

Complex Relationship Between Stock Price and Macro-Economy Based on Structural Equation Model

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Abstract

Studying China's stock market from a macroeconomic perspective has very important theoretical and practical significance. In the theoretical level, it can deepen our understanding of the field; but it can improve the investment combination of performance and increase our investment optional time reliability in the real level. This paper strikes up influence path diagram based on using the existing empirical research conclusion, and gets its path coefficient and the causal path diagram using the ML, ADF and GLS method. After the statistical significance test, we think the casual relationships of China's stock market as followed can be accepted: firstly, the year-on-year increase of M1 will cause the rise of Shanghai index; secondly, the year-on-year increase of PPI will cause the decrease of Shanghai index; thirdly, the year-on-year increase of M2 will cause the decrease of Shanghai index; finally, the appreciation of the RMB will cause the increase of Shanghai index at last.

Key words: Complex relationship; China's stock price; Macroeconomic variable; Structural equation model

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INTRODUCTION

Managing the risk of the stock market is very important for the sustainable development of the financial system. In 2008, the global financial crisis has brought serious trauma

to the world economy, which still did not heal. And the causes of the crisis were related with excessive financial innovation and the lack of supervision. Risk management is the process of risk identification, risk evaluation and risk management. Risk management can provide useful information to predict market risk, such as stock market variables, stock price, and macroeconomic situation and so on. The systematic risk management, researching the influence path of the macroscopic variables to the stock price is indispensable.

There are at least four important practical significances to understand the stock market in the macroeconomic perspective. a) It can improve the performance of the portfolio. If we understand the relations between the stock market rate of return and macroeconomic, we can buy more stock when the macroeconomic stage is beneficial to the stock market, vice versa. b) It can increase the success possibility in selecting the investment opportunity. At present, there are three schools in the stock market, which are fundamental analysis, industry and company analysis, and technical analysis. Among them, the fundamental analysis belongs to the category of opportunity election, industry and company analysis belongs to the category of choosing category, technical analysis belongs to the category of choosing. From the perspective of optional time, researching the influence of macroeconomic trends to the stock market is indispensable. c) About the complicated relationship between stock prices and the macroeconomic variables, there have been unable to come to an agreement at home and abroad. This paper can draw a conclusion of relative certainty using the tool of structural equation, which can be data validation. d) It can avoid the extreme means in macroeconomic regulation and control, which can avoid some adverse effects on economic.

Until now, many scholars have studied the complexity relationship between the stock price and the macro economy, but none of them have been unable to draw a deterministic conclusion. In addition, much of the existed

research ignored the complicated relationship between them. In view of this situation, this article tries to make some innovation about the research methods and idea, hoping to draw a of relative certainty conclusion.

1. THE MAIN MACROSCOPIC FACTORS ON STOCK PRICE INFLUENCE

1.1 The Influence of Money Supply

The theory relationship between Stock prices and monetary supply includes two aspects. Firstly, how the money supply influence the stock prices. Money supply can influence the stock prices in three ways, including the expected effect, investment combination effect and stock intrinsic value growth effect. All the three effect in general are positive, which means that the stock market prices will increase when the money supply increases. Secondly, the stock market price can influence the money supply. Stock price can influence the money supply in two ways, including the wealth effect, transaction effect, asset portfolio effect and substitution effect. Among them, the wealth effect, transaction effect, and asset portfolio effect has positive influence, the substitution effect has negative influence, so the impact of share price change on the money supply is uncertain in theory. Yu (2011) used GARCH model studied the effects of selected macroeconomic variables on the stock market index in South Africa. It finds that South Africa's stock market index is positively influenced by the growth rate of real GDP, the ratio of the money supply to GDP and the U.S. stock market index and negatively affected by the ratio of the government deficit to GDP, the domestic real interest rate, the nominal effective exchange rate, the domestic inflation rate, and the U.S. government bond yield.

1.2 The Influence of Economic Growth

So far, there still exists dispute between the relationships of stock price and economic growth in theory and empirical. Friedman did an empirical analysis of the influence of stock price to inflation and output effect of the United States for a relatively long period of time, and the results show that the effect was not significant. One study of the research group of the people's bank of China shows that, the influence of stock price to the macroeconomic would become more prominent with the development of the stock market and financial innovation, but the role of stock market in the monetary policy transmission was still quite small.

1.3 The Influence of Price Index

There are three theory hypotheses between the Stock prices and inflation: fisher effect hypothesis, demand shock and supply shock, wealth effect and the substitution effect hypothesis. Using the demand shock and supply shock to explain stock prices and inflation relations mainly depends on the impetus source of inflation and

its importance. According to the wealth effect and the substitution effect hypothesis, the relationship between stock prices and inflation can be positive or negative, which depends on whether the wealth effect or the substitution effect is dominated.

1.4 The Influence of Exchange Rate

In general, the local currency devaluation will promote the export and inhibition the import. In addition, the exchange rate can impact company's performance through the following ways: a) influence the company's outstanding achievement; b) influence the money supply and demand in the stock market. Although the capital project in our country is still under control, but the RMB appreciation attracted a large number of international capital into the stock market of China through informal channels, and the turnover of money will inevitably lead to the price fluctuations of domestic asset. Lee, Dong, and Chou (2011) used STCC-GARCH model studied the interaction between stock price and exchange rate and explored their dynamic correlation influenced by the stock market volatility. The empirical results indicated that there are significant price spillovers from stock market to foreign exchange market for Indonesia, Korea, Malaysia, Thailand and Taiwan.

1.5 The Influence of PMI

Due to the released and formulated attribution, PMI is highly correlation with many data index, especially GDP.

In addition, the subentry indexes of PMI, which represents the demand and supply information of the industry, are closely linked to production, and will affect the enterprise's strategy decision.

1.6 The Influence of Fixed Investments

Investment is the largest part of change in GDP, and can be used to measure the economic "heat". Usually, most of the demand decline in the recession period is caused by the investment decline, and most of demand expansion in the overheating period is caused by the investment increase. Although investment is not in the largest part in total demand, it plays an important role in economic cycle due to its characteristics of frequent fluctuation.

2. METHOD AND MODEL

2.1 Method and Analysis Procedure of Structural Equation Model

The economists Wright first put forward the concept of "path analysis" in 1921. Karl Joreskog, the Swedish statisticians and psychologists, put forward the Structure Equation Model (SEM for short) in 1973 (Hendry, 1986). Since then, path analysis was gradually shifted to LISREL, AMOS and SEM software, which is called the path analysis oriented in the structure equation model.

The main tool of Path analysis is the path diagram (Wu, 2009), it uses a arrow line (single arrow representative

causal relationship between variables, the double arrow representative correlation relationship between variables) representative the preset relationship between variables, the arrow indicates the relationship between variables is linear, and the direction of arrow representative the direction of causal relationship.

This paper uses AMOS software to analyze the complex relationship between the macro economic variables and stock price.

Model estimation is the most important part of SEM, and we can't come to the correct results if we choose the inappropriate model estimation. Hoyle and Pinter did a special study and presented suggestions as follows (Huang, 2005): We suggest that the author should routinely report ML estimation results. If the characteristic of the data makes it inappropriate to estimate using ML, we would better use other estimate methods and list the results in the comments. In this paper, I use the ML estimation method firstly, and then use the ADF and GLS estimate methods, if the latter results are significant different from the former, I would present it in this article.

The debugging process of SEM is somewhat similar to that of multiple regressions. Firstly, we need to test the single path coefficient, if all the single path coefficients are significant; we need to test the whole model's adaptation. There are three widely used tests to test the whole model's significance: Chi-square test value, GFI and AGFI tests. The closer the value of χ^2/df is to 1, the better of the fitting results. GFI and AGFI revealed the extent of the whole adapter, most of the scholars suggested that it's better when GFI and AGFI value are greater than 0.9.

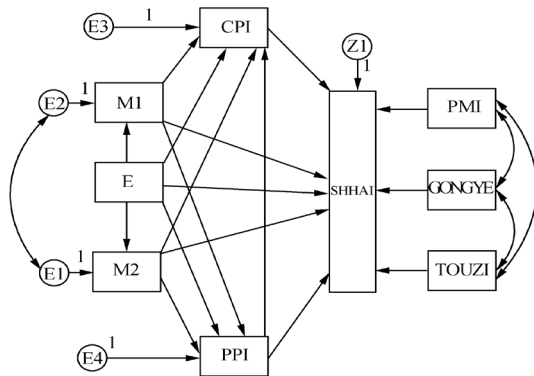


Figure 1
Preliminary Design of SEM Path Diagram

2.2 Model Design

Based on the theory and empirical research conclusion of the former two chapters, we design out the path diagram preliminary (see Figure 1). In view of the exchange rate reform of our country in 2005, and after which the market structure has changed dramatically, so this paper mainly use the data after the exchange rate reform.

In Figure 1, M2 represents broad money demand, M1 represents narrow money demand.

CPI represents consumer price index, PPI represents producer price index, E represents the exchange rate of RMB against the dollar (direct quotation), PMI represents purchasing managers index.

TOUZI represents year-on-year growth of fixed asset investment, GONGYE represents industrial added value year-on-year growth rate.

Among them, we use M1 and M2 represents the money supply, and the data comes from the people's bank of China, E represents the exchange rate, and the data from China foreign exchange administration; CPI and PPI representative price, and the data come from the national bureau of statistics; SHHAI represents the Shanghai index, and the data comes from the Dazhahui software; PMI represents the purchasing managers index, and the data comes from China federation of logistics & purchasing; TOUZI and GONGYE represent economic growth situation, and the data comes from the national bureau of statistics.

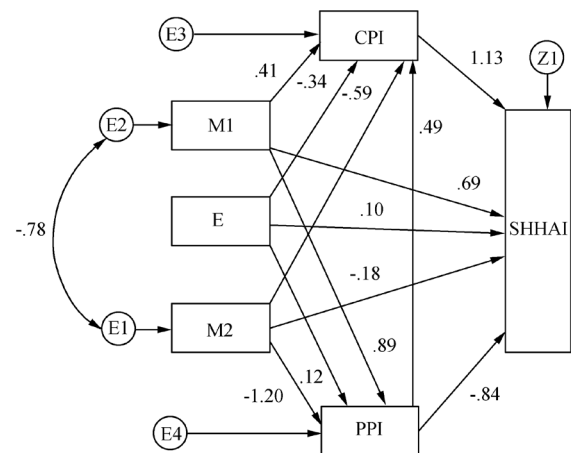


Figure 2
Standardized Path Diagram and Path Coefficients (ML Estimation)

Table 1
Non-Standardized Coefficient and Statistical Test (ML Estimation)

Variable relationship	Estimate	S.E.	C.R.	P
PPI ← M1	0.49	0.06	8.133	***
PPI ← M2	-1.223	0.112	-10.906	***
PPI ← E	0.785	0.451	1.741	0.082
SHHAI ← PPI	-208.196	17.531	-11.876	***
SHHAI ← M2	-45.445	26.879	-1.691	0.091
SHHAI ← M1	92.814	12.115	7.661	***
SHHAI ← E	155.689	77.984	1.996	0.046
SHHAI ← CPI	480.731	31.753	15.14	***
CPI ← M2	-0.348	0.08	-4.321	***
CPI ← PPI	0.283	0.049	5.737	***
CPI ← M1	0.13	0.037	3.472	***
CPI ← E	-1.299	0.217	-5.981	***

Note. ← means the influence path of variables.

2.3 Model Estimation and Debugging

According to the model study of chapter three, we estimated the path coefficients using the method of ML firstly, and got the path diagram (see Figure 2). Table 1 is the test results of parameter hypothesis, Table 2 and Table 3 is the test of the whole model. Seen from Table 1, all the other path coefficient pass the significant test of 0.05 level after debugging, except the path of E to PPI, M2 to SHHAI. Model's Chi-square test value is 0.3, GFI value is 0.998, and AGFI value is 0.977, all of which are ideal.

Table 2
Chi-Square Test (ML Estimation)

Model	NPAR	CMIN	df	P	CMIN/DF
Default model	18	0.6	2	0.741	0.3
Saturated model	21	0	0	-	-
Independence model	6	453.87	15	0	30.258

Table 3
The Whole Test of Model (ML Estimation)

Model	RMR	GFI	AGFI	PGFI
Default model	6807.996	0.998	0.977	0.095
Saturated model	0	1	-	-
Independence model	959.886	0.558	0.381	0.398

Similarly, we used ADF and GLS to estimate the parameters. Because the results of them have little different from that of ML methods, we will not show the results here.

3. THE EMPIRICAL RESULTS AND ANALYSIS

Path analysis is mainly used to reveal the interaction relationship between variables, and these relationships can be reflected through the path coefficient in the model. Table 4 is the standardized total effect of ML estimation; Table 5 is not the standardized total effect of ML estimation. The final results can be expressed using Equation (1) and Equation (2).

Table 4
Standard Total Effect

Variable	E	M2	M1	PPI	SHHAI
PPI	0.119	-1.199	0.894	0	0
CPI	-.338	-.586	.408	0.488	0
SHHAI	.096	-.181	.688	-.845	1.134

Table 5
Non-Standardized Total Effect

Variable	E	M2	M1	PPI	SHHAI
PPI	0.785	-1.223	0.49	0	0
CPI	-1.299	-.348	.130	.283	0
SHHAI	155.689	-45.445	92.814	-208.196	480.731

Note. Here are the standard equation and non-standard equation of ML estimation.

$$\begin{aligned} \text{SHHAI} &= 0.096E - 0.181M2 + 0.688M1 - 0.845PPI + 1.134CPI, \quad (1) \\ \text{SHHAI} &= 1.55689E - 45.445M2 + 92.81M1 \\ &\quad - 208.196PPI + 480.731CPI. \quad (2) \end{aligned}$$

We can draw three conclusions from the equation above:

a) The Shanghai Stock Index will rise with the appreciation of E, decrease with M2's year-on-year growth, rise with M1's year-on-year rise, and decrease with PPI and CPI's year-on-year rise.

b) Influence of the last four macroeconomic variables can be sort as $CPI > M1 > M2 > E > PPI$.

c) GONGYE, PMI and TOUZI don't have apparent influence on GDP in this model, which also proves that there isn't obvious causality between the Chinese stock market and economic growth.

CONCLUSION

In this paper, we did the theory research on the relationship of stock price and the macro-economic firstly; then, we introduced the model using in the paper; at last, we designed the model based on the theory research and model research and estimated the path coefficient.

After analysis, we think the casual relationships as followed can be accepted:

Firstly, the year-on-year increase of M1 will cause the rise of Shanghai index. Secondly, the year-on-year increase of PPI will cause the decrease of Shanghai index. Thirdly, the year-on-year increase of M2 will cause the decrease of Shanghai index. Fourthly, the appreciation of the RMB will cause the increase of Shanghai index at last. Finally, the year-on-year increase of CPI will cause the rise of Shanghai index.

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