

Empirical Analysis of China Purchasing Managers Index(PMI) and Shanghai Composite Index(SH)

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Abstract-Studying the relationship between PMI and SH is of great significance to analyze the trend of stock market and a industry's development ability quantitatively and promote the healthy development of economic society. The paper employs VAR model based on econometrics, conducting the unit root test, the co-integration test and impulse response to analyze the relationship between purchasing managers index(PMI) and shanghai composite index(SH) from January 2009 to July 2011, furthering empirical research to improve accuracy and credibility of prediction on stock market. The conclusions of the research are that PMI has a longterm co-integration relationship with SH, in addition playing a positive role to SH. Consequently, correct application of PMI is of great importance in analyzing and predicting the trend of stock market. In brief, the conclusions are matched with the actual situation of China.

Key words-PMI; SH; VAR; Impulse response analysis

1.Introduction

PMI can be defined as a kind of comprehensive economic monitoring index system, released monthly, which composed of manufacturing and service sector, and construction sector in some other countries. Through summarizing monthly survey data of purchasing managers, PMI reflects economic trend. Being prefigurative, timely and instructive, PMI is of great importance to measure economic development. PMI has high correlated relationships with other indexes, being meaningful in economic prediction and business analysis for government departments, financial institutions, investment companies and enterprises.

2.Related literature

This section mainly introduces some empirical studies on PMI. China Logistics Center constantly applies PMI, the monthly comprehensive data, and subdivision indexes of PMI on Chinese economic situation analysis and prediction. Ying Yu(2007)^[1] discusses sampling method of PPS as to data acquisition when applying PMI. Ying Yu and Jin Cai(2008)^[2] investigate the relationship between PMI and other data, which proved in high correlation coefficient between them, laying the theoretical basis for future regression analysis and prediction research. Besides, many other scholars discuss the empirical relationships between PMI and other indexes. For example, Daodeng Zhang and Lin Yu (2009)^[3] conduct empirical relationship between PMI and

CPI, CCI with VAR model. Libin Zhang and Yi Feng(2012)^[4] analyze the inner granger causality of GDP and PMI. Focusing on stock market, the paper builds VAR model based on quantitative method to discuss inner relationship between PMI and SH, furthering empirical research to improve accuracy and credibility of prediction on stock market.

3.Model and test

3.1 Introduction of VAR model

Based on the statistical property of data, vector auto regression (VAR) set regression of some lagged variables among all variables. Nowadays, the model is mostly used for prediction in relevant time series system and dynamic effect of random disturbance on variable system. Generally, mathematical expression for the VAR model is:

$$Y_t = \alpha + A_1 Y_{t-1} + \dots + A_p Y_{t-p} + B_1 X_{t-1} + \dots + B_r X_{t-r} + e_t \quad (1)$$

Y_t and X_t represent endogenous and exogenous that are p th-lagged and r th-lagged respectively. $A_1 \dots A_p$ and $B_1 \dots B_r$ are parameters to be estimated, and e_t is disturbance. In the modeling process of VAR, number of variables existence in interrelation and lagged phases need to be determined, which generally determined according to minimum criterion of AIC and SC value in practice.

$$AIC=N \ln (ESS)+2K$$

$$SC= \ln (RSS/N)+K/N \times \ln (N)$$

Here K is the number of the model parameters. N is sample capacity. RSS is the sum of squared residuals, ESS is regression sum of squares.

3.2 Unit root test

Unit root test is the process of inspecting whether the variables are smooth, mainly composed of ADF inspection that will be introduced on focus and DF inspection. ADF has three kinds of model that are:

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^m \beta_t \Delta X_{t-j} + \varepsilon_t \quad (2)$$

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^m \beta_t \Delta X_{t-j} + \varepsilon_t \quad (3)$$

$$\Delta X_t = \alpha + \beta t + \delta X_{t-1} + \sum_{j=1}^m \beta_t \Delta X_{t-j} + \varepsilon_t \quad (4)$$

Null hypothesis: $H_0: \delta=0$, alternative hypothesis: $H_1: \delta \neq 0$. The α is constant term. t is the time trend term, m

is lag intervals. ε_t is residual term. Reject the null hypothesis H_0 and accept H_1 if the ADF value of δ is less than a critical value, demonstrating the series being stationary and out of unit root, or need further observation until being sure that it is integrated of d , namely $I(d)$ sequence.

3.3 Co-integration test

Popular said, Co-integration means there may be a long-term equilibrium relationship between unstable and same order data sequences. Here is formal definition of co-integration: y_t and x_t are co-integrated of (d, b) if $a_1 y_t + a_2 x_t$ -the linear combination of time sequences of $y_t \sim I(d)$, $x_t \sim I(d)$ -is integrated of $(d-b)$, expressed as $y_t, x_t \sim CI(d, b)$.

4. Empirical analysis

The paper will analyze data of PMI and SH from January of 2009 to June of 2011 empirically with Eviews 6.0.

4.1. Unit root test

The paper test unit root for PMI and SH respectively with ADF that is mostly used, showing in table 1:

Table1. Result of unit root test

	T value	option	Critical value (5%)	stationarity
SH	0.36	(0,0,1)	-1.95	unstable
DSH	-3.92	(c,0,1)	-2.98	stable
PMI	0.02	(c,0,1)	-2.97	unstable
DPMI	-3.89	(c,0,1)	-2.98	stable

Table 1 shows that the original sequence of SH and PMI is unstable while their respective first-order

difference sequences are stationary, namely integrated of one $I(1)$.

4.2. VAR model of SH and PMI

Determining the best lagged phase according to

judgment principle of minimum value of AIC and SC to build model based on the data of 1-5 lag intervals firstly:

Table 2 . Related data of VAR

	1	2	3	4	5
AIC	15.76	15.28	15.57	15.72	15.93
SC	16.05	15.75	16.24	16.59	17.00

Showing as table 2, second-order lagged phase is the best lagged phase for VAR model of SH and PMI according to judgment principle of minimum value of AIC

and SC. Through software tests showing as table 3 can we get VAR model of SH and PMI.

Table 3. Test-results of VAR model

	PMI	SH
PMI(-1)	0.759724	100.6354
PMI(-2)	0.225614	-113.7069
SH(-1)	0.000393	0.479380
SH(-2)	0.000180	0.035480
C	0.229977	2693.557

$$PMI = 0.229977 + 0.759724PMI(-1) + 0.225614PMI(-2) + 0.000393SH(-1) + 0.000180SH(-2) \quad (5)$$

$$SH = 2693.557 + 100.6354PMI(-1) - 113.7069PMI(-2) + 0.479380SH(-1) + 0.035480SH(-2) \quad (6)$$

The estimated results of (5) show that the coefficients

of lagged influence of SH on PMI equal 0.00393 and 0.000180 respectively, the greater influence of which is the first-order lagged coefficient, demonstrating the shorter intervals the greater influence, in addition, sum of which equals 0.000573, demonstrating SH playing positive role in PMI.

On the contrary as (6), the coefficients PMI on SH equal 100.6354 and -113.7069 respectively, among which the second-order lagged phase has greater while negative influence on SH, showing PMI playing negative role in :

SH in a certain lagged phase.

4.3. Co-integrated inspection

In order to confirm whether PMI and SH getting long-term equilibrium relationship that is inspecting whether et-residual term-being steady, EG two-step method is applied for the co-integrated inspection. Result shows as figure 1

Null Hypothesis: ET has a unit root				
Exogenous: None				
Lag Length: 1 (Fixed)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.589494	0.0009
Test critical values:	1% level		-2.656915	
	5% level		-1.954414	
	10% level		-1.609329	
*Mackinnon (1996) one-sided p-values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(ET)				
Method: Least Squares				
Date: 04/22/12 Time: 16:14				
Sample (adjusted): 2009M05 2011M06				
Included observations: 26 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
ET(-1)	-1.079930	0.300859	-3.589494	0.0015
D(ET(-1))	0.032567	0.210612	0.154628	0.8784
R-squared	0.507731	Mean dependent var		0.029030
Adjusted R-squared	0.487220	S.D. dependent var		0.667398
S.E. of regression	0.477915	Akaike info criterion		1.435036
Sum squared resid	5.481665	Schwarz criterion		1.531812
Log likelihood	-16.65546	Hannan-Quinn criter.		1.462904
Durbin-Watson stat	1.940039			

Figure 1. Result of unit root test

According to figure 1 can we get that sequence of et is steady which means SH and PMI are in long-term equilibrium relationship, what is more, which means it is reasonable and credible to predict SH under PMI, given that the value of ADF is less than a critical value on the 5% confidence level.

4.4. Impulse response analysis

Usually, in the process of analyzing impulse response,

we discuss the impact on the other variables when error term get changed instead of one of the variables getting changed, analyze the dynamic effect on system when the model get shocked, consider how the influence that the disturbing term get spread to other variables.

Mentioned above, this section mainly discusses how the disturbing term of PMI affect itself and SH, through applying the impact of standard deviation to disturbing term of PMI, showing as figure 2:

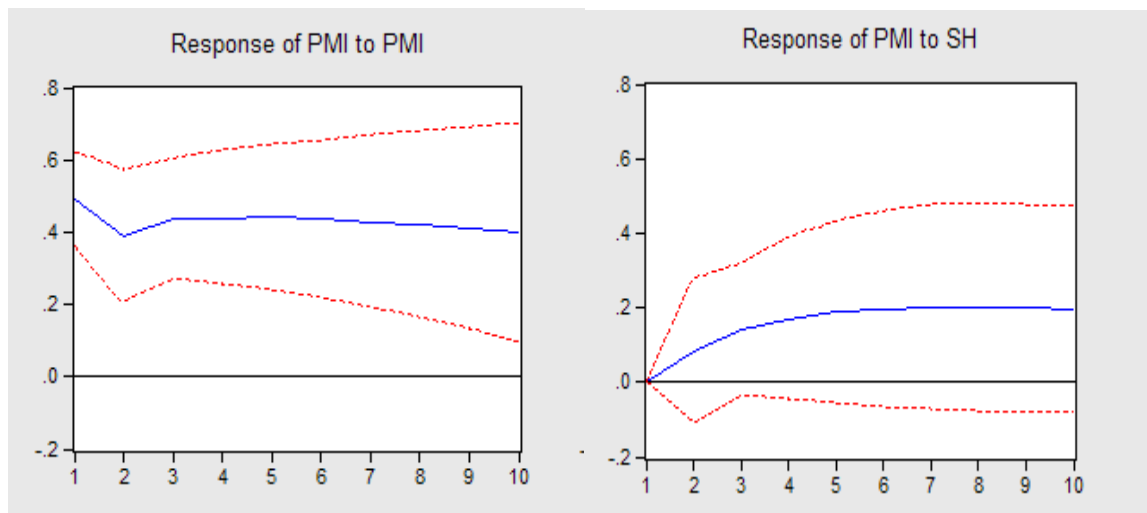


Figure 2.Results of impulse response

The left one shows that when applying a positive impact on PMI in this period, its fluctuation decrease to minimum value in the second phase and rise gradually but steadily finally. The right one tells us SH grows immediately after applying a positive impact on PMI in this period, producing long-term and continuously positive effect, demonstrating the response of PMI to SH being long-term and positive.

5.Conclusion

The paper study the inner-relationship between PMI and SH with VAR model and discuss the response of PMI to SH under impulse response function. Integrated the above analysis, we come to the conclusions that china purchasing manager index (PMI) and shanghai composite index (SH) are in a long-term and co-integrated relationship, and SH act in positive direction when PMI get external and positive impact, which proving that the related analysis of PMI being conducive to analysis and prediction on stock market, while as we all know, the empirical results proved efficient though longer and more sufficient analysis may be hard without enough data. Still, We can apply PMI to analyze and predict trend of the stock market. Certainly, we could not just rely on the system, but combined with other data systems meanwhile, achieving more accurate results on prediction. At the same time, we could deepen each index research of PMI to combine PMI with specific industry, being more accurate and specific on prediction.

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Vitae

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