calcutta (Kolkata) by British. Then several years later, formal insurance regulation embarked in India when the Life Insurance Corporation (LIC) Act, 1912 and the Provident Fund Act, 1912 was enacted. After that, a comprehensive legislation was passed in 1938 by introducing the Insurance Act, which provided for the stringent State control over the insurance firms.

Shortly thereafter, nationalization of over 240 private life insurance firms and provident fund societies was done by the Government of India (GOI) in 1956. By amalgamating these 240 entities, a monopoly corporation i.e., Life Insurance Corporation of India (LIC) was incorporated for increasing the insurance penetration. Similarly, over 170 private non-life insurance firms were amalgamated and General Life Insurance Corporation (GIC) was established in 1972 with its four subsidiaries. Till the FY 1999-2000, these two State-run insurers (i.e., LIC and GIC) were the monopoly insurance companies in India. Later in 1994, the Malhotra committee recommended the greater autonomy to the Indian insurance sector and to open it up for the private investors. So, on the committee's recommendations, the Insurance Regulatory and Development Authority (IRDA) Bill was passed in FY 2000 under IRDA Act, 1999. The IRDA Bill was cleared on July 30, 2002, which approved for removing all the entry barriers imposed on private players. It also allowed foreign investors to enter into the Indian insurance market by collaborating with the domestic insurance firms, with a limit of 26 per cent on Foreign Direct Investment (FDI). This ended the monopoly of the Life Insurance Corporation (LIC) and General Insurance Corporation (GIC), thus enhancing competition in the Insurance sector. The IRDA Act, 1999 also provided that private insurance firms should have a minimum capital of ₹100 crores to have entry into insurance sector, for the purpose of ensuring their financial stability.

The IBEF report (2023) provides that with the clearance of IRDA Bill, share^{1a} of private companies in the life insurance sector has increased from approximately 2 per cent in FY 2002-03 to 34.8 per cent in FY 2022-23. With respect to the non-life insurance market, market share^{1b} of the private sector firms has grown from 15 per cent in FY 2003-04 to 56.4 per cent in FY 2022-23. Further, the major boom in the Indian insurance sector had occurred in December, 2014, when the ordinance was approved by the Government of India (GOI) for increasing the Foreign Direct Investment (FDI) limit from 26 per cent to 49 per cent, which further fuelled up the competition in the Indian insurance market.

Over one and half decade from FY 2008-09 to 2022-23, the number of insurance firms has increased from 22 to 24 firms in the Indian life insurance sector and from 21 to 33 firms in the Indian non-life insurance sector, as shown in Annexure 1. This depicts that there are not so many insurance companies competing in both the sectors (i.e., life insurance and non-life insurance sectors). As of FY 2022-23, the total number of the life insurers are 24 firms and non-life insurers are 33 firms. In the FY 2022-23, Life Insurance Corporation (LIC) of India (the only public sector life insurance firm in India) is found to be the market leader in with 66.36 per cent market share in terms of new business premium generation. On the other hand, HDFC Standard Life is found to be market leader in case of private sector with a 7.07 per cent market share, followed by SBI Life with 6.80 per cent market share and ICICI Prudential Life with 4.88 per cent (IBEF Report, 2023). Hence, it clearly shows that there is high level of concentration in the Indian life insurance market (66.36 per cent of market share enjoyed by only one insurance firm), which can significantly deter the market competition.

In addition to this, the IBEF report (2023) also analysed the extent of market share enjoyed by the major players in the non-life insurance sector in the FY 2022-23. It was found that the cumulative market share of public sector accounted for approximately 45.28 per cent of the total gross direct premium, with New India Assurance being the market leader having 14.04 per cent market share in the non-life insurance segment. In the private sector non-life insurance companies, ICICI Lombard was found to be market leader with 8.93 per cent market share, followed by Bajaj Allianz with 6.6 per cent share. Thus, in case of non-life insurance market also, approximately 55.6 per cent of the total market share (in terms of gross direct premium) belongs to 6 major players² out of 33 non-life insurance companies. This also points out the

high level of concentration in the Indian non-life insurance segment, although it is less concentrated as compared to the life insurance segment, where only one firm i.e., LIC accounted for 66.36 per cent of market share.

3. Theoretical Background

The extant literature on competition provides for the use of many direct and indirect measures for assessing the extent of competition in the financial services sector. The direct measures include Herfindahl-Hirschman Index (HHI) (based on the concentration ratios), entry-exit rates of firms or Lerner Index (based on price-cost margin). HHI and Lerner Index tend to suffer from the various theoretical as well as empirical difficulties due to lack of data availability (Bikker and Van Leuvensteijn, 2008; Cummins et al., 2017). Some of the empirical studies have argued that Lerner Index may sometimes show the increase in the competition, which in fact might have decreased, or vice-versa (Boone, 2008; Braila et al., 2010). Moreover, an ambiguous link has been observed between concentration levels and competition in the recent empirical literature on the financial services industry (e.g. Berger et al., 2004)³. Though the direct measures are easier to calculate, these are being recognised as the non-monotonic measurement methods due to their limitations.

In order to overcome the shortcomings of the direct proxies used for measuring competition, efficiency and the Boone indicator has been developed as the indirect measures. Theory advocates that increased competition forces the insurance companies to enhance their efficiency ((Bikker and Van Leuvensteijn, 2008). Thus, high efficiency of the insurance firms may signal the existence of competition and vice-versa. Another indirect approach i.e., the Boone indicator has been developed by Boone (2008). Boone's methodology is mainly grounded in the efficient structure hypothesis. This novel approach is based on the concept that market competition rewards the efficient firms and punishes the inefficient ones. In the competitive environment, more efficient entities outperform the inefficient entities by gaining the greater market share and thus, realising higher profits (Bikker and Van Leuvensteijn, 2008; Cummins et al., 2017; Olly and Pakes, 1996; Stiroh, 2000). As this approach captures the efficiency based on profit of companies, it is also called as profit elasticity approach. The Boone index is generally measured over the time period for portraying the development of competition.

Further, theoretical research has also been undertaken to examine the association between competition and financial soundness within the financial service industry. From a theoretical viewpoint, researchers rely on the two alternative theories: the competition-fragility theory and the competition-stability theory. The traditional competition-fragility theory states that increased competition among the financial institutions reduces their market power, which in turn decreases their profitability. So to cover up their financial losses, these financial entities are likely to make investments in more risky portfolios. Hence, this increased risk-taking behaviour weakens the financial soundness of financial entities (Allen and Gale, 2004; Beck et al., 2006; Hellmann et al., 2000; Keeley, 1990; Marcus, 1984).

In contrast to this, the competition-stability theory suggests that there is positive influence of competition on the financial soundness of financial institutions. Boyd and De Nicolo (2005) claims that in the weak competitive market condition, banks enjoy considerable market power. Enhanced market shares in the loan market allow banks to charge higher interest rates on loans, thus increasing the risk-taking capacity of borrowing entities. This induces the adverse selection (financing of riskier projects by banks) and moral hazard problem (risk shifting from borrowing firms to banks). As a result of risk shifting, bankruptcy of banks become more likely, thus, negatively affecting the financial soundness of banks. In simple words,

the competition-stability theory suggests that decrease in competition reduces the financial stability of financial institutions and vice-versa.

Recently, Schaeck and Cihak (2014) have developed transmission mechanism hypothesis for assessing the effect the competition on the financial soundness in the insurance industry. This hypothesis assumes that market competition has positive influence on the financial stability, considering efficiency as the transmission mechanism. This implies that increased competition can enhance efficiency, which in turn will enhance the financial soundness. The present study uses same approach by applying the Boone indicator to evaluate the effect of market competition on the financial soundness in the Indian life and non-life insurance industry.

4. Literature Review and Hypotheses Development

The review of literature has been conducted in the present study under two sub-sections, i.e., section 4.1 and 4.2. Section 4.1 presents a review of the studies related to measuring competition, while section 4.2 deals with the literature related to competition-stability relationship.

4.1 Measuring Competition

In the emerging economies, the insurance market has paucity of comprehensive literature on the measurement of competition, although lot of empirical studies have been done in the developed insurance industries. One of the main factors for the dearth of literature in this field can be the lack of availability of historical data on insurance companies (Camino et al, 2019). The Indian insurance industry is not an exception to this case. So far in India, there is only one study done by Acharya and Parida (2016) which attempted to measure the level of competition using seven different sets of concentration measures⁴ in the Indian life insurance segment from FY 2000-01 to 2014-15. The study found high level of market concentration and very weak competition among the Indian life insurers using different concentration indexes.

With respect to competition in the insurance market of emerging economies, only few studies have been carried out. In South Africa, Alhassan and Biekpe (2016) did the empirical investigation of competition-efficiency nexus and found the existence of monopoly in the non-life insurance segment. In another study, Alhassan and Biekpe (2017) found that the liberalisation of South Africa's non-life insurance market increased the number of foreign players in domestic market. This led to the creation of larger firms through consolidation, which worsen the competition in insurance market. In the same line, Todorov (2016) found the existence of some collusion power among the insurance firms in Bulgaria during the study period 2005-2014. In addition to this, Jeng (2015) empirically investigated the level of market competition in the Chinese life insurance market and property-liability insurance industry. By examining the data from year 2001 to 2009, results of the study showed the existence of monopoly in both markets and found the foreign firms to be less competitive than domestic firms due to geographic restrictions.

On the other hand, fair amount of literature is available in this field with respect to the developed economies. For example, in the Turkish non-life insurance market, Kasman and Turgutlu (2008) observed a short-run oligopoly competition and long-run monopolistic competition by dividing the sample into two periods due to implementation of regulatory policies. Another study that has been done by Gagnepain and Ivaldi (2016) during the study period from 2005 to 2011 found high degree of market competition in the French life insurance industry. Likewise, Coccoresse (2012) examined competition in the Italian vehicle insurance industry and found the existence of monopoly in the market during the study period. Further, in

the international non-life insurance market, Pope and Ma (2008) employed panel data analysis to study the insurance markets of 23 countries from the period 1996 to 2003. The result of the study revealed that liberalisation of insurance industry has positive influence on market concentration, which weakens the market competition.

Furthermore, very few studies have measured the competition in the insurance market by using the Boone indicator (Kaffash et al., 2020). Bikker and Van Leuvensteijn (2008) empirically assessed the degree of competitiveness in Netherlands during 1995-2003 and found very weak competition in the life insurance segment. In line with this, by examining the Dutch life insurance firms during 1995-2010, Bikker (2016) observed high competition in case of collective policy market and low in unit-linked insurance business. Added, Cummins et al. (2017) also did the cross-country analysis of life insurance markets by investigating ten European Union countries during 1999-2011 using the Boone index. The results varied across countries, wherein weakening of competition was observed in most of the countries over the study period.

4.2 Competition and Stability

Several recent studies have extended the horizon of existing literature on competition by establishing its link with the financial stability of financial institutions. In case of the banking sector, the extant literature has shown mixed results relating to competition-stability relationship. One set of studies has supported the competition-fragility hypothesis (Allen and Gale, 2004; Beck et al., 2013; Begenau, 2024; Hellman et al., 2000; Marcus, 1984; Matsuoka, 2013; among others), while other set has reported results supporting the competition-stability hypothesis (Boot and Thakor, 2008; Boyd and De Nicolo, 2005; Fiordelisi and Mare, 2014; Martinez-Miera and Repollo, 2010; among others). More recently, Schaeck and Cihak (2014) has tested and developed the transmission mechanism hypothesis for evaluating the effect of degree of competitiveness on the financial stability. This hypothesis supports the competition-stability view, wherein the efficiency is being considered as the channel through which competition enhances the stability of financial institutions.

Regarding the insurance industry, limited literature is available in this field. Based on the transmission mechanism hypothesis only, Cummins et al. (2017) has examined the competition-stability relationship of the life insurers in 10 European Union countries during 1999-2011 and found the results in support of this hypothesis. In other words, this study confirmed efficiency to be the mechanism through which competition enhances financial soundness. Few other studies have empirically established a positive relationship between market competition and efficiency. Bikker and Van Leuvensteijn (2008) analysed the Dutch life insurers from year 1995 to 2003 with 867 firm-year observations and found that X-inefficiencies of the insurers reduces with the increase in competition. Similarly, Boone (2008) also tested the efficient structure hypothesis and established the concept that efficiency is being rewarded by the market competition. This means, when the competition increases, more efficient insurers earn higher profits and gain higher market share, which in turn enhances their financial soundness. In the same line, Cummins and Rubio-Misas (2016) examined the 10 life insurance markets in European Union countries over the period 1998-2007 and concluded that increased average cost efficiency and revenue efficiency results into more financially stable insurance markets. Thus, based on the extant literature, following hypothesis can be framed:

H1: *Competition enhances the financial stability in the life insurance industry.*

With respect to the non- life or General insurance market, Shim (2017) analysed the property-liability insurance industry of United States from 1992 to 2010. The study concluded that low market concentration among insurance firms result in higher financial stability and vice-versa. Added, study also indicated that along with market concentration, firm-specific determinants (for example: size of insurance firms, leverage, diversification of insurance products, etc.) play a pivotal role in analysing the financial soundness of insurance firms. In line with this, Berry-Stolzle et al. (2011) also studied the property-liability insurance market of 12 European countries during 2003-2007 and found the results supporting the efficient structure hypothesis. Using the panel data analysis, study found similar results that with the increase in competition, efficient firms are able to capture more market share and this enhances their financial stability. Another study done in Australian general insurance market by Murat et al. (2002) found that under monopolistic competition, the profits of firms fall because of the increase in their marginal cost, which lowers their financial stability. This study also supported the competition-stability view. Furthermore, examining the association between competition and cost and profit efficiency, Alhassan and Biekpe (2017) studied the 75 non-life insurance firms during 2007-2012 and observed the positive association between these two variables (i.e., competition and efficiency). Thus, above discussion leads to the ensuing hypothesis:

H2: *Competition enhances the financial stability in the non-life insurance industry.*

Overall, there is a dearth of literature which empirically tests relationship between competition and financial soundness of the insurance firms. Till date, no such comprehensive study has been undertaken which analyses both life and non-life segments of insurance industry. The present study bridges this gap by studying the evolvement of competition over a period and measuring its influence on the financial stability of Indian insurance market, segmented into life and non-life insurance business.

5. Data and Research Methodology

5.1 Sampling and Data Sources

The sample used for the study is a balanced panel data set of the 22 life and 22 non-life insurance companies in India. Annual data has been considered for the sample companies spanning over one and half decade from April 1, 2009 to March 31, 2023. The sample period begins from the financial year 2009-10 due to data limitations⁵ and the last year considered is FY 2022-23, being the recent year for which annual data is available. Initially, all the Indian life and non-life insurance companies were considered for the purpose of study. Based on the previous insurance industry literature, companies with non-positive values of profits, equity capital, invested assets, net premiums and/or operating expenses were excluded. Also, only those companies have been considered for as sample which has survived over the whole study period. Final sample is the balanced panel data set of 22 firms from the life insurance market⁶ and 22 insurance firms from non-life insurance market⁷, accounting for 330 firm-year observations from each market.

Further, all the financial data required for empirical analyses has been collected from annual financial statements of each insurer, provided in the Handbook of Indian Insurance Statistics issued by IRDAI. This source has been fully relied upon while obtaining data as the Insurance Regulatory Development Authority of India (IRDAI) is the regulatory and supervisory institution of the Indian insurance industry since 1999. All the variables having monetary values are expressed in terms of Indian rupees.

5.2 Variable Selection and Description

The present study has focused on analysing the effect of competitiveness on the financial soundness of the Indian life and non-life insurance industry. Based on the previous literature, the study has controlled for the effect of other relevant variables which can potentially affect the relationship of competition with financial soundness. This section offers detailed explanation of the independent variable (i.e., competition proxied by the Boone indicator), dependent variable (i.e., financial stability proxied by the Z-score) and the other control variables as under:

5.2.1 Measuring competition: The Boone indicator

Following the recent studies (Bikker and Van Leuvensteijn, 2008; Cummins et al., 2017; Jeon and Lim, 2013; Kaffash et al, 2020; Schaeck and Cihak, 2014), this study has measured competition by using the Boone indicator given by Boone (2008). This indirect measure of market competition is grounded in the efficient-structure hypothesis, assuming that efficiency is rewarded by competition. In other words, Boone's index is based on the assumption that in the more competitive environment, reallocation effect occurs i.e., more efficient firms are rewarded with more profits (by reducing marginal costs) and hence, more market share. Thus, Boone (2008) indicator mainly captures the profitability-marginal costs relationship to determine the level of efficiency of the desired firm, by using following regression equation:

$$\Pi_{it} = \alpha + \beta \ln(MC_{it}) + e_{it} \quad (1)$$

where,

Π_{it} = profit of an insurance firm i for the year t , scaled by book value of total assets;

MC_{it} = marginal costs of an insurance company i for the year t ;

$\ln(MC_{it})$ = natural logarithm of MC_{it} ;

β = estimated coefficient of $\ln(MC_{it})$ representing the profit elasticity or the Boone index;

e_{it} = error term.

β coefficient, called the Boone index, is expected to be a negative value, reflecting inverse relationship between profit and marginal costs of a firm. This inverse relationship means that if the efficient insurer reduces marginal costs, this will enhance their profit and vice-versa. Also, an increase in the absolute value of β coefficient (i.e., competition) will enhance their inverse relationship between profit and marginal costs. This means, more negative is the Boone index greater is the competition in an insurance industry⁸.

In order to construct the variables in equation 1, approach developed by Boone (2008) has been followed. Π_{it} for the particular year has been measured as the deviation between variable revenues and variable costs, divided by the book value of total assets of an insurance company. Variable revenue is calculated as the sum total of net income and net investment income generated through the investments made from shareholders' and policyholders' funds. Variable costs have been considered as the sum total of operating expenses and net incurred claims of each insurance company in each year. Due to the non-availability of data for measuring the marginal costs (MC) directly, average variable costs (AVC) are being used a proxy of marginal cost as suggested by Boone (2005)⁹. Average variable costs (AVC) have been calculated by dividing variable costs with variable revenues.

Further, for capturing change in the Boone index over the study period, year dummies have been included in the equation 1 and their interaction has been observed with AVC using following regression equation¹⁰:

$$\Pi_{it} = \alpha + \sum_{t=1}^T \beta_t \ln(AVC_{it}) \times \text{Yeardummy}_t + \sum_{t=1}^T \gamma_t \text{Yeardummy}_t + e_{it} \quad (2)$$

where,

Π_{it} = profit of an insurance firm i for the year t, scaled by book value of total assets;

AVC_{it} = average variable costs of an insurance firm I for the year t;

$\ln(AVC_{it})$ = natural logarithm of AVC_{it} ;

Yeardummy_t = dummy variable equals to 1 for each year of the study period;

β_t = standardized coefficient of the product of $\ln(AVC_{it})$ and dummy for each year, capturing the degree of change in competition over the time;

γ_t = standardized coefficient of the Yeardummy_t .

Thus, two regression equations have been used in the study for measuring the degree of market competition in the Indian life as well as non-life insurance market. The regression equation has been used to obtain the Boone index for the entire study period from the financial year 2008-09 to 2022-23. Then, the year dummies have been included and interacted with $\ln(AVC_{it})$ for observing the changes in the Boone index over the study period. The regression equation 2 has been used for estimating the Boone values on yearly basis.

5.2.2 Measuring financial stability: The Z-Score

As in case of banking institutions, shareholders' equity serves as a buffer for the insurance companies also, against its unforeseen losses. Moreover, it is pivotal for insurance firms to have sufficient equity to fulfil its obligations. Thus, Z-score can be used as an indicator for measuring insurer's financial stability which uses shareholder's equity as a base (Pasiouras and Gaganis, 2013; Shim, 2011). So, following Laeven and Levine (2009), the Z-score has been used as a proxy for measuring financial soundness of the Indian life and non-life insurance industry. It has been calculated as:

$$Z_{it} = \frac{ROA_{it} + EqAst_{it}}{\sigma_{ROA_{it}}} \quad (3)$$

where,

Z_{it} = financial soundness of an insurance company i for the year t;

ROA_{it} = return on assets calculated as a percentage of net profit after taxes earned on the book value of total assets of an insurance firm i for the year t;

$EqAst_{it}$ = ratio of equity to book value of total assets of an insurer i in the year t;

$\sigma_{ROA_{it}}$ = standard deviation of ROA_{it} measured by using three-year rolling window period¹¹.

The Z-score has been extensively used by the researchers for analysing the financial soundness of the insurance business (e.g. Cummins et al., 2017; Jeon and Lim, 2013; Pasiouras and Gaganis, 2013; Shim, 2011; among the others). The Z-score captures the firm's distance to default, inversely proportional to the

probability of being insolvent (Roy, 1952). Thus, greater the value of Z-score, lower is the risk of bankruptcy for a particular insurance firm.

5.2.3 Control variables

For controlling the effect of firm-specific variables on the competition-stability relationship, control variables have been used in the study by reviewing the prior literature. The natural logarithm of the total assets has been used in the regression analysis for controlling the size of an insurance firm¹² (Cummins et al., 2017; Jeon and Lim, 2013). Age of an insurer (measured in terms of natural logarithm of number of years since the company's incorporation) has also been controlled to account for the difference in the experiences of the insurance companies. Further, for controlling the efficiency of accounts receivable management of an each insurance company, ratio of invested assets to the book of total assets has been used (Cummins et al., 2017). Assets growth rate has also been included for accounting the differences in the risk preferences of an each insurer (Schaeck and Cihak, 2014). Assets growth rate is defined as the percentage change in the book value of total assets over the period of one year (i.e., $\text{Total assets}_{it} - \text{Total assets}_{it-1} / \text{Total assets}_{it-1}$) (Shim, 2015). In addition to this, insurance leverage ratio (ratio of net premium to shareholders' equity) has been included in the final regression equation, as prior literature has shown it to be related with the insurer's stability (Cummins et al., 2004).

The summarized description of all the study variables is given in Annexure 2.

5.3 Empirical Approach

To analyse the effect of degree of competitiveness on financial soundness of the Indian life and non-life insurance market, fixed panel data¹³ regression modelling was done. Firstly, F-test (or Likelihood Ratio test) was used to choose between pooled OLS regression model and Least Squares Dummy Variables (LSDV) model (i.e., fixed-effect model). As the p -value of was found to be small enough for rejecting H_0 ($p = 0.000$), null hypothesis was not supported implying that fixed-effect model significantly increase the goodness-of-fit values (Park, 2011). Hence, for the present study, fixed-effect model was found to be better as compared to pooled OLS regression model for both the life and non-life insurance segment. Further, Hausman specification test was applied to compare the suitability of fixed-effect model or random effect model for the present study. The P -value in this case was also found to be small, suggesting rejection of H_0 . Thus, fixed-effect model was found to be more appropriate as compared to random-effect model in case of both the markets i.e., life and non-life insurance market. Also, M-Estimation method (Maximum Likelihood type Estimation) method was used to get the more robust results by dealing with the problem of data sensitivity to outliers. In addition to this, Huber-White-Sandwich Estimator for variance was invoked to the fixed-effect model for controlling the presence of serial correlation and heteroskedasticity in case of the non-life insurance market. On the other hand, homoskedasticity was observed in case of the Indian life insurance market. The final empirical model that has been used for examining the effect of market competition on the financial soundness is given as:

$$\ln(Z_{it}) = \alpha + \beta_1 (\text{Boone}_{it}) + \sum_{t=1}^N \beta_2 (\text{Control Variables}_{it}) + e_{it} \quad (4)$$

where,

Z_{it} = financial soundness of an insurer i in the year t as defined in equation 3;

$\ln(Z_{it})$ = natural logarithm of Z_{it} ¹⁴;

$Boone_{it}$ = the Boone index i.e., measure of competition for an insurer i in the year t ;

Control Variables = SIZE, AGE, LEVERAGE, EFFICIENCY, and GROWTH;

ϵ_{it} = error term

Here, a negative value of standardized coefficient of the Boone index variable would indicate that reallocation effect is occurring within the particular industry and is enhancing its financial soundness. This means that, the efficient firms would be able to earn higher profits and market share at the expense of less efficient firms and ultimately, this will enhance the financial stability in the respective life and/or non-life insurance market. The software packages used for the purpose of data analysis were SPSS (version 20) and STATA (version 12).

5.4 Summary Statistics

The descriptive data for the sample companies has been presented in Table 1 sectioned into four panels. Panels A and B give description of the total number of firm-year observations, mean values, medians, standard deviation and range of all the key variables for selected sample of the life and non-life insurance firms, respectively. Considering 330 firm-year observations in each market, average Z (Z -score) of the life and non-life insurers was found to be 58.67 and 18.02, respectively. This means that on an average, stability of the Indian life insurance firms is more as compared to non-life insurance firms. Overall, lower competition was observed in the Indian life as well as non-life insurance industry as average β (i.e., the Boone indicator) was found to be 0.20 (for life-insurers) and 0.73 (for non-life insurers).

With respect to the control variables used in present study, SIZE has varied greatly ranging from as low as ₹ 139.69 crores to as high as ₹ 27,91,615.25 crores among the life insurers. In case of the non-life insurance firms, SIZE has varied from ₹ 0 to ₹ 52,308.81 crores within the selected sample. Average AGE of the life insurance firms was found to be 12 years, youngest firm being 1 year old and oldest company being 62 years old. On the other hand, average AGE of non-life insurance firms was observed to be 22 years, with a range of 1 year being minimum age and 99 as the maximum age. Added, LEVERAGE ratio was observed to be ranging from 0.02 times (minimum) to 3,182.33 times (maximum) in case of the life insurance firms. For the Indian non-life insurance market, there were companies having minimum LEVERAGE of -0.02 times, maximum being 112.67 times. Positive average LEVERAGE suggests that the insurers assume risks in order to improve their profitability. Furthermore, EFFICIENCY of the insurance companies for managing accounts receivables was observed to be 0.41 times and 2.33 times of the book value of total assets in the life and non-life insurance market, respectively. In addition to this, average GROWTH of 77 per cent was observed in the life insurance industry and 18 per cent in non-life insurance industry during the entire sample period.

Panel C provides the correlation coefficients between all the key variables used in the study for the life insurance market, while Panel D gives the correlation coefficients matrix for the non-life insurance market. In case of the Indian life insurance industry, $\ln(Z)$ (i.e., financial stability) has a significantly negative correlation with the GROWTH. Also, AGE and LEVERAGE bear a negative but insignificant association with $\ln(Z)$. However, β (i.e., the Boone indicator), SIZE and EFFICIENCY shows insignificant yet positive relationship with $\ln(Z)$. On the other hand, in case of the non-life insurance firms, $\ln(Z)$ has significantly negative association with SIZE and LEVERAGE, while having positive association with EFFICIENCY. Also, β and AGE have negative but insignificant correlation with $\ln(Z)$. Furthermore, in

contrast to the results of life insurance firms, GROWTH shows insignificant yet positive association with $\ln(Z)$.

Table 1: Descriptive Statistics for the Sample Companies

Panel A: Summary statistics for the sample companies in the life insurance industry							
Variable	Obs.	Mean	Median	Std. Dev.	Minimum	Maximum	
Z	330	58.67	16.37	163.72	0.13	1602.86	
β	330	0.20	0.20	0.07	0.00	0.31	
SIZE (₹ Cr)	330	92390.66	10008.04	374813.79	139.69	2791615.21	
AGE (Years)	330	12.00	10.00	10.75	1.00	62.00	
LEVERAGE (times)	330	111.07	2.45	494.19	0.02	3182.23	
EFFICIENCY (times)	330	0.41	0.35	0.50	0.06	7.10	
GROWTH (times)	330	0.77	0.16	6.86	-0.86	101.39	
Panel B: Summary statistics for the sample companies in the non-life insurance industry							
Variable	Obs.	Mean	Median	Std. Dev.	Minimum	Maximum	
Z	330	18.02	8.88	27.26	-1.96	189.11	
β	330	0.73	0.69	0.48	0.00	1.38	
SIZE (₹ Cr)	330	4950.55	1093.54	9172.16	0.00	52308.81	
AGE (Years)	330	22	11.00	27.67	1.00	99.00	
LEVERAGE (times)	330	15.70	4.32	23.55	-0.02	112.67	
EFFICIENCY (times)	330	2.33	1.94	1.30	0.00	6.85	
GROWTH (times)	330	0.18	0.13	0.26	-0.43	1.77	
Panel C: Correlation coefficient matrix for the life insurance industry							
Variable	$\ln(Z)$	β	$\ln(SIZE)$	$\ln(AGE)$	LEVERAGE	EFFICIENCY	GROWTH
$\ln(Z)$	1						
β	0.123	1					
$\ln(SIZE)$	0.019	0.163*	1				
$\ln(AGE)$	-0.059	-0.229**	0.455**	1			
LEVERAGE	-0.101	0.014	0.615**	0.300**	1		
EFFICIENCY	0.021	0.051	0.192**	0.188**	0.397**	1	
GROWTH	-0.242*	-0.177**	-0.108	-0.065	0.003	-0.027	1
Panel D: Correlation coefficient matrix for the non-life insurance industry							
Variable	$\ln(Z)$	β	$\ln(SIZE)$	$\ln(AGE)$	LEVERAGE	EFFICIENCY	GROWTH
$\ln(Z)$	1						

β	-0.085	1					
ln(SIZE)	-0.360* *	0.119	1				
ln(AGE)	-0.127	-0.322**	0.374**	1			
LEVERAGE	-0.336* *	0.057	0.711**	0.191**	1		
EFFICIENCY	0.204* *	0.130	-0.086	-0.090	-0.062	1	
GROWTH	0.112	0.128	-0.138* *	-0.074	-0.213**	0.022	1

Source: Author’s own calculation using the Handbook of Indian Insurance Statistics.

Notes:

1. Table provides descriptive information of 330-firm year observations in each segment of the Indian insurance industry over FY 2009-2023.
2. The symbols *, ** and *** indicates the statistical significance at .1, .05 and .01 levels, respectively
3. Definitions of all the variables are given in Annexure 2.

6. Results and Discussions

6.1 Analysis of Competition

Table 2 exhibits the results of degree of competition existing in both Indian life and non-life insurance segments, as measured for the entire sample period. Panel A and B shows coefficient of the Boone index (i.e., β) measured for the life insurance and non-life insurance market, respectively. The results of the regression equation 1 highlight that in both cases, the standardized coefficients of marginal costs are significantly and positively influencing profitability of the insurance firms. For the life insurers, ln(MC) (β = .257; p < 0.05) show a significantly positive influence on the dependent variable i.e., Π with the R² = 60 per cent. Similarly, for the non-life insurers, ln(MC) (β = .714; p < 0.05) bear a significant and positive relation to Π (R² = 39.8 per cent).

The positive relationship between marginal costs and profitability means that in case of both segments of an Indian insurance industry, when companies want to enhance their profit margin, they need to incur additional costs. This is due to the fact of existence of high level of concentration in both the segments of Indian insurance market, as explained earlier. In the more concentrated markets, competition decreases and inefficient firms need to incur additional operating costs for ensuring required level of profit margin (Camino et al., 2019). The results of this study are also in support of the findings by Murat et al. (2002), wherein the researchers had studied the Australian non-life insurance market. The study found that in monopolistic competition, insurers are forced to increase their prices with the increase in their marginal costs for ensuring the required profit margin. Hence, positive β (i.e., the Boone index) coefficient indicates the high level of concentration and ultimately, low level of market competition in both the segments of an Indian insurance industry.

Table 2: Estimation of the Boone Index

Dependent Variable: <i>H</i>		
Variable	Coef.	t-value
Panel A: Life Insurance industry		
ln(MC)	0.257**	18.07
Constant	-0.009	-0.72
R Square	0.600	
No. of observations	330	
Panel B: Non-Life Insurance Industry		
ln(MC)	0.714**	3.83
Constant	0.077**	2.75
R Square	0.398	
No. of observations	330	

Source: Author’s own calculation.

Notes:

1. Table provides results of the regression equation 1 for the 330-firm year observations in each segment of the Indian insurance industry over FY 2009-2023.
2. The t-statistics of the standardised coefficients are based on robust standard errors.
3. The symbols *, ** and *** indicates the statistical significance at .1, .05 and .01 levels, respectively.
4. Definitions of all the variables are given in Annexure 2.

In addition to this, Table 3 presents the Boone indices calculated on yearly basis, separately for the sample of life and non-life insurance firms. The yearly Boone indices were required to be calculated for constructing the panel data, so as to analyse the effect of market competitiveness on the financial soundness of insurance firms. For this purpose, year dummies were included and interacted with ln(MC) in equation 1 to get equation 2. The results of the regression equation 2 depicts that estimated coefficients of the yearly Boone indices are quantitatively similar to the results for entire sample period as shown in Table 2. With respect to the life insurance segment, significant and positive influence of marginal costs is being observed on profits of the insurance firms each year (adjusted $R^2 = 48.7$ per cent). Thus, positive β indicates the existence of weak competition among the Indian life insurance companies. Similarly, for the non-life insurance firms, marginal costs bear a significantly positive influence on the profitability of insurance firms in most of the financial years during the study period (adjusted $R^2 = 51.7$ per cent). In this case also, the Boone indices points out high level of concentration and thus, weak competition among non-life insurers.

On careful observation, a slight increase in competition can be noticed in both the segments after FY 2013-14. This is due to the fact that in the Indian insurance industry, the Foreign Direct Investment (FDI) limit had increased from 26 per cent to 49 per cent in December, 2014. This encouraged more foreign players to enter the insurance sector and hence the competition accelerated in the Indian insurance sector to certain extent. These findings are also similar to the previous studies done by Alhassan and Biekpe (2017) and Pope and Ma (2008), which concluded the positive association between liberalisation of insurance market and high market concentration. Further, after the financial year 2015-16, concentration indices improved (IBEF Report, 2023) due to which level of competition started worsening in both the segments.

Table 3: Estimation of the Yearly Boone Indices

Dependent Variable: <i>II</i>				
	Life Insurance Industry		Non- Life Insurance Industry	
Year	Coef.	t-value	Coef.	t-value
Intercept	0.148**	5.35	0.055	0.75
2009	0.235**	7.73		
2010	0.257**	6.98	0.621**	10.39
2011	0.211**	4.10	0.758**	8.11
2012	0.177**	3.42	1.302**	2.76
2013	0.305**	6.20	1.343**	2.60
2014	0.189**	2.11	0.437	1.5
2015	0.223**	2.28	0.210	1.02
2016	0.194**	2.31	0.286	1.2
2017	0.195**	1.74	0.929**	3.13
2018	0.213**	1.88	1.379**	8.60
2019	0.245**	5.25	0.231	2.02
2020	0.218**	6.36	0.249	2.16
2021	0.266**	7.96	0.267	2.30
2022	0.293**	9.56	0.285	2.44
2023	0.319**	11.16	0.303**	2.58
Year Dummies	Included		Included	
Adjusted R Square	0.487		0.517	
No. of Observations	330		330	

Source: Author’s own calculation.

Notes:

1. Table provides results of the regression equation 2 for the 330-firm year observations in each segment of the Indian insurance industry over FY 2009-2023.
2. The t-statistics of the standardised coefficients are based on robust standard errors.
3. The symbols *, ** and *** indicates the statistical significance at .1, .05 and .01 levels, respectively.
4. The regression equation 2 includes 14 year dummies for the FY 2008-09 to 2022-23, but the coefficients of year dummies are not reported in the table.

6.2 Competition and Stability

By using the Boone values calculated through equation 2, the regression equation 4 examines the effect of market competition on the financial soundness of both segments of the Indian insurance industry. Table 4 reports the results using a fixed-effect regression model for entire sample of the life as well as non-life insurance firms in India. The empirical analysis has also accounted for some firm-specific factors i.e., SIZE of the firm, AGE, LEVERAGE, EFFICIENCY and GROWTH of the business.

For the life insurance industry, standardized coefficient value of the Boone index is negatively and significantly associated with $\ln(Z)$ ($\beta = -3.230; p < 0.05$). This means, when the competition increases in the life insurance industry, profit allocation effect occurs and efficient firms enjoy more market share, more profits at the expense of inefficient ones. When more market share is captured by efficient firms,

this enhances the financial soundness of insurance industry as a whole. Thus, results of this study support the competition-stability hypothesis developed by Boyd and De Nicolo (2005), which assumes that competition enhances financial stability.

Further, results also support the transmission mechanism hypothesis by concluding that efficiency is the mechanism through which market competition enhances financial soundness. Hence, H1 of the present study is supported. For the non-life insurance firms also, results of the regression equation 4 (Adjusted R² = 15.9 per cent) reports negative and significant coefficient of the Boone indicator ($\beta = -0.494; p < 0.05$). Thus, similar to the life insurance industry, these results support competition-stability hypothesis as well as transmission mechanism hypothesis, consequently proving H2 of the present study.

Concerning the analysis related to control variables, all coefficients reported for the life insurance industry are in line with the previous literature. SIZE ($\beta = 1.109; p < 0.05$) has a significant and positive influence on ln(Z). This is in support with earlier studies which proves that larger is the size of insurers (based on total assets), lower are the chances of firms being getting failed. Thus, SIZE is positively related to financial soundness (Berger et al., 1993; Cummins et al., 2017; Schaeck and Cihak, 2008). AGE ($\beta = -0.298; p < 0.05$) and growth ($\beta = -0.036; p < 0.05$) bear a significant and negative influence on the financial stability of insurance companies. One of the possible arguments for this can be that insurance companies start investing into risky assets with more experience and during growth years, which affect their soundness adversely (Berger et al., 2009). Also, LEVERAGE has a positive yet insignificant effect on stability of life insurers. In addition to this, EFFICIENCY ($\beta = .515; p < 0.05$) also enters the regression equation significantly as higher the efficiency of life insurance in managing accounts receivable, higher is the financial stability (Cummins et al., 2017). The adjusted R² for this model is 31.5 per cent.

On the other hand, with respect to the non-life insurance, only one control variable i.e., SIZE ($\beta = 0.64; p < 0.05$) has a significantly positive influence on the financial soundness of non-life insurance firms. All other variables i.e., AGE, LEVERAGE, EFFICIENCY and GROWTH do not enter the regression equation significantly. This might be due to the fact that life insurance companies have only single product market, while non-life insurers have well diversified range of products which reduces the insolvency risk of non-life insurance business to certain extent (Alhassan and Biekpe, 2016). This in turn might overcome the influence of the control variables considered in this study for non-life insurers.

Table 4: Effect of Competition on Financial Stability in the Indian Insurance Industry

Dependent Variable: ln(Z)				
Independent variables	Life Insurance Industry		Non-Life Insurance Industry	
	Coef.	t-value	Coef.	t-value
Boone	-3.230**	-2.76	-0.494**	-3.46
ln(SIZE)	1.109**	7.78	0.634**	2.34
ln(AGE)	-0.298**	-2.84	0.046	0.61
LEVERAGE	0.000	-0.53	0.012	1.12
EFFICIENCY	0.515**	2.91	-0.024	-0.08
GROWTH	-0.036**	-3.2	0.164	0.45
Constant	-6.435**	-5.37	-2.417	-1.53
R Square	0.315		0.159	
No. of observations	330		330	
Hausman Test (p- value)	0.000		0.000	

Source: Author's own calculation.

Notes:

1. Table provides results of the regression equation 4 for the 330-firm year observations in each segment of the Indian insurance industry over FY 2009-2023.
2. The t-statistics of the standardised coefficients are based on robust standard errors.
3. The symbols *, ** and *** indicates the statistical significance at .1, .05 and .01 levels, respectively.
4. Definitions of all the variables are given in Annexure 2.

7. Conclusion and Implications

The Indian insurance industry operates under two major segments, i.e., life insurance market and non-life insurance market. Both these markets consist of public, private as well as foreign players. The entry of private and foreign investors was allowed in insurance sector when the Insurance Regulatory Development Authority (IRDA) Bill, 2000 was passed in the parliament under IRDA Act, 1999. The present study offers a discussion about whether the liberalisation of the insurance sector in 2000 resulted into enhanced competition in the Indian life and non-life insurance market. It also endeavours to elucidate the competition-stability nexus in terms of whether more competition leads to financial stability of the life and non-life insurers.

In an attempt to measure market competition, study uses the Boone (2008) index which measures competition in terms of the operational efficiency of firms. The results of the study find weak competition and even worsening of market competition over the study period in both segments of the Indian insurance industry. Plausibly, competition is declining over the period owing to the continuous increase in concentration among big insurers in both the markets. Further, on investigation of the competition-stability relationship in both segments using panel regression analysis, study unravels the positive influence of competition on the financial soundness (measured by the Z-score). This means, higher market competition in the Indian insurance industry leads to enhanced financial stability of the industry as a whole. However, these results are not homogeneous across efficient and inefficient insurance firms. By using the Boone indicator, study confirms that high level of market competition has larger influence on the financial stability of inefficient insurers than on the efficient insurers. In addition, the study also finds that size of insurance firms significantly and positively influences the financial stability of insurers in both segments. These findings can offer relevant insights to the policymakers for designing public policies which can promote competition. As the study provides empirical evidences of declining competition in the Indian insurance sector, this could be the point of concern for policymakers. For example, in order to promote market competition, operational efficiency of the insurance firms can be focused on while formulating policies. The understanding of operational efficiency of insurers can help, as such if competition increases, inefficient insurance can benefit from enhanced solvency margins.

Pointedly, these results suffer from some potential limitations. First, the data source used for collecting data is assumed to be completely reliable, although some insurance firms may not be able to report certain expenses in real way due to difference in size and nature of their business operations. Second, the competition-stability relationship may get affected by various other factors like corporate strategy factors, economic factors, etc., which have not been accounted for in the regression model of the study. Finally, the influence of control variable used in study is found to be more vibrant in case of the life insurance market as it is single product market. So, the results for this market should be interpreted with caution.

Despite these limitations, the major contribution of this paper is that it is an initiatory attempt in the Indian insurance market which empirically establishes the relationship between competition and stability using the Boone indicator. Another important contribution of this research study is that unlike earlier studies, it comprehensively studies the life and non-life insurance industry of India. With regards to the future research areas, one can go for cross-country analysis for evaluating the degree of competition in different insurance markets. Moreover, present study can be further extended for analysing competition-stability nexus across different countries. Furthermore, different model specifications can be done, different proxies can be used for measuring competition, as such extensions might divulge different results on the competition-stability nexus.

8. Notes

1. ^{1a 1b} Market share is in terms of new business premium generation.
2. By February, 2023, six major players in non-life insurance market were: The New India Assurance Co. Ltd. with 14 per cent market share, United India Insurance Co. Ltd. with 9.9 per cent share, ICICI LOMBARD General Insurance Co. Ltd. having 8.9 per cent share, National Insurance Co. Ltd. with 8.6 per cent share, The Oriental Insurance Co. Ltd. with 7.7 per cent and Bajaj Allianz General Insurance Co. Ltd. having 6.6 per cent market share (in terms of new business premium generation).
3. Traditionally, negative association was being observed between concentration levels and competition (i.e., competition decreases when concentration increases). However, the recent studies have shown that if consolidation occurs as a result of increasing competition, positive relationship can be expected among both variables.
4. The study included the use of Entropy index (ENT), Ginevicius index, GRS index, the Hall-Tideman index (HTI), Herfindahl-Hirschman index (HHI), Hovarth index (HOX) and K- concentration ratio (CRk) as the different measures of concentration.
5. Before FY 2008-09, number of the Indian life and non-life insurance firms was very less. Most of the insurance companies which presently exist were either not incorporated or had not started business operations even after incorporation. So, to ensure sufficient number of firm-year observations for panel data analysis, sample period begins from FY 2008-09.
6. The life insurance firms which were eliminated from sample are: Edelweiss Tokio Life Insurance Company and India first Life Insurance Company. Both these insurance firms were incorporated after FY 2008-09.
7. The non-life insurance companies which were eliminated from sample are: Acko General Insurance Ltd., Aditya Birla Health Insurance Co. Ltd., CIGNA TTK Health Insurance Co. Ltd., DHFL General Insurance Ltd., Edelweiss General Insurance Co. Ltd., Go Digit General Insurance Ltd., ITI General Insurance Co. Ltd., Kotak Mahindra General Insurance Co. Ltd., Liberty General Insurance Ltd., Magma HDI General Insurance Co. Ltd., Max Bupa Health Insurance Co. Ltd., Religare Health Insurance Co. Ltd., and SBI General Insurance Co. Ltd. All these insurers came into existence after FY 2008-09.
8. While the Boone index (measured as a standardized coefficient of marginal costs) is expected to be a negative value, no defined threshold is there for identifying whether industry is competitive or not. Moreover, it is not surprising for the empirical studies to find positive coefficient values of the Boone indicator, particularly when estimated over the years (e.g. Van Leuvensteijn et al., 2011).

9. Following Boone (2005), many researchers have used AVC as a proxy for marginal costs (e.g. Bikker and Van Leuvensteijn, 2008; Schaeck and Cihak, 2014). Also, some studies have attempted to measure marginal costs through a cost frontier (e.g. Van Leuvensteijn et al., 2011), but this method is complex when determining multi-output cost functions (Cummins et al., 2017).
10. Regression equation 2 is formulated by following Cummins et al. (2017).
11. In other words, the standard deviation of the rate of return on assets for one particular year (e.g. 2009) is estimated as the average of three year rolling values (2007-2009).
12. Size of an insurance firm is controlled as the prior literature offers very divergent results related to the relationship between size and soundness of the firm. Some research studies have shown that larger firms are more likely to achieve cost and profit efficiency, which enhances their financial soundness (Berger et al., 1993; Hao and Chou, 2005). On the other hand, Fama and Jensen (1983) proved that large firms may face difficulties in monitoring large-scale operations and this may increase insolvency risk of such business.
13. Fixed panel data is the data set in which same entities (or individuals) are observed in each period (Greene, 2008).
14. The natural log of the Z-score is used for controlling non-linear effects and outliers (following Demirguo-Kunt et al., 2008; Pasiouras and Gaganis, 2013).

9. Annexures

Annexure 1: Number of the Life and Non-Life Insurance Companies in India over FY 2008-09 to 2022-23.

<i>Life Insurance Market</i>		<i>Non-Life Insurance Market</i>	
Year	Number of firms	Year	Number of firms
2008-09	22	2008-09	22
2009-10	23	2009-10	24
2010-11	23	2010-11	25
2011-12	24	2011-12	25
2012-13	24	2012-13	27
2013-14	24	2013-14	29
2014-15	24	2014-15	30
2015-16	24	2015-16	30
2016-17	24	2016-17	30
2017-18	24	2017-18	33
2018-19	24	2018-19	36
2019-20	24	2019-20	34
2020-21	24	2020-21	33
2021-22	24	2021-22	32
2022-23	24	2022-23	33

Source: Handbook of the Indian Insurance Statistics issued by IRDA.

Annexure 2: Variable Description

Variable	Acronym	Description
Panel A: Dependent variable and its components		
Z-score	Z_{it}	Measure of financial soundness calculated by equation (2).
Natural logarithm of Z-score	$\ln(Z_{it})$	Natural Logarithm of the Z-score calculated in equation (2).
Return on assets	ROA_{it}	Net profit after taxes/ total assets
Ratio of equity to total assets	$EqAst_{it}$	Shareholders equity/ total assets
Standard deviation of return on assets	$\sigma_{ROA_{it}}$	Standard deviation of return on assets using a three-year rolling time window.
Panel B: Independent variable and its components		
Boone Indicator	β	Measure of Competition calculated by equation (1).
Profit of Insurer	Π_{it}	Profit of the insurance company measured as difference between variable revenues and variable costs, scaled by total assets.
Marginal costs	MC_{it}	Marginal costs of company measured by proxy of average variable costs.
Natural logarithm of marginal costs	$\ln(MC_{it})$	Natural log of marginal costs measured through proxy of average variable costs.
Average variable costs	AVC	Variable costs/ variable revenues
Variable revenue	VR	Sum of net premiums and net investment income.
Panel C: Control Variables- Company-specific		
Size of firm	SIZE	The natural log of book value of total assets of the insurance company.
Firm age	AGE	The natural log of the number of years since the company's incorporation.
Firm risk	LEVERAGE	Net premium divided by equity capital.
Efficiency of Insurer's accounts receivable management	EFFICIENCY	Invested assets divided by total assets
Assets Growth of the firm	GROWTH	The percentage change in the book value of total assets over the period of one year (i.e., $\frac{\text{Total assets}_{i,t} - \text{Total assets}_{i,t-1}}{\text{Total assets}_{i,t-1}}$)

Source: Drawn from literature.

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