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An Analysis on The Correlation Between FDI Inflows and Chinese Manufacturing PMI Index

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Abstract: FDI inflows are vital for the China's development and Chinese manufacturing PMI index is the important indicators measuring national industry development trend. The relation research between them has important economic significance. So the VAR model to establish and stationery test, cointegration regression, ECM model, granger test and impulse response function method are used. It is concluded that there is long-term equilibrium and stable relations between them and FDI inflows were significantly positive role in promoting the manufacturing PMI index in the short term. FDI inflows are the granger reason of the manufacturing PMI index which confirms that FDI inflow has important influence on the Chinese manufacturing PMI index. But it is not significant that the manufacturing PMI index impacts on FDI inflows.

Key words: FDI inflows, Chinese manufacturing PMI index, VAR model, important influence

INTRODUCTION

Since, the reform and opening up, China has been widely considered to be a success story that foreign direct investment promotes the country's economic development. Foreign direct investment has played a significant role in optimization of resource allocation, improvement of marketing model, stimulating demand and improving the employment. Especially, manufacturing sector becomes the most significant Foreign Direct Investment (FDI) industry. (Ahmed, 2012) According to Commerce Department statistics, in 2012, the total foreign direct investment in the manufacturing sector reach 48.866 billion U.S. dollars, accounting for 40.36% of total foreign direct investment in the country; the number of enterprises reached 8970, accounting for 35.97% of the national total foreign direct investment enterprises. With the adjustment of industrial structure, the proportion of both the gross amount and the number of enterprises, of manufacturing sector in the total foreign direct investment has a gradual decline. But even so, the proportion is the largest one in all industries (Drysdale, 2009).

PMI index is an important indicator of both the industrial development trend analysis in every country and the supply and procurement of enterprises. The index is a weighted composite index from five diffusion index: product orders, product yield, employment, supplier product delivery time and inventory. PMI index is mainly divided into manufacturing and non-manufacturing PMI. Manufacturing PMI plays an important role in detecting and predicting of manufacturing economic and market trends. Generally, 50% is the watershed for the manufacturing PMI index. If PMI index is more than 50%, it is indicated that the manufacturing sector shows an overall trend of expansion. If PMI index is less than 50 %, it is indicated that the manufacturing sector shows an overall declining trend. Since, 2008, Chinese manufacturing PMI have slight fluctuations around 50% while in most of the months remain above 50%. Oriental Fortune Data Center shows that since October 2012, the manufacturing sector PMI index has remained above 50%, indicating that manufacturing sector shows an overall trend of expansion. The PMI index can be weighted by five categories of indicators: production, new orders, employees, supplier product delivery and inventory, with equation:

$$PMI = Order\times30\%+Production\times25\%+Employees\times 20\%+Distribution\times15\%+Inventories\times10\%$$

The order which accounts for 30 % in the equation, is greatly influenced by the economic environment: If the economy improves and the product is in great demand in the market, the company will receive stack of orders. The production which accounts for 25%, is mainly affected by production costs and product prices. The employees, distribution and inventories, however, are mainly derived from the company's internal operations.

Research on the linkage between FDI and manufacturing PMI is not much at home and abroad. The economic effecting of logistics FDI (Wang and Wang, 2010) is researched. There are not many literatures about

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PMI index. The calculation method of the manufacturing PMI index (Cho and Ogwang, 2007) is provided. However, as manufacturing FDI plays a crucial role in Chinese economic development, it is indispensable to detect and predict manufacturing economic activity by PMI index. FDI plays a role on the PMI index mainly through its impact on economic environment, the cost of production and the price. So, analysis of the linkage between the two is of significant importance in research. In this study, VAR model is established by time-series data of China from December 2011 to September 2013. Empirical research and analysis of the linkage between FDI and manufacturing are conducted.

EMPIRICAL TEST

Data source and variable set: The data derives from China Economy Information Net,the variables involved in the model are as follows: FDI inflows and manufacturing PMI index which is measured by respectively manufacturing foreign direct investment actual using capita and manufacturing purchasing manager index, FDI and PMI is replaced in the following empirical process.

Unit root test: Before time series analyzes, the selected variable sequences need unit root test. The study selects ADF unit root test, test results are shown in Table 1.

As can be seen from the results in Table 1, ADF unit root test of PMI and FDI original sequence both have received the null hypothesis, showing that they are the presence of a unit root, namely that is not stable, when ADF test is used after first-order difference of two sequences which rejected the null hypothesis in the 1% significance level, indicating that the PMI order and FDI order are all the time series of the integrated first-order.

Cointegration test: The change trend is described after the first order difference of the PMI and FDI sequence in Fig. 1. Seen from the table, some synchronization phenomenon maybe exist in the change trend of the two sequences at different time points, so they need to use cointegration test. Because the bivariate cointegration test is considered in this article, EG cointegration test is performed.The process of EG cointegration test: Firstly, long-term equilibrium equation carries out cointegration regression which received regression residuals sequence et,and then et uses the stationary test. In case of stability,cointegration relationship exists between PMI and FDI. Instead, there is not cointegration relation. The test results are shown in Table 2.

Seen from Table 2, the long-term equilibrium equation of regression residual sequence rejected the null hypothesis of ADF unit root test under the 5% significance level, showing that the residual sequence is stable. Namely that the change of PMI and FDI exists a long-term equilibrium.

ECM model: Through the above analysis, the change of PMI and FDI exist a long-term equilibrium and stability relation, but the long-term stable relationship is built on the foundation of the short-term dynamic adjustment, so the short-term adjusting effect is needed to test. This study chooses the ECM model to analyze.

Seen from Table 3, in the short term, the FDI change have significant positive promoting effect on the PMI index change (lag phase 3). Because the short-term adjustment coefficient under 95% significance level is significantly negative, namely that the deviation in the short term has been corrected 43.7% (Mutascu and Fleischer, 2010).

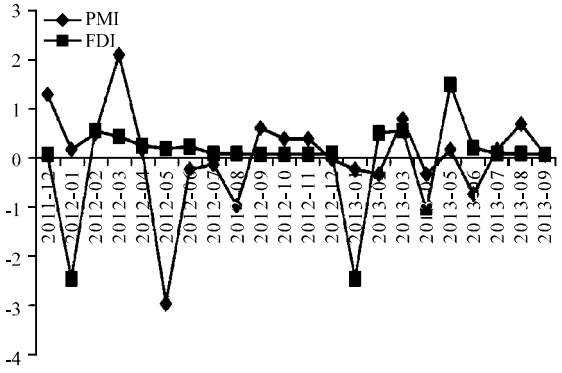

Fig. 1: PMI and FDI of first-order difference sequence

Table 1: ADF unit root test

Variable	t-value	1%	5%	10%	Conclusion
PMI	-2.823162	-4.440739	-3.632896	-3.254671	Accepting the null hypothesis
D (PMI)	-5.986013	-4.616209	-3.710482	-3.297799	Rejecting the null hypothesis
FDI	-2.699245	-4.440739	-3.632896	-3.254671	Accepting the null hypothesis
D (FDI)	-5.116278	-4.467895	-3.644963	-3.261452	Rejecting the null hypothesis

Table 2: Cointegration test results

Variable	t value	1%	5%	10%	Conclusion
et	-3.163641	-3.788030	-3.012363	-2.646119	Rejecting the null hypothesis

Granger causality test: This article selects the granger causality test to analyze internal logic of relations between the the PMI change and FDI change. The test results are shown in Table 4.

From the results of granger causality test, you can see, the lag of length 2, the FDI change is the granger reason of PMI changes, but it is not significant that PMI change effects on FDI change.

VAR model: Before establishing the VAR model, we need to test the stability of the model. Also we need to select the appropriate lag length, according to the principle of minimum SC and AIC. Figure 2 shows the results of the stability test. It indicates that the eigenvalues are smaller than 1 which means the model is stable.

Table 5 explores the process of the lag length selection. According to the minimum of the AIC and SC, we set the lag length is 1. Then we can get the results as follows.

$$DPMI = 0.0667297589114 \times DPMI(-1) - 4.50189587927 e\text{-}06 \times DFDI(-1) + 0.0285925717633$$

$$DFDI = -4041.31375348 \times DPMI(-1) - 0.12081296408 \times DFDI(-1) - 490.597084125$$

Impulse response function: Figure 3 and 4 show that the responses of DPMI and DFDI to Cholesky one S.D. Innovations. As we can see, when there is a S.D innovation to the DPMI, the DPMI has a immediately positive response of 0.9. However, the response will be fallen to 0.1 at time 2. Then it will tend to be constant after the time 4. Similar to the DPMI, DFDI also has a

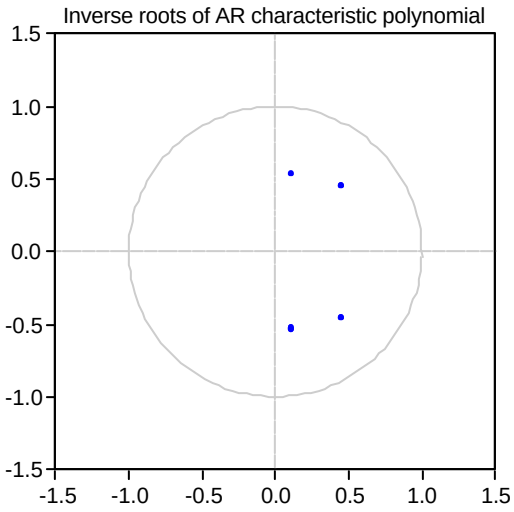

Fig. 2: Stability test of the VAR model

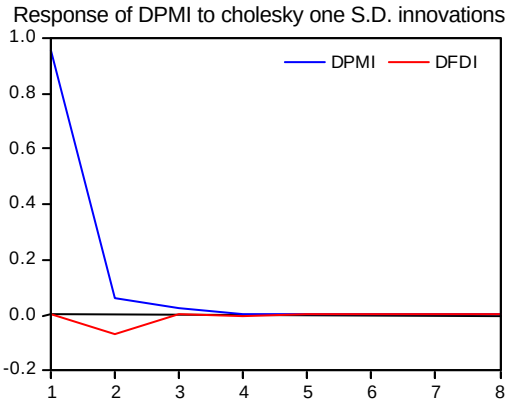

Fig. 3: Response of DPMI to Cholesky One S.D

Table 3: ECM model parameter estimation results

Variable	Coefficient	SD	t-value	p-value
C	-0.301136	0.449820	-0.669458	0.5134
FDI(-1)	5.39E-06	1.43E-05	0.376898	0.7115
FDI(-2)	-2.24E-05	1.49E-05	-1.504642	0.1532
FDI(-3)	2.99E-05	1.33E-05	2.244964	0.0403
ECM(-1)	-0.437120	0.205469	-2.127423	0.0500

Table 4: Granger causality test

Lag period length	Null hypothesis	F-value	p-value	Conclusion
2	FDI change is not the granger cause of the PMI change	3.02821	0.0786	Rejecting the null hypothesis
	PMI change is not the granger cause of the FDI change	0.05934	0.9426	Accepting the null hypothesis
3	FDI change is not the granger cause of the PMI change	1.30791	0.3171	Accepting the null hypothesis
	PMI change is not the granger cause of the FDI change	0.05072	0.9842	Accepting the null hypothesis
4	FDI change is not the granger cause of the PMI change	0.53996	0.7107	Accepting the null hypothesis
	PMI change is not the granger cause of the FDI change	0.19853	0.9329	Accepting the null hypothesis

Table 5: Selection of the lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-232.2324	NA	1.75e+08	24.65604	24.75546	24.67287
1	-224.6942	12.69590*	1.21e+08*	24.28360*	24.58185*	24.33408*
2	-222.0779	3.855586	1.43e+08	24.42926	24.92633	24.51338
3	-219.3139	3.491390	1.71e+08	24.55936	25.25526	24.67713
4	-213.6156	5.998216	1.57e+08	24.38059	25.27532	24.53202

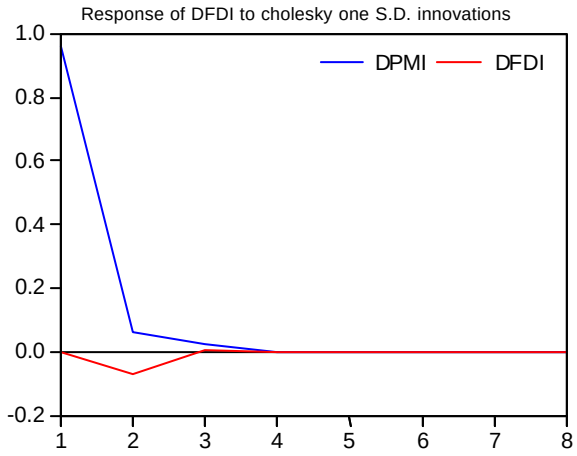

Fig. 4: Response of DFDI to cholesky One S.D. innovations

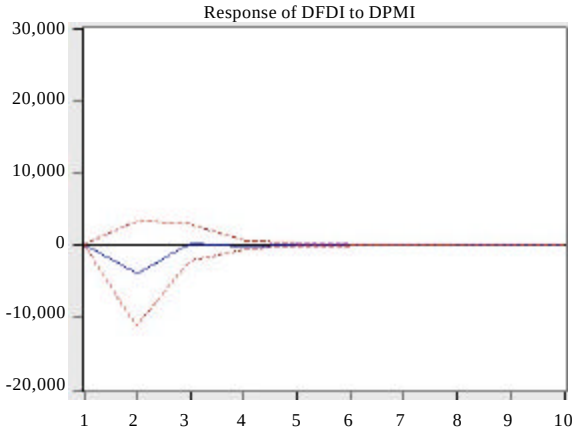

Fig. 5: Response of DFDI to DPMI

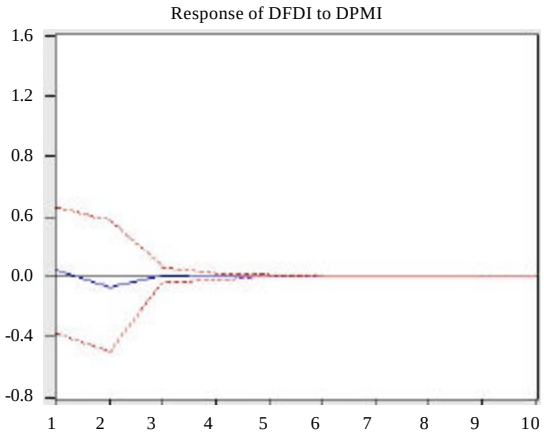

Fig. 6: Response of DPMI to DFDI

immediately response when there is a S.D. innovation. Then at the time 2, the response will be turned to a negative respond from the positive response at time 1. And it will keep constant after the time 4.

Figure 5 and 6 show that the responses of DFDI to DPMI and DPMI to DFDI. It indicates that the response of DFDI will be the top at the time 2 when there is a S.D. innovation of DPMI. Also when there is a S.D. innovation of DFDI, the DPMI has a immediately response. Both the responses of DFDI and DPMI will be constant after the time 4.

CONCLUSION

Seen from the above empirical process, long-term stable equilibrium relation exists in FDI inflows and manufacturing PMI index by the use of the cointegration test. From the ECM model,in the short time, the FDI inflows have significant positive promoting effect on the PMI index change in the lag phase3. Granger causality test results show that FDI inflows is the Granger reason of manufacturing PMI index at the time of lag length 2. but on the other hand, the effect is not obvious. Through the selection of lag, VAR model is established. From the impulse response function, FDI inflows and manufacturing PMI index impulse on each other, they all have immediately response and then they gradually recede,Finally they tend to be constant.According to the above, FDI inflows has important influence on manufacturing PMI index which should cause the attention of the government.

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