

Factors Influencing the Profitability and Loss of Chinese Insurance Companies Based on Factor Analysis

Zhenjie Wang

School of Mathematics, Hohai University, Nanjing, Jiangsu, 211106, China

Keywords: Factor Analysis, Insurance, Ridge Regression, Balance Sheet

Abstract: The insurance industry has a significant impact on economic development. This study selects the balance sheets of 55 Chinese insurance companies as samples for the year 2021. Selecting multiple items from the balance sheet for factor analysis. The factor analysis of Chinese insurance companies' balance sheets has identified three crucial factors: Financial Activity Diversity, Insurance Liabilities and Investment Strategy, and Financial Risk Management. Ridge regression analysis revealed that these three factors have a positive impact on the net profits of insurance companies. These factors collectively contribute positively to company operations, underscoring the significance of diversifying financial activities, aligning insurance liabilities with investment decisions, and strategically managing financial soundness and risk. The findings highlight key considerations for insurance companies seeking to enhance their financial resilience, optimize investment strategies, and ensure effective risk management. The study aims to uncover the relationship between the balance sheet and company profits, further assisting in enhancing the market value of insurance companies.

1 INTRODUCTION

Insurance is crucial in people's lives, offering both economic and social security by reducing various risks and uncertainties. Ilhan's analysis highlighted a positive link between the insurance industry and economic growth (Ege and Bahadir 2011). Studying the profitability of insurance companies reflects the industry's development and provides insights into the objective state of the economy. The study of factors influencing the profitability and loss of insurance companies has made extensive and deep progress globally. The main analysis factors include company size, leverage ratio, liquidity, capital adequacy ratio, premium growth rate, market share, and so on. However, the impact of these factors varies in different countries.

Berhe studied the factors influencing the profitability of insurance companies in Ethiopia. The regression analysis results showed that the profitability of insurance companies is notably affected by factors like insurance size, capital adequacy, liquidity ratio, and GDP growth rate. Conversely, the leverage ratio, loss ratio, market share, and inflation rate were found to have an insignificant impact on insurance companies'

profitability (Berhe and Kaur 2017). In Saudi Arabia, Dhiab's empirical findings indicated that the profitability of Saudi insurance companies was positively influenced by the written premium growth rate, tangible asset ratio, and fixed asset ratio. Although company size and liquidity ratio showed a positive correlation with profitability, they lacked statistical significance. On the other hand, loss ratio, liability ratio, insurance leverage ratio, and, to a lesser extent, company age, had a negative impact on the profitability of Saudi insurance companies (Dhiab 2021). Kulustayeva argued that in Kazakhstan, the most significant impact on the profitability of insurance companies was financial leverage (Kulustayeva et al 2020). In general, the role of leverage ratio varies significantly across different countries. Besides, according to Tegegn's results, the key determinants of profitability were size, premium growth rate, liquidity, and age. Specifically, premium growth rate and size exhibited a positive correlation, while liquidity and age were negatively and significantly associated with profitability (Tegegn et al 2020). Similarly, in Malaysia, Alarussi's research results indicated a significant positive correlation between company size (total sales), working capital, company efficiency (asset turnover ratio), and profitability (Alarussi and Alhaderi 2018). Likewise,

Orty's results indicated a positive correlation between the size of the company and its profitability (Ortyński 2016). Hence, it can be observed that the company size has a positive impact in the majority of studies.

Regarding liquidity and growth rate, Kripa found that factors such as growth rate, liabilities, liquidity, and fixed assets play a crucial role in influencing the profitability of insurance companies. Specifically, profitability is positively correlated with the growth rate, while liabilities, liquidity, and fixed assets are negatively correlated (Kripa 2016). Daar found that in India, the capital adequacy ratio and GDP have a positive impact on profits, while liquidity and inflation have a negative impact on the profitability of general insurance companies (Daare 2016).

In addition to these market indicators, many scholars have also analyzed more detailed factors. Ullah identified a strong inverse link between Underwriting Risk and Size in relation to Profitability (ROA). It also found a noteworthy positive association between Expense Ratio, Solvency Margin, and ROA (Ullah et al 2016). Datu's research results indicated that profitability was positively influenced by factors such as low underwriting risk, low reinsurance utilization rate, low input costs, and a smaller company size (Datu 2016).

With the rapid development of the Chinese economy and the acceleration of globalization trends, the role of the insurance industry in the national economic system is becoming increasingly prominent

(Zhou 2023). As a vital component of economic risk management, China's insurance sector not only plays a crucial role in providing risk protection for individuals and businesses but also exerts a profound impact on capital markets and financial stability. However, the fluctuation of profitability and loss in insurance companies remains a focal point of market attention. Therefore, in-depth research into the factors influencing the profitability and loss of Chinese insurance companies is significant.

2 METHODOLOGY

2.1 Data Source and Description

This study takes various insurance companies in China as research samples and selecting data from 2021 for empirical research. A total of 55 insurance companies were selected for analysis. Data processing is carried out as follows: categories with five or more years of data missing within the decade are excluded. For categories with data missing in a few years, this study uses the data from the previous year or the second year for replacement. All the data used in the empirical research in this paper are sourced from the annual information disclosure of various insurance companies (Table 1).

Table 1: Definition of variables

Abbreviation	Variables	Range
TFA	Trading Financial Assets	[0.63,123131]
CE	Cash and Cash Equivalents	[3.71,526301]
L	Loans	[0,2599510]
RE	Retained Earnings	[-9816.97,521677]
LPP	Loans Pledged by Policyholders	[0,768975]
PR	Premiums Receivable	[0.17,94003]
RAs	Repurchase Agreements	[0,122765]
RAP	Repurchase Agreement Payables	[0,276602]
CS	Capital Surplus	[-405.25,134474]
CP	Claims Payable	[-0.12,65094]
HTM	Held-to-Maturity Investments	[0,1189369]
AFSA	Available-for-Sale Financial Assets	[182.03,1215603]
SR	Surplus Reserve	[2.7,86027]
TD	Time Deposits	[7.3,545667]
LIR	Long-term Health Insurance Reserve	[0,2768584]
PDP	Policyholder Dividends Payable	[0,122510]
PDI	Policyholders' Deposits and Investments	[0,200730]
LHIR	Long-term Equity Investments	[-92.73,187019]
LR	Loss Reserve	[0,162022]
UPR	Unearned Premium Reserve	[0,177041]
PIC	Paid-in Capital	[500,44224]
IPF	Insurance Protection Fund	[-9.55,1008]

Selecting the balance sheet from the annual financial reports of each company as a variable for analysis. The balance sheet reflects a company's assets, liabilities, and shareholders' equity, offering an initial understanding of attributes such as debt-paying ability, liquidity, net worth, and more. Selecting variables as shown in the following table. All units are in millions.

2.2 Method Introduction

Due to the multitude of variables and the high degree of correlation among them, considering the use of factor analysis for dimensionality reduction. Factor analysis is a statistical method aimed at uncovering the underlying structure or factors among observed variables. It simplifies the data by interpreting the observed variables as latent, unobservable factors.

Building upon this, Considering the use of ridge regression for factor analysis to assess the correlation with insurance company profits. Ridge regression adds a regularization term to the loss function of multiple linear regression to prevent overfitting and enhance the model's generalization ability. The expression of the loss function is as follows:

$$\text{Loss} = \sum_{i=1}^n (y_i - \hat{y}_i)^2 + \alpha \sum_{j=1}^p \beta_j^2 \quad (1)$$

Regularization term $\alpha \sum_{j=1}^p \beta_j^2$ used to penalize the magnitude of coefficients. It makes the absolute values of the coefficients as small as possible. This helps prevent the model from overfitting the training data and, in the presence of multicollinearity, stabilizes the estimates. The goal of ridge regression is to minimize the aforementioned loss function. This is achieved by solving the following optimization problem:

$$\beta = \operatorname{argmin} \sum_{i=1}^n (y_i - \hat{y}_i)^2 + \alpha \sum_{j=1}^p \beta_j^2 \quad (2)$$

Its analytical solution can be expressed in matrix form:

$$\beta = (X^T X + \alpha I)^{-1} X^T y \quad (3)$$

X is the feature matrix, y is the output vector, I is the output vector.

3 RESULTS AND DISCUSSION

3.1 Model Results

Firstly, perform the Kaiser-Meyer-Olkin (KMO) and Bartlett's tests to assess the suitability for factor analysis. The results of the KMO test indicate a value of 0.724, and concurrently, the results of Bartlett's sphericity test reveal a significance p-value less than 0.0001, demonstrating statistical significance. There

is significant correlation among the variables, suggesting the suitability of factor analysis with a high degree of appropriateness (figure 1).

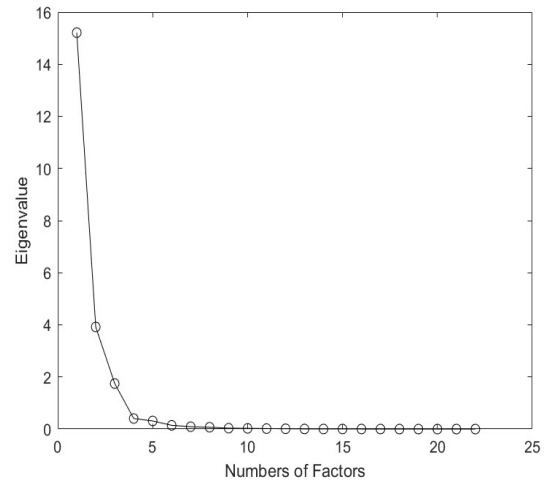


Figure 1: Scree Plot (Picture credit: Original)

To draw a scree plot based on the explanatory power of each principal component regarding data variability. Its purpose is to confirm the number of factor principal components to be selected by examining the slope of the eigenvalues' descent, combined with the variance explained table, which can be used to confirm or adjust the number of factor principal components:

At Principal Component 4, the eigenvalue explaining the total variance falls below 1.0, with a contribution rate to the variable explanation reaching 96.736%. Selecting 3 factors for analysis (Table 2).

Table 2: Factor Weight Analysis

	Rotated Variance Explained (%)	Rotated Cumulative Variance Explained (%)	Weight (%)
Factor 1	0.422	42.193	44.462
Factor 2	0.342	76.352	35.996
Factor 3	0.185	94.896	19.542

The results of factor analysis weight calculations show that the weight for Factor 1 is 44.462%, for Factor 2 is 35.996%, and for Factor 3 is 19.542%.

Table 3: Factor Loading Coefficient

	Factor 1	Factor 2	Factor 3
TFA	0.969	0.088	0.188
CE	0.968	0.07	0.214
L	0.938	0.238	0.237
RE	0.88	0.324	0.328
LPP	0.872	0.342	0.167
PR	0.811	0.187	0.543
RAs	0.787	0.056	0.553
RAP	0.772	0.455	0.379
CS	0.808	0.408	0.241
CP	0.701	0.661	0.247
HTM	-0.015	0.989	0.102
AFSA	-0.028	0.945	0.21
SR	0.089	0.917	0.159
TD	0.366	0.893	0.202
LIR	0.479	0.862	0.147
PDP	0.448	0.86	0.074
PDI	0.584	0.785	0.107
LHIR	0.594	0.706	0.226
LR	0.377	0.104	0.899
UPR	0.561	0.063	0.811
PIC	0.055	0.412	0.809
IPF	0.5	0.286	0.783

From the table 3, it can be observed that TFA, CE, L, RE, LPP, PR, RAs, RAP, CS, CP exhibit high factor loadings in Factor 1. These financial items can be considered to belong to a category with similar characteristics. These factors all involve the company's management of cash flow, optimization of capital structure, and investment through buying and selling financial assets. This factor encompasses various financial activities, including financial investments, insurance operations, and financial management. Therefore, Factor 1 is referred to as the Financial Activity Diversity Factor. HTM, AFSA, SR, TD, LIR, PDP, PDI, LHIR exhibit high factor loadings in Factor 2. These characteristics are related to insurance liabilities, investments, assets, financial reserves, and accumulations. These factors reflect some common features in the company's management of its investment portfolio, financial risks, and future preparations. Factor 2 is termed as

the Insurance Liabilities and Investment Strategy Factor.

LR, UPR, PIC, and IPF exhibit high factor loadings in Factor 3. These characteristics are related to the financial health of the company, reserve management, as well as risk management and the provision of insurance protection funds. They reflect some common features in the company's efforts to maintain financial strength, manage risks, and provide safeguards. Factor 3 is termed as the Financial Risk Management Factor.

Table 4: Component Matrix

	Component1	Component2	Component3
TFA	0.181	-0.065	-0.099
CE	0.177	-0.069	-0.086
L	0.153	-0.035	-0.077
RE	0.116	-0.018	-0.028
LPP	0.143	-0.007	-0.102
PR	0.07	-0.05	0.092
RAs	0.073	-0.074	0.107
RAP	0.072	0.013	0.011
CS	0.11	0.007	-0.058
CP	0.065	0.065	-0.047
HTM	-0.098	0.189	0.006
AFSA	-0.118	0.177	0.061
SR	-0.079	0.165	0.016
TD	-0.021	0.137	-0.015
LIR	0.017	0.125	-0.061
PDP	0.024	0.13	-0.089
PDI	0.055	0.104	-0.096
LHIR	0.041	0.082	-0.038
LR	-0.091	-0.049	0.345
UPR	-0.029	-0.067	0.271
PIC	-0.171	0.039	0.349
IPF	-0.054	-0.018	0.259

Based on the matrix composition table 4, factor scores for each factor can be calculated, thereby reducing variables. By calculating the Variance Inflation Factor (VIF), it was observed that there is multicollinearity between Factor 1 and Factor 3. Considering ridge regression, the obtained results are as follows (Table 5):

Table 5: Ridge Regression Analysis Results

K=0.021	Unstandardized Coefficients		Standardized Coefficients	t	P	R ²	Adjusted R ²	F
	B	Standard Error	Beta					
constant	674.898	512.088	-	1.318	0.194			
Factor1	0.179	0.008	1.014	21.731	0.000***	0.979	0.978	775.366
Factor2	0.072	0.005	0.423	15.157	0.000***			(0.000***)
Factor3	0.044	0.016	0.144	2.836	0.007***			**

dependent variable: net profit

Note: ***, **, and * represent significance levels of 1%, 5%, and 10%, respectively.

It is found that factors 1, 2, and 3 all have a positive impact on the profits of the insurance company, with factor 1 having a significant influence.

3.2 Discussion

The results indicate that the three factors derived from the factor analysis all have a positive impact on the profits of Chinese insurance companies.

Factor 1 is identified as the Financial Activity Diversity factor. Through diversification of financial activities, companies can better cope with claims payments and other short-term liabilities, ensuring an adequate supply of liquid assets. According to modern financial theory, insurance companies can enhance cash flow management by diversifying their investment portfolios, encompassing both short-term and long-term assets. Additionally, this approach provides a more flexible capital structure and broader investment opportunities. These practical implications underscore the strategic significance of financial activity diversity in the insurance industry.

Factor 2 is identified as the Insurance Liabilities and Investment Strategy factor, holding significant importance in the operations of insurance companies. This factor is not only closely linked to the company's insurance operations, ensuring adequate funds for claims payments and policy dividends to maintain financial health, but it also influences investment decisions, requiring the company to consider the structure of liabilities within its investment portfolio. This association underscores the foundational importance of elevated liability levels for insurance companies in terms of compliance, customer trust, and business continuity. Supported by financial theory and industry practices, this factor highlights the intimate interplay between insurance operations and investment decisions, crucial for the long-term robustness of the company.

Factor 3, the Financial Risk Management factor, also exerts a positive impact on the operations of insurance companies. The significance of this factor lies in ensuring the company maintains a robust financial foundation. Through prudent reserve management strategies, it mitigates potential risks and underscores the importance of risk management and safeguarding funds to shield the company, customers, and stakeholders from potential threats. Supported by financial theory and industry practices, this factor emphasizes the long-term strategic importance of insurance companies in terms of financial health, reserve management, and risk mitigation. This not only aids in establishing a reliable financial soundness but also lays a solid

foundation for attracting investors and customers while ensuring business continuity.

Due to significant differences among samples, the research results may deviate from reality. Further analysis, such as exploring the mean values of assets and liabilities over multiple years for a broader range of companies, could be conducted to gain additional insights.

4 CONCLUSION

In summary, the factor analysis of Chinese insurance companies' balance sheets has revealed three pivotal factors: Financial Activity Diversity Factor, Insurance Liabilities and Investment Strategy Factor, and Financial Risk Management Factor. These factors demonstrate positive influences on company operations, emphasizing the importance of financial activity diversity, the close connection between insurance liabilities and investment decisions, and the strategic significance of financial soundness and risk management.

It is recommended that insurance companies adopt a series of strategies to optimize their operational efficiency. Firstly, diversifying financial activities to enhance liquidity, reduce short-term liability risks, and adapt flexibly to market fluctuations is advised. Secondly, there is a suggestion to further integrate insurance operations and investment decisions, ensuring coordination between investment portfolios and liability structures for maximizing returns and securing funds for claims payments and policy dividends. Additionally, a strong emphasis is placed on reinforcing financial health management, especially in reserve management and risk mitigation, to effectively withstand potential risks. Furthermore, maintaining a proactive stance towards learning and improvement is advisable, involving the comparison and learning from best practices of peer companies, with timely adjustments of strategies to adapt to market changes. These recommendations aim to assist insurance companies in enhancing business resilience, adaptability, and competitiveness, fostering sustainable development.

Despite potential biases introduced by significant differences among samples, further analysis involving the mean values of assets and liabilities over multiple years for a broader range of companies could provide a more comprehensive understanding of the universality and practical impact of these factors. This study offers valuable insights into

comprehending the financial characteristics of Chinese insurance companies.

REFERENCES

- I. Ege and T. Bahadir, *International Journal of Economic Research* **2**, 1-9 (2011).
- T. A. Berhe and J. Kaur, *International journal of research in finance and marketing* **7**, 124-137 (2017).
- L. B. Dhiab, *The Journal of Asian Finance, Economics and Business* **8**, 235-243 (2021).
- A. Kulustayeva, et al, *Entrepreneurship and sustainability issues* **7**, 2394 (2020).
- M. Tegegn, L. Sera and T. M. Merra, *International Journal of Commerce and Finance* **6**, 1-14 (2020).
- A. S. Alarussi and S.M. Alhaderi, *Journal of Economic Studies* **45**, 442-458 (2018).
- K. Ortyński, *Central European Review of Economics & Finance* **12**, 53-66 (2016).
- D. Kripa, *European Journal of Multidisciplinary Studies* **1**, 352-360 (2016).
- W. J. Daare, *International Journal of Marketing, Financial Services & Management Research* **5**, 1-8 (2016).
- G. M. Ullah, M. N. Faisal and S. T. Zuhra, *International Finance and Banking* **3**, 138-147 (2016).
- N. Datu, *The DLSU Research Congress*, (2016).
- Y. Zhou, *Tsinghua Financial Review* **1**, 22-24 (2023).