



Relationship between Solvency and Financial Ratios in Iranian Insurance Institutions

A. SAFARI^{1,*}, N. SARLAK², R. NASIRI³

¹PhD in Financial Management from the University of Karlsruhe in Germany and Central Insurance Consultants

²Professor, University of Qom

³MA degree from the University of Qom

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Abstract. Obviously a major concern for regulatory bodies and for insurers in today's insurance industry is to make sure that all obligations of the insurance company are duly met. An existence of a solvency system influenced by all risks that an insurer is faced with seems necessary as an effective tool for insurance regulation. The main objective of this study is to investigate any relationship between solvency system and those financial ratios representing all risks that an insurer is exposed to. The present article attempts to answer the question that whether the system of solvency adopted in Regulation No. 69 is sensitive to the risks or not. In case of no relationship, a serious shortcoming in the model is induced. For statistical analysis, a time period of 1389 to 1391 including a sample of 22 insurance companies is considered. The research methodology consists of a multiple regression analysis using panel data. The results indicate that there is a significant relationship between the solvency ratio and the selected financial ratios including current ratio, equity ratio, reserves ratio and loss ratio among which equity ratio has the highest meaningful correlation with the solvency ratio.

Keywords: Solvency Ratio, Bankruptcy, Solvency Regulation, Risk of Insurance Company, Financial Ratios.

1. INTRODUCTION

One of the most important factors in the supervision of insurance companies, is to ensure that it is able to perform its obligations, so a regulatory system attempts to measure and control the risks associated with these institutions, significant risks that insurance companies face include financial risks and Insurance risk. Regulatory bodies in insurance industry must try to control the solvency of insurance companies through regulations and support the insured against the risk of corporate bankruptcy and catastrophic events that lead to failure in fulfillment of obligations on behalf of the insurers. Therefore the regulatory system on solvency must be designed so that it could be relevant to insurance institute risks. There are several ways to regulate the performance of insurance companies, by approval of specific laws the regulatory agencies in each country try to maintain the solvency of insurance companies to an acceptable level (Ali Teimouri, 2008). In our country tariff system has been dominating for several years. However, due to the increasing volume of market and variety of insurance services, this method couldn't meet the current situation (Hashemi et al., 2010). In recent years most of the attentions of regulatory section is drawn to monitoring the financial regulation of insurance companies (Hashemi et al., 2010). In order to ensure the stability of insurance markets and to compensate the loss of the insured, insurance companies must hold a certain sum as the edge of solvency (Aziznasiri et al., 2012). The edge of solvency determines whether an insurance company has access to minimum capital adequacy requirements set by the supervisory authorities (Hashemi et al., 2010). The edge of solvency is calculated through a solvency index. There are different models for calculating the solvency of insurance companies. The model of using fixed ratios, risk-based capital model, and

*Corresponding author. A. SAFARI

the model based on complex-probabilities are some examples among which risk-based capital model has more consistency with insurance market of Iran according to insurance terms and conditions in this country (Bilandi, 2012).

Due to the fact that solvency index assesses the financial capability of the insurance companies, we must make sure of its measurement accuracy and reliability. By examining the significance of the relationship between indexes of solvency and financial ratios the reliability of solvency can be measured. By processing and interpreting the relationships between items in the financial statements, financial ratios would help to understand the financial situation and performance of the business unit in a simple and understandable way, financial ratios argue about the profitability capacity, financial resources and operational efficiency of a business unit.

Financial ratios are accepted instruments that change the raw data into meaningful accounting information which are used in management analysis, measurement of operation efficiency, etc. and in case there don't be any meaningful relationship between indexes of solvency and financial ratios then it might mean that this index for assessing future financial results of the insurance companies are not correctly designed or are even misleading. According to the previous information the aim of this study is investigating the relationship between solvency index and financial ratios.

2. THEORETICAL FOUNDATIONS AND LITERATURE REVIEW

The first researches that led to create a model for predicting bankruptcy, was the research of William Beaver in 1966 and Altman in 1968. Beaver in his model chose a set consisting of 30 financial ratios for assessing the health of a company that he believed are the best ratios in this regard. Then, based on the way of assessment of organizations, classified ratios into six groups. Beaver in his studies came to the conclusion that the use of financial ratios can predict the bankruptcy of the companies and their inability to perform obligations related to the bonds for at least five years in advance. He put the ratio of cash flow obtained from operations to debt in the first place of importance and investment ratios (capital structure) in the second place and liquidity ratios after them. Altman introduced index Z which indicated the probability of bankruptcy in company. In his model, the index Z of bankruptcy is calculated based on five financial ratios and in this way the probability of bankruptcy is determined within the next 2 years. His model success rate was 95% (Safari, 2002). Many bankruptcy prediction models were created afterwards that used these two models as a template.

Solvency system is as a bankruptcy prediction model and a system to control the risks of insurance companies. In designing solvency system it was tried to include specific risks that insurance fields are faced with. For example, the types of risks that life insurance institutes are faced with include insurance risk, credit risk, market risk, operational risk, liquidity risk, the risk of group companies (holding groups and etc.) which uses the model of Altman Z-Score as a template (Safari, 2013). A mentioned model for insurance companies in Iran, is a model based on risk factor/coefficient that is obtained from multiplication of amounts of exposure to risk (which are extracted from the financial statements) in the risk factors, and finally by merging the amounts of risk values we can obtain the risk of the whole of insurance company. 4 values of risk are: R1: Total Insurance Risk; R2: Total market risk; R3: total credit risk; R4: Total liquidity risk (Note that catastrophic accident risk lies within the insurance risk according to the above definition) they can be combined with each other according to the following formula:

$$RBC = \sqrt{R_1^2 + R_2^2 + R_3^2 + R_4^2}$$

The result is a value of Rials which is an essential capital that every company should have according to their risk level. This value is equivalent to the fraction denominator of solvency ratio. The following formula is used to calculate the amount of insurance company solvency from the solvency ratio:

$$\text{Solvency Ratio} = \frac{\text{value of existing capital}}{(\text{RBC}) \text{ deriuqeR} \backslash \text{Amount of Capital}} \times 100$$

Z-score model of Altman has many problems such as its generality for application in various industries and the most important one is the intuitive nature of Z index values, in fact, the amount of variable is dependent on a mental value, In the real world this amount is not observable and measurable instead, the ratio of solvency is a more tangible and measurable variable that has a particular application in the insurance industry.

2.1. Research Conducted Outside of Iran

The first research was conducted on the prediction of bankruptcy by Thomas Wodlok in 1900. He did a classical analysis in the rail industry and presented the results of his research in an article entitled "The percentage of operating expenses to gross cumulative profit". In 1911, Lars Jambr Line in an article entitled "Principles of Investment bonds from the ratios obtained by Wodlok, created the performance ratios. In 1930 and 1935, Arthur, Nikkor and Raymond Smith found in their studies entitled as the analysis methods in financial ratios of bankrupt companies that the most accurate ratio to determine the state of bankruptcy, is the ratio of working capital to total assets. The first research to create a model for bankruptcy prediction, were the studies of William Beaver in 1966. Other researches conducted abroad in recent years: Diaz et al (2005) studied about two non-parametric statistical techniques to predict financial failure in an article entitled "Predicting financial failure in life insurance companies in Spain" the study showed that these two techniques are suitable alternative for bankruptcy prediction models in the insurance sector.

Adnan Aziz (2006), compared various models for bankruptcy prediction in one year before the bankruptcy event, and by analyzing the results of 46 studies and investigating 89 companies concluded that 60 percent of the conducted studies have used financial ratios as descriptive variables of their research and 7% of information have used cash flow and the remaining 33% have used a combination of financial ratios and other variables such as macro and micro economic, company specific and industry specific, this finding suggests the validity of the content of the company's accounts.

Wu et al. (2010), in a study investigated models for bankruptcy prediction of Altman (1968), Olson (1980), *Zmijewski* (1984), Shumway (2001) and Hiljest et al (2004). They used a wide range of independent variables (accounting data, information characteristics of the company and market, tacit probability of option pricing model) and different economic characteristics (distinctive-multiple analysis, Logit, Probit and risk model) in their study. They also used a series of performance criteria in the sample and out of the sample. The results showed that Altman's MDA model was the weakest model compared to other models. Ohlson and *Zmijewski* model were properly implemented in 1970, but their performance got worse in the recent periods, and this means that the ability to predict corporate bankruptcies in these models has decrease compared to other existing models. Risk model of Shumway that includes market data and company characteristics, usually believe that bankruptcy prediction models are exclusively based on accounting data. Use of the optional tacit probability by Hiljest et al was proposed in 2004 and was implemented properly. Through reasoning they concluded that the most comprehensive model, is a model that by using key accounting data, market information and characteristics of the company, presents a more reliable prediction of bankruptcy in the future, according to the research hypotheses, results are interpreted as follows:

2.2. Researches Conducted in Iran

Khoshnoudi et al (2012) in a study entitled as investigating the financial vulnerability of the banking sector and the factors influencing it by using Z-Score index” investigated the stability of the banking sector and factors affecting it in the period 2001 to 2009, to this end, the balance sheets and profit and loss data of banks were used. The results suggest that increase in the ratio of debt to assets and cost to income, increases the vulnerability of the banking sector. Ali Akbari (2009) in the article entitled as predicting bankruptcy of companies for manufacturing companies in America, and concluded that the profitability and leverage ratios have a higher predicting power in predicting bankruptcy.

Safarzadeh (2009) in his study concluded that the performance of the model in classification of companies has been suitable and classification accuracy of the model exceeded 84.9 percent. The results also showed that the model is able to predict the financial crisis and can help auditors, tax authorities and banking system.

Seyyed Abbas Hashemi et al (2010) in a study entitled “margin of the insurance company's solvency”, calculated the solvency index for insurance companies, the results showed that this index for private insurance companies must be at least 15% and for public insurance companies must be at least 11% of premiums received by insurance, so that the company could meet its obligations.

Samaneh Aziz Nasiri et al (2012) in an article entitled “ calculation of insurance company's solvency based on risk-based capital presented by NAIC” by calculating available risks in insurance companies, adjusted balance sheet items based on these risks and obtained five possible levels that insurance companies could be placed in them based on calculated solvency. Each level is separately calculated and at each of these levels appropriate measure is taken by the supervisory authority.

Safari (2013) in an article described the solvency systems in several countries and explained and described the assessment of monitoring system on the solvency of insurance companies in accordance with the Regulation No. 69 by law approval of the High Council of Insurance. Then, by comparing the characteristics and specifications of solvency in Iran with other countries, this system is relatively evaluated. Since the above system is a risk-based system, the sensitivity of the system and its relations with representative financial ratios of the insurance company risk is evaluated through regression multivariate model. Independent variable in this study, is the risks of the insurance company, which is shown in the model of solvency, and the goal is to assess the impact of risk in solvency index formula. Mahdavi (2011) in his study entitled as “predicting the bankruptcy of companies using logit model” concluded that the bankruptcy process in Iran, is not a gradual and long-term process, but the companies are affected by the economic and political volatility and go bankrupt in a short-term period.

Ahangari (2011) in a study that predicted the bankruptcy of companies listed in Tehran Exchange Stock by using a variety of decision tree methods, concluded that: CART algorithm with average accuracy of 94.43% in each year t, t-1, t-2, the year t for the bankrupt company, is the bankruptcy year and for non-bankrupt companies is the year for being placed in the sample. It has a higher efficiency in predicting bankrupt and non-bankrupt companies.

Seyyed Hosseini (2012) concluded in his study that the accounting information in predicting bankruptcy is of greater benefit to the market accounting information and market information cannot be a good supplement for accounting data in predicting bankruptcy.

3. METHODOLOGY

In terms of research goal this study is an applied research, as well as in terms of the type of data and time of collecting information is compilation-historical data, the available samples were analyzed during different time periods. Methodology is deductive-analysis correlation based on the characteristics of the subject. Data required for this study was extracted from of the financial statements, notes along the financial statements, stocks website and Rahavard Novin software.

3.1. Research Hypotheses

In this study, the following hypotheses are proposed:

1. There is a significant relationship between the ratio of solvency and financial ratios in the Iranian insurance companies.
 - 1-1. There is a significant relationship between solvency index and Current ratio in the Iranian insurance companies.
 - 1-2. There is a significant relationship between solvency index and reserves ratio in the Iranian insurance companies.
 - 1-3. There is a significant relationship between solvency index and loss ratio in the Iranian insurance companies.
 - 1-4. There is a significant relationship between solvency index and equity ratio in the Iranian insurance companies.

3.2. Population and Statistical Sample

As mentioned above, the purpose of creating solvency system, is to control risk and assess the solvency of insurance companies to ensure insurance policyholders of the future loss payment. Therefore to assess the system we use indexes that would be useful in determining the financial and insurance risk of these institutions. The time period is between the years 1389 to 1391(2010-2012). The statistical population of this research has been all insurance companies, both public and private. In the statistical population, the following companies with the following characteristics are selected:

1. Insurance companies that have been working for at least three years since the beginning of the activity as of 2012.
2. Those companies that have been active and weren't bankrupt during 2010-2011 and 2012.
3. The companies Information be available for preparation of financial ratios and desired index

By applying the above conditions, we selected 22 insurance companies as sample.

3.3. Research Model

The dependent variable is the ratio of solvency. Important financial ratios that represent risk also form the independent variables of the model that include financial ratios, equity ratio, reserves ratio, loss ratio. Thus, the multiple regression model is defined as follows:

$$SR = f(x_1 + x_2 + \dots + x_n) + \varepsilon$$

SR here is the solvency ratio as the dependent variable; X_1 to X_n are the explanatory or independent variables, i.e. important financial ratios that represent risks of insurance companies, and ε is the disturbance. The independent variables of the model, are the financial ratios that are representative of the types of risk, including current ratio X_1 , equity ratio x_2 , x_3 reserves ratio x_4 , loss ratio.

A) The independent variable

The definition of independent variables one by one:

- *Current ratio*: Current assets to current debts.

This ratio indicates the ability of a company to repay its debts and liabilities of the assets that can be in liquidity.

- *Equity ratio:* the equity of the shareholders to total assets. This ratio indicates to what extent the assets are brought by shareholders, and we use this financial ratio given that the used solvency index calculation model in this study was designed based on the determination of capital adequacy. Equity of shareholders in insurance company is not different from other companies.
- *Reserves ratio:* total technical and mathematical reserves and to total assets. This ratio indicates the real solvency of the insurance company. Insurance companies maintain a reserve from their portfolios that is used for loss payment. This source is separate from source that the insurance company uses to pay for its current costs. Technical and mathematical reserves are different in each of life and non-life insurance fields
- *Loss ratio:* The ratio of total loss to total premiums. This ratio expresses that what percentage of revenues of a company, belongs to the loss. Or in other words, what percentage of insurance income was spent on loss.

3.4. Data analysis

For data analysis, we describe research data first by using descriptive statistics. Then we examine research hypothesis using multiple regression. In order to use regression we should test classic assumptions which are based on permission on the use of regression. Errors Normality Test is done using both histograms and normal distribution, and both confirm normality.

3.5. Descriptive statistics

In this paper, central and distribution indexes are used to describe data. As you can see in the table fluctuations of independent variables for all insurance companies are brought forward and the average value is given in a column, this table can be used to determine the amount of the distribution.

Table 2. Can be used to determine the amount of the distribution.

	Number	Minimum	Maximum	Average	SD	Variance	Elongation	
							Statistic	Standard error
Iran	15	.15	119.00	34.2067	45.68898	2087.483	.804	.580
Asia	15	.07	104.00	29.6487	40.23947	1619.215	.879	.580
Dana	15	.01	111.00	30.2580	42.35065	1793.577	1.009	.580
Alborz	14	.16	143.00	29.0164	44.02117	1937.864	1.591	.597
Moalem	14	.01	106.86	32.2264	42.46704	1803.450	.850	.597
Parsian	14	.22	92.00	26.6607	35.39424	1252.752	.876	.597
Kar Afarin	14	.12	130.00	25.7036	39.83972	1587.203	1.674	.597
Mellat	14	.31	241.00	37.1821	66.75153	4455.767	2.501	.597
Sina	14	.17	159.00	29.2886	50.39433	2539.589	1.765	.597
Razi	14	.21	102.85	32.5814	41.62731	1732.833	.692	.597
Tose'eh	14	.19	98.12	25.3393	34.72670	1205.944	1.240	.597
Saman	14	.22	114.00	29.2114	40.05529	1604.426	1.088	.597
Dey	15	.26	167.00	38.1027	51.75319	2678.392	1.366	.580
Novin	12	.19	83.12	25.9450	33.74923	1139.011	.824	.637
Pasargard	12	.32	113.00	30.8800	37.53197	1408.649	.987	.637
Mihan	12	.11	205.30	47.6717	64.25969	4129.308	1.513	.637
Kowsar	11	.06	92.00	24.6136	31.95190	1020.924	1.074	.661
Arman	8	.00	813.00	116.5138	282.26202	79671.846	2.795	.752

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Ma	9	.14	447.00	62.8467	145.40562	21142.795	2.897	.717
Hafez	14	.20	193.00	35.3529	57.91027	3353.599	1.840	.597
Omid	13	.27	492.00	62.2192	134.76814	18162.451	3.124	.616
Iran Moein	14	.10	520.00	53.5964	136.85666	18729.745	3.505	.597

3.6. Analysis of Research Findings

F-Limer test was used to select between compositional data and panel data. Given that significance level of the F- Limer test is equal to (0.000) H0 is rejected (significance level ≥ 0.05) and panel data method is accepted. Panel data method itself has fixed effects and random-effects and to choose between two methods Hausman test is used. Since the obtained significance level of Hausman test equals (0.000) the H0 is rejected and thus fixed effects method is accepted. Test results are shown in Table 2.

$$F_0 = \frac{(RRSS - URSS)/(N-1)^{H_0}}{URSS/(NT-N-K)} \sim F_{N-1, N(T-1)-K}$$

Table 2. Research findings.

Hausman test		F- Limer test	
1.22451	(0.000)	4.96185	(0.000)

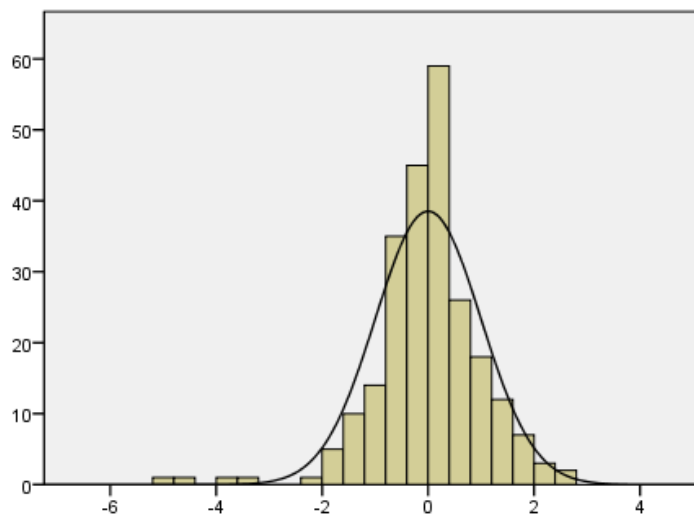


Figure 1. Normal distribution of residues histogram.

By looking at the table above it becomes clear that the amounts of residues have almost normal distribution with a mean of zero and standard deviation 1.

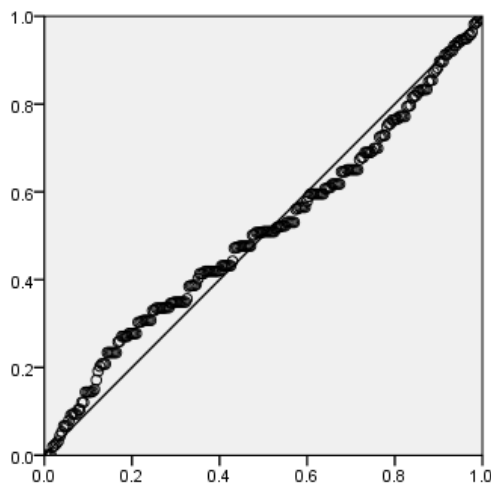


Figure 2. Normal probability diagram.

Since the distribution of data is normal, so we can use regression. Table 3 shows the correlation coefficient, the amount and intensity of the relationship between variables. Using this table, we can build regression model variables.

Table 3. Regression Results.

Regression model	Non-standard coefficients		standard coefficients	t	Sig.	
	B	Std. Error	Beta(β)			
1	Constant coefficient	5.412	.011		4.705	.000
	Current ratio	.248	.005	.285	5.252	.001
	reserve Ratio	.268	.005	.373	6.929	.000
	Loss ratio	.253	.005	.402	8.066	.000
	Equity ratio	.419	0.087	.608	9.453	.001

$$Y = 5.412 + .248 * (\text{Current ratio}) + .268 * (\text{reserve Ratio}) + .253 * (\text{Loss ratio}) + .419 * (\text{Equity ratio})$$

According to the calculated T values in the table and error level (SIG) all variables are significant in the regression equation. In column B (B) the results are analyzed as follows:

For one unit change in the current ratio, a change of 24.8% happens in solvency of the insurance companies (direct and positive change). For one unit change in the reserve ratio, a change of 26.8% happens in solvency. One unit change in the level of loss, causes 25.3% change in solvency. And finally one unit change in the equity ratio, causes 41.9% change in solvency.

Table 4 shows the results of the study hypothesis F statistics show that the model was significant in general, and according to statistics Durbin-Watson, no problem correlation.

This table shows that the correlation coefficient is very strong. There is a strong relationship between research variables. In other words, 84.9% of the changes are due to the independent variables. According to the obtained results shown in Table 3 the equity ratio has the greatest effect on solvency and is 0.79 percent. To evaluate the significance of the multiple regression we used variance analysis. As seen in Table 4, according to obtained F it can be concluded that the independent variables (predictor) are effective in the prediction of the dependent variable (response), also given that the level of significance of the model is 0.001, and this value is smaller

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than 0.01, so H0 hypothesis is rejected (regression is not significant) with a confidence level of 99%, i.e. the regression model is significant.

Table 4. Research hypothesis test results.

Pearson correlation coefficient		Current ratio	reserve ratio	Loss coefficient ratio	equity ratio	Solvency
Current ratio	Pearson coefficient	1	.051**	.002	.055	.434**
	Significance level		.062	.109	.219	.000
	Number	22	22	22	22	22
reserve ratio	Pearson coefficient		1	.043**	.052	.573**
	Significance level			.085	.060	.000
	Number		22	22	22	22
Loss coefficient ratio	Pearson coefficient			1	.088**	.684**
	Sig. (2-tailed)				.208	.000
	Number			22	22	22
equity ratio	Pearson coefficient				1	.792**
	Significance level					.000
	Number				22	22
Solvency	Pearson coefficient					1
	Significance level					
	Number					22
The coefficient of determination		R Square				.849
Adjusted coefficient of determination		Adjusted R Square				.267
Durbin -Watson statistic		Durbin-Watson				1.65
F-Statistics		ANOVA	Prob.(0/001)			11.290

4. SUMMARY AND CONCLUSIONS

The conducted test results confirms that there was a significant correlation between solvency and financial ratios. Confirmation of this hypothesis suggests that solvency index for predicting bankruptcy of the insurance company for the insured and insurers is important. Although solvency is not reported in the financial statements, but it is effective in predicting the financial crisis of insurance companies and companies that have high solvency index, are faced with lower risk of financial crisis or financial collapse.

4.1. Executive Recommendations of the Research

Insurance companies in recent decades, have paid special attention to the prediction of financial crisis to report to the beneficiary parties and sought to find a way to evaluate a variety of risks that are faced with. Therefore considering the results of this study we will present the following suggestions:

1. Proposing drafters of solvency index to draw up a law regarding the presentation of this index in accompanying notes of the financial statements for the information of the insured.
2. Proposing Central Insurance to publicize access to the detailed calculation of solvency index through their own sites or magazines.
3. Insurance companies can use this model to analyze their financial situation in order to evaluate the performance of the company's operation.

4.2. Recommendations for Future Research

Based on the research results and questions that occurred to the researcher in the process of doing research. The following topics are proposed for further research in this area

1. Measuring the relationship between solvency index using other financial ratios.
2. Measuring the relationship between solvency index and financial ratios using other ratios and the components that insurance represent the risk of insurance companies.
3. With regard to the fact that calculation of this index has become obligatory since the year 90 and according to the Regulation No. 69 made by High Council of Insurance, its impact on the insurance company may not be visible in a short-term period but in the coming years the impact of this index can be evaluated on the performance of the managers of insurance companies.

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