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Financial Stability of Iran's Insurance Industry: A Multidimensional Approach

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Growing concerns over financial crises have prompted international organizations to introduce various sub-indices to measure financial stability (FS). In the insurance sector, financial failures and insolvency events can significantly impact stakeholders including policyholders, shareholders, and investors. Therefore, regulatory authorities require robust tools to monitor the financial resilience of insurance firms. This study aims to construct a multidimensional FS index for Iran's insurance industry using annual data from 2006 to 2018. Relying on 27 theoretically and empirically grounded sub-indicators, we apply the Principal Component Analysis (PCA) method to develop a composite FS index. The results reveal a long-term downward trend in the industry's financial stability, indicating increasing systemic vulnerability. In contrast, short-term fluctuations reflect temporary responses to economic and policy shocks. Moreover, capital market reactions appear to align with changes in the FS index, suggesting that the index has predictive value for investor behavior.

Keywords: Financial Stability, Financial Health, Insurance Industry, Principal Component Analysis, Market Value
JEL Classification*:* C38, L22, L2, G22

1 Introduction

The convergence of global economic trends, evolving social dynamics, geographical shifts, rapid technological advancements, and the unprecedented speed of information exchange has created a complex new reality for financial institutions and enterprises worldwide. These forces simultaneously generate

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opportunities and amplify risks, necessitating innovative management strategies (Aon, 2017). Within this landscape, insurance companies—as critical pillars of economic stability play a foundational role in safeguarding societal resilience. However, financial scandals and bankruptcies within these institutions can trigger systemic repercussions, harming shareholders, policyholders, beneficiaries, and broader economic ecosystems. For instance, the collapse of major insurers during the 2008 financial crisis demonstrated how instability in this sector can cascade across markets (IMF, 2019).

As and efficient insurance system not only serves as an essential safeguard for protecting individual and institutional assets, but also functions as a vital channel for directing institutional and retail investment resources into capital markets, thereby supporting credit creation and economic growth. To preserve this strategic role, the International Association of Insurance Supervisors (IAIS) emphasizes the necessity of developing and implementing multidimensional and composite indicators capable of providing a more precise and comprehensive assessment of financial stability. Such indicators must go beyond traditional one-dimensional measures such as capital adequacy ratios, solvency metrics, or liquidity risk indicators and instead capture the dynamic interactions among macroeconomic conditions, regulatory frameworks, and the operational performance of the insurance industry. Nevertheless, despite the evident need for such comprehensive tools, many existing frameworks continue to fall short in adequately addressing the complex challenges facing the insurance sector an issue reflected in the persistence of systemic vulnerabilities and the declining trajectory of public trust in the industry (OECD, 2020)

This gap underscores the urgency of developing a multidimensional FS index. Prior studies, such as those by Alharthi (2017) and Tagkalakis (2014), have relied on narrow metrics like return on assets (ROA) or debt-to-asset ratios, which provide limited insights into systemic stability. Similarly, liquidity and capital adequacy metrics—highlighted by Sharp and Stadnik (2007) and Smajla (2014)— overlook broader macroeconomic interdependencies. In response, global institutions like the IMF, IAIS, and OECD have advocated for sub-indices that integrate diverse dimensions of risk and performance.

This study introduces an innovative 27-subindex multidimensional framework to evaluate FS in Iran's insurance industry. By synthesizing variables such as regulatory compliance, market volatility, policyholder behavior, and macroeconomic shocks, this approach mitigates distortions inherent in one-dimensional models. For example, while traditional indices

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might overlook the impact of geopolitical instability on insurer solvency, our framework explicitly incorporates such factors. The resulting tool equips policymakers and regulators with actionable insights to enhance systemic resilience, aligning with the IAIS's call for dynamic, adaptive supervision.

This paper is structured as follows: Section 2 reviews the theorical and empirical literature on FS, including its conceptual evolution and measurement challenges. Section 3 details the methodology for constructing the Principal Component Analysis (PCA)-based FS index. Section 4 presents empirical findings, and Section 5 concludes with policy implications and directions for future research.

2 Literature Review

2.1 Theoretical Foundations and Definitions of Financial Stability (FS)

The first step in developing a practical approach to assessing financial stability (FS) is establishing a clear definition that delineates the boundary between stable and unstable financial conditions. While a universally applicable definition across countries and contexts remains elusive, insights from prior literature help extract essential characteristics of FS. Several scholars and institutions, including Schinasi (2004), have criticized equating FS simply with the absence of systemic risk, warning that such definitions may mislead policymakers and hinder effective interventions.

The World Bank emphasizes that FS implies the system's ability to operate effectively during periods of stress, maintaining functionality in resource allocation, risk management, and price stability. It also highlights the macroeconomic consequences of instability, such as hyperinflation and severe market disruptions. Similarly, the International Monetary Fund describes a stable system as one that supports economic growth and addresses endogenous and exogenous imbalances. (Schinasi, 2004)

Numerous researchers, including Chant (2003), and Phan et al. (2021), have explored FS as a multifaceted concept encompassing core financial institutions, intermediaries, and market mechanisms. According to Allen and Wood (2006), FS should not be confined to a narrow definition but viewed as a continuum adaptable to evolving economic and financial environments.

2.2 Empirical Approaches to Measuring Financial Stability

Measuring FS has become a central focus in financial sector supervision, especially post-2008. Scholars have employed a variety of techniques,

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including performance indicators, capital adequacy metrics, and the Z-score method.

$$Z_{i,t} = \frac{ROA_{i,t} + E/A_{i,t}}{\sigma ROA_{i,t}} \quad (1)$$

In the equation, ROA represents a measure of profitability defined as the ratio of net profit after tax to total assets. E/A is an investment measure, representing the ratio of equity to assets, while σ_{ROA} denotes the standard deviation of ROA, indicating the volatility of returns (Kramarić et al., 2019).

Studies by Barzideh et al. (2012) and Stevanovic et al. (2020) reflect the diversity of methods used, such as the CARAMELS framework and actuarial analysis. The Z-score, frequently referenced in works by Shim (2011, 2017) and Cummins et al. (2017) is inversely related to the likelihood of insolvency and incorporates profitability (ROA), equity-to-assets ratio (E/A), and ROA volatility.

International institutions like the IMF, IAIS, and NAIC have also made significant contributions. The IMF's framework features 22 sub-indices categorized under seven domains, including capital adequacy and sensitivity to market risk. The NAIC developed the Insurance Regulation Information System (IRIS), with tailored indices for different types of insurers, reflecting a systematic approach to early intervention and monitoring.

2.3 Recent Advances in FS Analysis and Multidimensional Indices

Recognizing the multidimensional nature of FS, recent studies advocate for composite indices incorporating diverse indicators. Rajabpour et al., (2019) and Khitrova et al., (2020) emphasize the value of integrated approaches that account for both internal and external factors affecting financial stability. Siopi and Poufinas (2023) also argue that FS analysis benefits from dynamic indicators capturing vulnerabilities from multiple dimensions. For instance, Přečková and Palečková (2023) developed an FS index for Czech insurance companies, examining both life and non-life sectors. Their findings highlight that firms specializing in non-life insurance showed stronger FS, and organizational dynamics influenced long-term resilience.

Bitetto et al. (2023) proposed a machine-learning-based FS index for 119 countries over 17 years, incorporating IMF indicators. Their study shows that traditional statistical models often fail to account for market dynamism and policy-related variables, underscoring the value of data-driven approaches.

A critical examination of the theoretical foundations of commonly employed methods and models for evaluating financial stability (FS) reveals

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that many of these approaches often fail to account for key functional factors and their dynamic characteristics. To overcome these limitations, this study utilizes a composite FS index constructed through the Principal Component Analysis (PCA) method, which enables the integration of multiple relevant indicators into a unified analytical framework.

The FS of Iran's insurance industry is assessed based on the conceptual model illustrated in Figure 1, which is adapted from frameworks developed by the International Monetary Fund (IMF) and the organization for Economic Co-operation and Development (OECD), and implemented using the PCA approach. The IMF applies this model within its Financial Sector Assessment Program (FSAP), and it is endorsed by the World Bank (WB) and the United States Agency for International Development (USAID) (Rossiter, 2006, as cited in OECD, 2016). Furthermore, this model has been widely used in both academic research and official reports across a range of countries, including OECD members, various Asian economies, and South Africa (OECD, 2016).

Given the credibility and scientific rigor associated with the IMF and OECD, adopting this conceptual framework provides a robust foundation for cross-country and institutional comparisons. Accordingly, this study adopts the IMF-OECD model as the analytical basis for evaluating FS in the Iranian insurance sector.

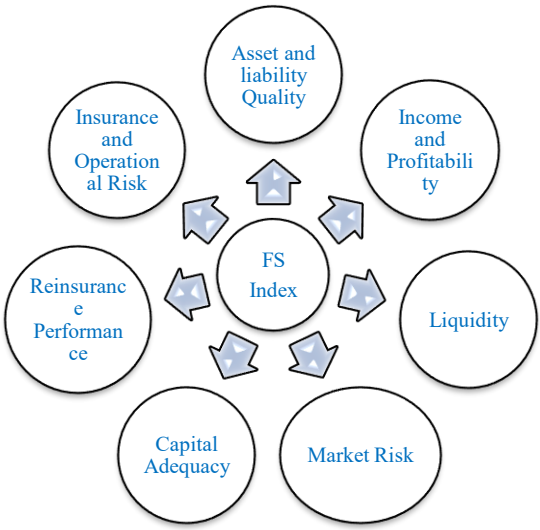

Figure 1. Conceptual model, *Source:* IMF, 2006; OECD, 2016

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2.4 Selecting sub-indices of Principle Components

Given the extensive number of indicators initially considered for constructing the Financial Soundness (FS) index using Principal Component Analysis (PCA), and in light of the challenges associated with calculating certain indicators—primarily due to the unavailability of statistical data and the specific characteristics of Iran's insurance industry—the Delphi method was employed to refine and prioritize the most relevant indicators.

A panel of industry experts was engaged to evaluate the importance of each sub-indicator using a structured questionnaire. Participants rated each indicator on a scale from 0 to 10 based on their professional expertise and practical experience in the insurance sector, and were also encouraged to provide qualitative feedback on the relevance and significance of each variable.

The target population included technical experts, assistant and financial managers, risk managers, supervisors in financial regulation, insurance department professionals, and claims specialists across insurance companies. In total, 46 completed questionnaires were returned and utilized as the foundation for prioritizing and selecting the final sub-indicators.

Based on the analysis of expert feedback, a refined set of indicators—presented in Table (1)—was selected for calculating the FS index of Iran's insurance industry. In the resulting dataset, Xij denotes the value of sub-indicator j for insurance company i, where i=0,…,24 represents the companies, and j=0,…,27 refers to the sub-indicators outlined in Table (1).

2.5 Gaps in Literature and Research Justification

Despite the abundance of models, many approaches overlook critical functional dimensions of FS, particularly in the insurance sector. To address this gap, this paper employs a principal index approach using Principal Component Analysis (PCA). Based on a conceptual model adapted from the IMF and OECD—endorsed by institutions like the World Bank and USAID—this methodology allows meaningful cross-country comparisons and captures systemic risks effectively.

The PCA-based model used here, recommended in various global assessments (OECD, 2016), has been implemented in several countries and provides a scientifically robust framework for assessing FS in insurance. By adopting this approach, the present study aims to provide a comprehensive, context-sensitive evaluation of FS in Iran's insurance industry.

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3 Methodology and data

3.1 Method of Constructing the Principal Components

To construct principal components, a systematic methodology is applied to aggregate multiple sub-indices into a single representative measure. A principal index is a quantitative measure derived from the aggregation of multiple sub-indices. This process involves selecting and synthesizing individual indicators based on a theoretical framework with a multidimensional conceptual orientation. Stiglitz et al. (2009) note that principal indices condense a large number of metrics into a single value, which facilitates comparisons across different dimensions and entities (Rajabpour et al., 2019). In this study, the Principal Component Analysis (PCA) method is employed to construct the principal index.

PCA is a statistical technique designed to analyze a set of correlated variables within one or more domains. Its primary applications include multivariate analysis, dimensionality reduction, structure detection, and index construction. This method is particularly advantageous in situations where the dimensional structure of the data is complex or not well understood. PCA is widely used across various disciplines, with one of its key roles in economic research being the development of composite indices.

Given the diverse and numerous sub-indices that characterize financial soundness (FS), the construction of a principal index is essential to capture the latent information embedded in these sub-indicators. The principal objective of PCA in this context is to reduce the number of variables while preserving as much of the original informational content as possible (Fakhry, 2012).

Since principal components reduce large and complex datasets into smaller, more manageable dimensions, ensuring the reliability and validity of the results is essential. To achieve this, several statistical inference procedures are typically applied. These include estimating the eigenvalue distances of the covariance matrix, conducting the PCA test, selecting appropriate components, and performing eigenvalue (characteristic root) analysis of the covariance matrix. These steps are designed to evaluate the adequacy and suitability of the principal components used in the analysis.

Before performing PCA, a preliminary correlation structure test is conducted to examine whether the correlation coefficients among the variables are statistically different from one another. If all correlation

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coefficients are equal, the eigenvalues of the covariance matrix are also equal, implying that PCA is not appropriate for extracting meaningful components. To assess this structure, the Kaiser-Meyer-Olkin (KMO) test is commonly used:

$$KMO = \sum_{j=1}^{k}\sum_{i\neq j}^{k} r_{ij}^{2} / (\sum_{j=1}^{k}\sum_{i\neq j}^{k} r_{ij}^{2} + \sum_{j=1}^{k}\sum_{i\neq j}^{k} \rho_{ij}^{2}) \quad (2)$$

In this equation, rij represents the simple correlation coefficient, and pij denotes the partial correlation coefficient. The KMO statistic ranges from 0 to 1. A value below 0.5 indicates that the data are not suitable for PCA, and the principal components should not be used. Another widely used test to assess the adequacy of data for PCA is Bartlett's test of sphericity. However, one of the prerequisites for both the KMO and Bartlett's tests is that the number of time periods (observations) must be at least equal to or greater than the number of variables. In this study, the number of sub-indicators exceeds the number of years observed, rendering it impossible to apply either the KMO or Bartlett's test.

Instead, the Scree test was employed to determine the appropriate number of principal components. The Scree test relies on analyzing the eigenvalues, variances, and the overall covariance structure to identify components that explain the most variation in the data. In this study, the Scree test was conducted separately for each insurance company to determine the principal components influencing their financial soundness (FS) index.

3.2 Data

In this study, the data were obtained from the Central Bank of Iran's database and the Statistical Yearbook of Iran's Insurance Industry, covering the period from 2006 to 2018. A total of 27 sub-indicators were selected based on expert evaluations and calculated for 32 insurance companies over the study period. Insurance companies lacking sufficient data for this timeframe were excluded from the sample. Given the availability of consistent statistical yearbooks and the fact that most insurance companies began operations around 2000, the base year of 2006 was selected as the starting point for the analysis.

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4 Calculation

4.1 Measuring of FS

To extract the principal index of financial soundness (FS), the index for the selected insurance companies is initially calculated using Principal Component Analysis (PCA). Since 27 sub-indicators are included, 27 principal components are derived, each corresponding to the eigenvalues of the observation matrix, which consists of data from 2006 to 2018. This results in a 13 × 27 matrix, where the columns represent sub-indicators and the rows denote annual observations.

A critical step in this process is identifying which of the 27 components best capture the underlying structure of the FS index. This is determined through a component adequacy test in this study, the Scree test. The Scree test helps pinpoint the components that account for the most significant variance in the FS index.

Due to the large number of insurance companies analyzed, a representative example is provided using Asia Insurance. According to the Scree test results, six components lie above the threshold (as indicated by the red line in Fig. 2). Among these, the first three components alone explain approximately 72% of the variance in the FS index for Asia Insurance. As such, these three components are selected to construct the final index.

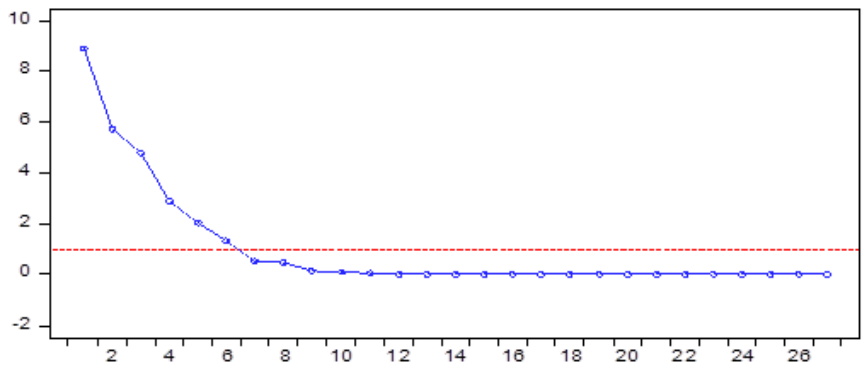

Figure 2. Scree test to determine Principal components
Source: Author's calculations

The coefficients of the sub-indices with the symbol x for the first three components in the form of Eq. (4) are as follows.

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$$FS_1^{asia}=-0.18x_{11}+0.06x_{12}+0.04x_{13}-0.11x_{14}+0.08x_{15}+0.28x_{16}+0.29x_{17}+0.27x_{18}-0.25x_{19}+0.1x_{110}+0.1x_{111}+0.21x_{112}-0.07x_{113}-0.31x_{114}+0.18x_{115}-0.18x_{116}+0.2x_{117}+0.27x_{118}-0.15x_{119}-0.29x_{120}+0.13x_{121}+0.26x_{122}+0.26x_{123}+0.04x_{124}-0.21x_{125}+0.01x_{126}-0.26x_{127}$$

$$FS_2^{asia}=-0.09x_{11}+0.37x_{12}+0.24x_{13}-0.18x_{14}+0.3x_{15}+0.1x_{16}-0.1x_{17}-0.05x_{18}-0.13x_{19}+0.36x_{110}+0.31x_{111}+0.06x_{112}+0.34x_{113}+0.12x_{114}-0.27x_{115}-0.13x_{116}-0.16x_{117}+0.04x_{118}+0.08x_{119}-0.1x_{120}-0.11x_{121}-0.16x_{122}-0.23x_{123}-0.02x_{124}+0.12x_{125}+0.19x_{126}-0.06x_{127} \quad (3)$$

$$FS_3^{asia}=0.2x_{11}+0.03x_{12}-0.06x_{13}+0.25x_{14}-0.06x_{15}+0.05x_{16}+0.17x_{17}+0.1x_{18}+0.00x_{19}+0.12x_{110}+0.18x_{111}+0.26x_{112}+0.17x_{113}-0.08x_{114}-0.21x_{115}-0.04x_{116}-0.26x_{117}+0.01x_{118}-0.36x_{119}+0.16x_{120}+0.4x_{121}-0.09x_{122}+0.13x_{123}+0.31x_{124}+0.08x_{125}-0.25x_{126}+0.27x_{127}$$

The principal FS index of Asia Insurance Company can be extracted from Eq. (4); the coefficient of each component is extracted from the principal component's method.

$$TFS^{asia}=0.53FS_1^{asia}+0.44FS_1^{asia}+0.71FS_1^{asia} \quad (4)$$

Based on Eq. (4), the trend of the Asia insurance principal index is shown in Fig. 3

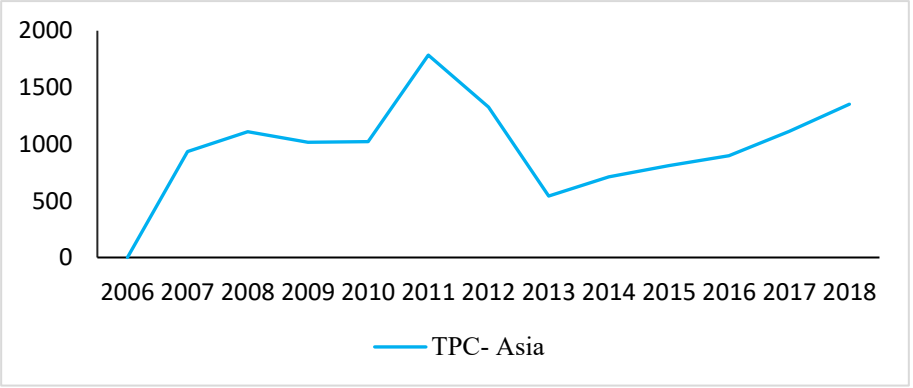

Figure 3. Trend Principal component of FS of Asia Insurance Company
Source: Author's calculations

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These coefficients represent the extent to which each sub-index contributes to explaining the variance in the principal Financial Soundness (FS) index. A higher positive coefficient implies a stronger positive relationship between the sub-index and overall financial stability, thereby indicating a greater stabilizing influence. Conversely, negative coefficients suggest that the corresponding sub-indices are associated with increased instability, reflecting adverse financial conditions in the respective insurance companies.

Given that each sub-index captures a distinct dimension of FS, the sign and magnitude of these coefficients offer valuable insights into the structural strengths and weaknesses of individual firms. Table (1) presents the coefficients for each sub-index across the sampled insurance companies. As illustrated, the contribution of sub-indices to the FS index varies significantly among companies. This variation is largely attributable to differences in firm size and financial structure.

Ehigiamusoe et al. (2020) argue that certain macroeconomic variables can have both positive and negative impacts on FS, depending on firm-specific factors. For example, the effect of inflation on FS differs markedly between Iran Insurance Company—with total assets of 291,924 billion rials and technical reserves of 98,104 billion rials—and Asia Insurance Company, which has significantly smaller assets (54,238 billion rials) and reserves (28,390 billion rials). Such disparities in scale and exposure influence how sub-indices contribute to the principal FS index, resulting in firm-specific variations in the explanation of variance.

To assess the contribution of individual sub-indices to the variance observed in the composite Financial Stability (FS) index, we classified the indicators into two categories based on their directional impact: positive and negative contributors. Sub-indices marked in green are associated with a positive contribution, indicating an enhancing effect on the FS index for each insurance firm. Conversely, sub-indices highlighted in red denote a negative contribution, suggesting a dampening effect on the overall financial stability of the corresponding insurer (see table 1).

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Table 1
Contribution of sub-indices in explaining the variance of the FS

INDEX	Pasargad	Sarmad	Kausar	Saman	Ma	Mihan	Melat	Asmari	Tavoon	Iran	Day	Asia	Dana	Novin	Razi	Parsian	Moein Iran	Omid	Alborz	Moalem	Karafarin	Sina	Hafez	Tosee
Total insurance reserves/equity	0.26	0.30	0.27	0.23	0.33	0.26	0.31	0.29	0.28	0.33	0.33	0.29	0.3	-0	0.03	0.11	0.01	0.01	-0.3	-0.3	-0.3	-0.1	-0.3	-0.1
Net premium/equity	0.28	0.28	0.26	0.25	0.21	0.31	0.33	0.29	0.28	0.32	0.31	0.31	0.27	0.09	0.11	0.17	0.13	0.05	-0	-0.3	-0.3	-0.2	-0.3	-0.1
Gross premium/equity	0.28	0.30	0.35	0.25	0.15	0.34	0.32	0.25	0.33	-0	0.05	0.13	0.28	0.34	0.33	-0.3	0.35	-0.6	-0	-0.3	0.02	-0.3	-0.2	0
Deferred loss reserve/equity	0.27	0.26	0.29	0.19	0.23	0.2	0.27	-0	0.13	0.32	0.3	0.32	0.23	0.03	-0	0.01	0.15	-0.3	0.11	-0.2	-0.2	-0.1	-0.1	-0.2
Share of reinsurers of technical obligations	0.27	0.19	0.19	0.23	0.18	0.27	-0	-0	0.19	0.21	0.16	-0.2	0.01	0.21	0.27	-0.1	-0.3	0.03	0.1	0.06	-0	0.02	0.18	0.19
Risk-retention ratio (net premium/gross premium)	0.24	0.11	0.1	0.26	0.16	0.22	0.08	0.04	-0.1	-0.2	-0.3	-0.2	-0.2	0.22	0.35	0.25	0	0.13	0.15	-0	-0.2	0.03	0.01	0.22
Loss ratio	0.27	0.19	0.2	0.23	0.09	-0.1	0.03	0.02	-0	-0.1	-0.1	-0.2	0.09	0.05	0	-0.2	0.06	0.03	0.29	-0.1	-0.2	0.11	0.09	0
Inflation	0.05	0.03	-0	0.08	0.05	0.04	0.08	0.29	-0.4	-0.2	-0.1	0.02	0	0.2	-0.1	0.12	0.05	0.32	0.1	0.11	0.11	-0.3	0.05	-0.1
Exchange rate	0.16	0.24	-0.1	0.14	0.35	-0.1	0.27	0.4	-0.3	-0.4	0.01	0.23	0.02	0.24	-0.1	0.13	0.05	0.31	0.16	-0.1	-0.2	-0.1	-0.2	0.01
Receivables/(gross premium + reinsurance recoveries)	0.11	0.18	0.09	0.1	-0	-0.4	-0	0.12	-0.1	-0.2	-0.1	0.3	0.01	-0.3	0.04	-0.2	-0.1	-0.2	0.09	0.09	0	0.21	0.28	0
Expense ratio (expense/net premium)	0	0.05	-0.1	-0.2	-0	-0.1	-0.1	-0.2	-0.2	0.02	0.12	0.23	0.12	-0.5	0.03	-0.1	-0.1	-0.2	-0.1	0.05	-0.1	0.28	0.13	0.2

Continuation of Table 1	Pasargad	Sarmad	Kausar	Saman	Ma	Mihan	Melat	Asmari	Tavoon	Iran	Day	Asia	Dana	Novin	Razi	Parsian	Iran.Moein	Omid	Alborz	Moalem	Karafarin	Sina	Hafez	Tosee
Return on equity	0.17	0.16	0.03	0.06	0.1	0.16	0.22	-0.16	0.08	-0.02	0.21	0.22	0.23	0.12	0.02	0.29	0.29	-0.04	-0.32	0.2	0.29	0.31	0.22	0.28
Operating profit/premium income	0.12	-0.15	-0.24	-0.16	-0.07	0.05	0.01	-0.1	-0.02	0.06	0.11	0.14	0.19	-0.13	0.05	-0.06	-0.14	-0.02	-0.1	0.23	0.39	0.24	0.26	0.28
Gross profit of insurance activity/premium income	0.15	-0.25	-0.15	-0.22	-0.21	0.05	0.13	-0.08	-0.07	0.03	0.11	0.22	0.22	-0.15	0.11	-0.3	0.08	-0.17	-0.24	0.22	0.24	0.31	0.17	0.03
Return on investment	0.11	-0.13	0.01	0.12	0.17	0.29	-0.08	0.04	0.28	0.17	-0.16	0.04	0.08	0.05	0.36	0.35	-0.1	-0.13	0.2	-0.06	0.17	0.27	0.39	0.2
Net premium/capital	0.28	0.28	0.33	0.25	-0.16	0.34	0.31	0.28	0.32	-0.05	-0.27	0.19	0.27	0.35	0.36	0.29	0.33	0.01	0.01	0.27	-0.08	-0.27	-0.19	-0.01
Solvency	0.23	0.18	-0.12	0.24	0.25	0.07	0.03	0.14	0.14	-0.1	0.01	0.02	0.28	0.14	0.27	0.23	-0.25	0.45	0.3	-0.14	0	-0.08	0	0
Investments & claims/equity	0.27	0.18	0.14	0.24	0.32	0.3	0.31	0.25	0.19	0.35	0.34	0.24	0.29	0.02	-0.03	0.05	0.16	-0.07	-0.09	-0.29	-0.34	-0.09	-0.35	0.17
return on assets	-0.21	-0.2	-0.16	-0.23	-0.29	0.1	0.01	-0.12	0.03	0.03	0.09	0.09	0.04	0.03	0	0.08	-0.08	0	-0.29	0.19	0.26	0.2	0.09	0.26
Liquidity coverage ratio	0.1	-0.09	-0.28	-0.04	-0.02	0.27	-0.16	-0.05	-0.01	0.09	-0.11	-0.3	0.17	-0.29	0.06	0.06	-0.19	0.05	0.21	0.09	0.13	0.11	-0.01	0.23
(Real estate + unquoted equities + debtors)/total assets	-0.12	0	0.08	0.2	-0.1	0.16	0.02	0.17	0.12	-0.07	-0.15	-0.08	0.07	-0.1	0.25	0.05	-0.17	0.1	0.26	0.04	0.05	0.15	0.07	0.32
Investment/insurance premiums	-0.11	0.05	-0.1	-0.08	0.26	0.01	-0.35	-0.12	-0.14	0.04	0.14	0.01	0.04	-0.08	-0.15	0.17	-0.17	-0.26	-0.11	-0.16	-0.18	0.17	0.15	-0.32
Capital/technical reserves	-0.17	-0.15	-0.3	-0.14	0	-0.06	-0.17	-0.18	-0.18	-0.02	0.14	-0.19	-0.31	-0.08	-0.32	-0.28	-0.18	0.25	0.19	0.09	0.13	0.19	0.06	-0.31
Claims paid by reinsurers/total claims	-0.1	-0.15	-0.15	-0.22	-0.24	-0.18	-0.16	0.33	-0.02	0.23	0.28	-0.15	0.18	0.02	-0.12	-0.15	0.01	0.19	-0.22	0.19	0.16	0	0.04	0.05
Current ratio	0.02	-0.16	-0.15	-0.2	-0.17	0.01	-0.13	0.02	0.25	-0.14	0.19	0.01	0.08	0.05	-0.01	0.16	0.24	-0.1	-0.3	0.15	0.09	-0.02	-0.09	0.33
Interest rate	0.16	0.11	0.12	0.14	0.14	-0.14	0.08	-0.05	0.14	-0.11	0.04	0	-0.23	-0.14	0.28	-0.04	-0.13	-0.03	0.16	-0.28	-0.12	0.25	-0.16	0.15
GDP	-0.19	0.19	0.09	-0.16	0.09	-0.17	0.04	-0.27	0.13	0.16	0.19	0.09	0.13	-0.24	-0.05	-0.24	0.25	-0.39	-0.22	-0.15	-0.06	-0.12	-0.08	-0.01

Source: Author's calculations

Table 1 presents the contribution of each sub-index to the variance in the composite Financial Stability (FS) index of insurance companies. The sub-indices are classified into two categories based on their directional influence: positive and negative contributors.

Positive Sub-Indices: Sub-indices highlighted in green denote a positive contribution to the FS index, implying that an increase in these indicators enhances a company's financial stability. For instance, as shown in Table X, companies such as Pasargad and Saman exhibit a strong positive correlation between their FS scores and indicators like Total Insurance Reserves to Equity and Net Premium to Equity.

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Negative Sub-Indices: Sub-indices highlighted in red reflect a negative contribution, meaning that higher values in these variables diminish the financial stability of the firm. For example, in the cases of Iran, Mihan, and Melat insurance companies, the Deferred Loss Reserve to Equity ratio negatively affects their FS index values.

According to this table, Iran Insurance Company—a major player in the market and a government-owned insurer exhibits a coefficient of -0.02 in the return on equity (ROE) sub-index, indicating a negative contribution of this magnitude to the financial stability (FS) index from this variable. In contrast, the ROE sub-index coefficients for Asia, Alborz, and Dana Insurance Companies are 0.22, -0.32, and 0.22, respectively, highlighting considerable variation in performance across firms. In the return on assets (ROA) sub-index, Iran Insurance Company has a positive contribution of 0.03, whereas Asia Insurance Company shows a stronger positive share of 0.09. Alborz and Kausar Insurance Companies, by contrast, exhibit negative contributions of -0.29 and -0.16, respectively. Using these sub-index coefficients, the composite FS index for the insurance industry is derived. Figure 4 presents this principal FS index separately for government-owned and privately-owned insurers, revealing that both sectors have contributed to financial instability over the sample period.

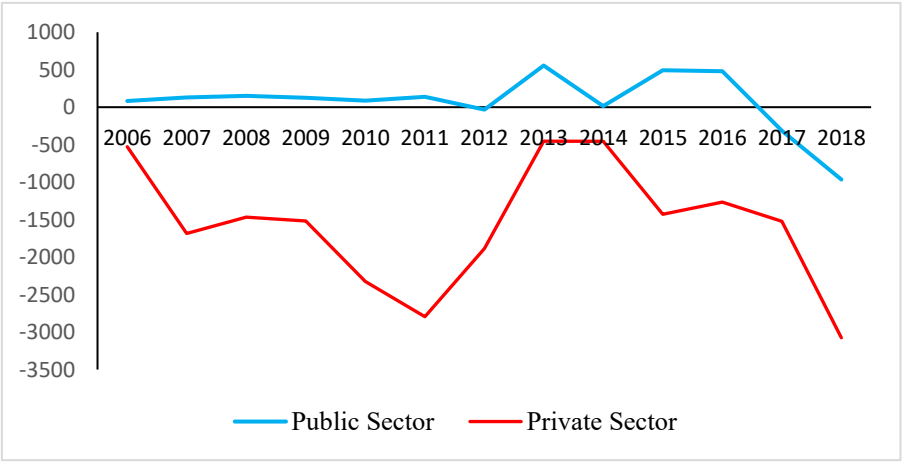

Figure 4. Principal component of FS by public and private insurance sectors
Source: Author's calculations

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Figure 5 presents the principal Financial Stability (FS) index of Iran's insurance industry, illustrating the influence of individual insurance companies over time. The index began to decline in 2013, signaling the onset of a period marked by growing financial instability. Between 2006 and 2018, the establishment of numerous private insurance companies reflected substantial expansion in Iran's insurance sector. This development fostered greater competition and reduced monopolistic dominance. As a result, the FS index initially recovered from a low of -447 points to a peak of 102 points. However, from 2013 to 2018, the index resumed its downward trajectory, plunging to -4,041 points.

Several factors contributed to this volatility. Notably, changes in tariffs structures of supplementary medical insurance which holds a 23% market share and third-party liability insurance which accounts for 39% of the market—played a critical role. Both were significantly affected by the country's annual inflation rate. As a result, the growth in insurance premiums often failed to align with the regulated pricing and conditions of mandatory third-party insurance policies. Moreover, the exit of foreign reinsurance firms during periods of intensified international sanctions, particularly following major catastrophic events, placed additional strain on the industry. Another source of instability was the annual transfer of large insurance contracts from one company's portfolio to another's, depending on the nature and volume of these contracts. Such reassignments introduced further fluctuations in the FS index.

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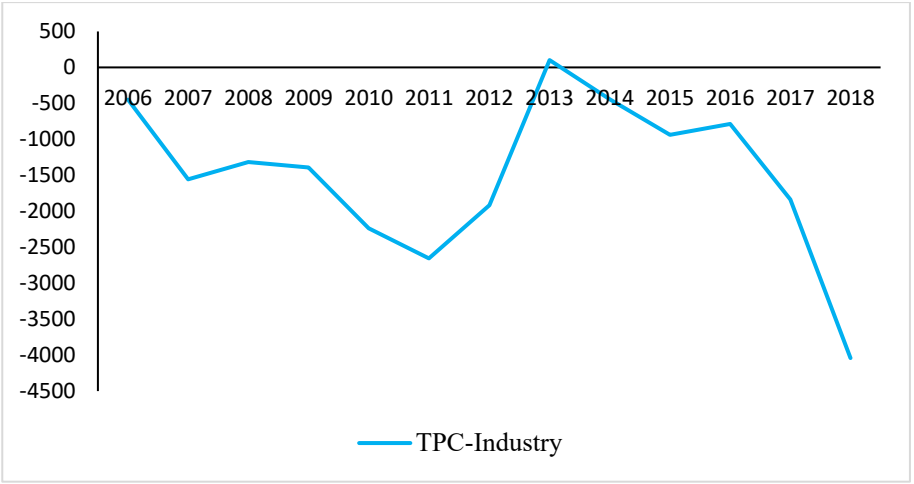

Figure 5. Principal component of FS in Iran's insurance industry
Source: Author's calculations

5 FS Index in the short and long term

To examine the behavior of the Financial Stability (FS) index of the insurance industry over both the short and long term, the Hodrick–Prescott (HP) filter method was employed. This technique decomposes the FS index into two distinct components: the long-term trend component, which captures permanent fluctuations or structural trends, and the cyclical component, which reflects short-term or temporary deviations. Let the FS index be represented by the symbol y. The HP filter separates the series (y_t) into a smooth trend component (s_t) and a cyclical component (c_t), by minimizing the sum of the squared deviations of the actual series from the trend component, subject to a penalty on the variation in the trend's second difference. This optimization problem is represented by Equation (5).

$$\sum_{t=1}^{T}(y_t - s_t)^2 + \lambda \sum_{t=2}^{T-1}\left((s_{t+1} - s_t) - (s_t - s_{t-1})\right)^2 \quad (5)$$

In this method, λ represents the smoothing (penalty) parameter, typically set to 100 for annual data, 1,600 for quarterly data, and 14,400 for monthly data. The results of the Hodrick–Prescott filter analysis applied to the FS index of the insurance industry are illustrated in Figure 6. The graph reveals that, in the short term, the FS index follows a fluctuating pattern, indicating cyclical volatility. However, the long-term trend displays a consistent downward

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trajectory, suggesting a gradual deterioration in the financial stability of the insurance industry over time.

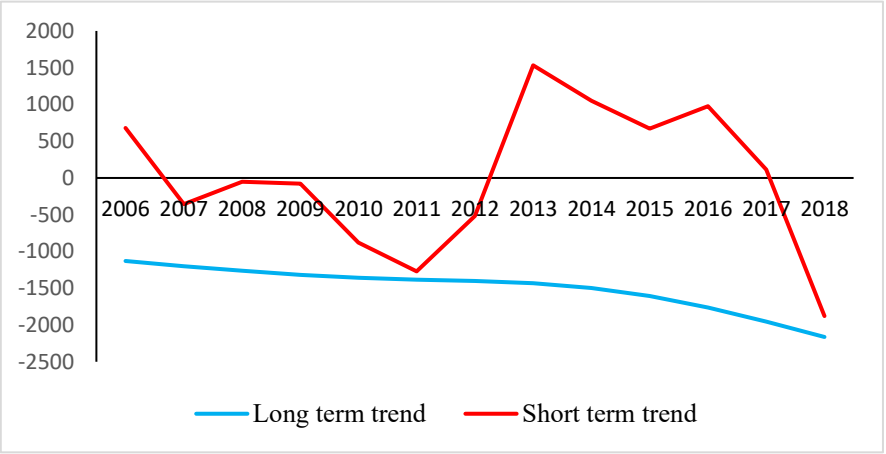

Figure 6. Short- and long-term trends of the FS index in the insurance industry
Source: Author's calculations

The FS index calculated for Tosee Insurance Company Figure 7 effectively predicted its bankruptcy. Following the liberalization of insurance tariffs, the company encountered a heightened risk of insolvency, primarily due to insufficient regulatory oversight by the Central Insurance Authority. As a result, the Supreme Council of Insurance formally declared the company's bankruptcy, and its operations ceased in 2014. This outcome provides strong empirical support for the reliability and predictive power of the FS index in assessing the financial stability of insurance companies.

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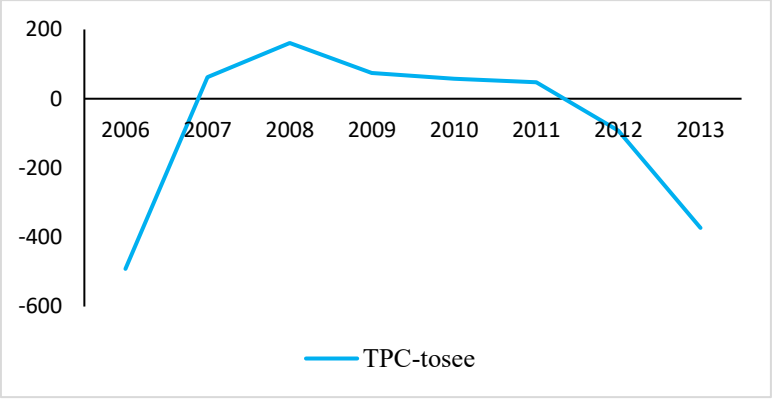

Figure 7. Principle component of Tosee compony
Source: Author's calculations

The instability of the insurance industry carries significant implications for various stakeholders, particularly both retail and institutional investors in the capital market. Assuming market efficiency, this section investigates how investors respond to changes in the financial stability (FS) of the insurance industry to evaluate the market's sensitivity to such fluctuations. Figure 8 compares the aggregate market value of insurance companies with the trend in the FS index. The results indicate that a decline in the industry's FS is accompanied by a corresponding decrease in its market value. This relationship suggests that the FS index is not only relevant to investors but also functions as a forward-looking indicator with predictive utility.

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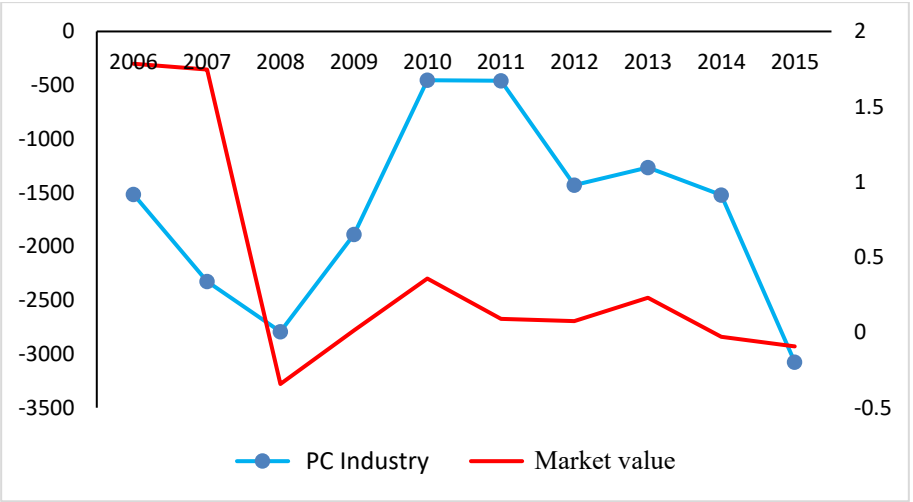

Figure 8. Comparison of the FS index and market value of the insurance industry
Source: Author's calculations

6 Conclusion and Policy Implications

This study develops and applies a composite Financial Stability (FS) index to assess the soundness of Iran's insurance sector from 2006 to 2018. Our findings indicate a persistent long-term deterioration in financial resilience, alongside pronounced short-term volatility—especially after 2013. These trends suggest a sector increasingly vulnerable to macroeconomic shocks and structural weaknesses. Notably, larger insurers with broader capital and reserve buffers tend to exhibit stronger FS scores, in line with international findings on scale-related advantages.

The divergence between Iran's insurance experience and that of advanced markets is also noteworthy. While European and OECD insurers have generally maintained moderate risk levels and sound capital positions—often aided by diversification and robust solvency frameworks—Iranian insurers have operated under unique pressures, including sanctions, inflation, and exchange rate instability. These macro shocks appear to have exacerbated firm-level fragility, particularly among smaller insurers.

Our analysis has important implications for regulatory and institutional reforms. We highlight several priority areas for action:

– **Institutionalized FS monitoring:** Regulators should implement regular (e.g., quarterly or semi-annual) assessments of industry soundness using

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composite, multi-factor indices. Such tools can provide early warning signals and enable timely interventions.

- Risk**-sensitive capital frameworks:** Strengthening solvency rules through risk-based capital requirements—especially for reserving and market risk exposures—can enhance sectoral resilience. International frameworks such as Solvency II offer useful templates.
- **Data and analytical capacity:** Requiring standardized insurer data and integrating advanced techniques (e.g., principal component analysis, stress testing) can improve supervisory effectiveness and capture multidimensional risk.
- **Market and legal modernization:** Revising insurance legislation, aligning accounting/actuarial practices with global standards, and promoting broader insurance penetration (e.g., via tax incentives or mandatory coverages) would improve transparency and sector depth.
- **Reinsurance and diversification:** Enhancing access to international reinsurance and expanding domestic capital markets can reduce concentration risk and improve investment flexibility.
- **Capacity building:** Investment in actuarial science, risk analytics, and internal risk-based decision-making (e.g., ORSA practices) will strengthen both insurer governance and regulatory oversight.

While these recommendations draw from global experiences, they are grounded in the specific dynamics of Iran's market. Our FS index framework can serve as a replicable tool for both supervisory use and academic research. Future work may extend this approach by incorporating forward-looking indicators or examining post-2018 developments.

Overall, the findings underscore the need for a proactive, data-driven regulatory approach—one that strengthens risk buffers, enhances resilience, and aligns Iran's insurance sector more closely with international best practices.

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