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Relationship between FDI and Export Trade in Shaanxi Province in China: A Co-integration Analysis Based on Data from 1996 to 2015

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Abstract

With the accelerating process of economic globalization, implementation of the Western Development and construction of the Silk Road Economic Belt, the impact of Foreign Direct Investment (FDI) on Shaanxi's export trade becomes more and more obvious. The data from 1996 to 2015 show that their changes are synchronized. To explore the effect of FDI on export trade, in order to make full use of FDI and promote foreign trade development in Shaanxi Province, this paper studies the relationship between FDI and export trade in Shaanxi province through Co-integration Analysis, and put forward relevant suggestions, hoping to have a certain reference value.

Keywords: Foreign Direct Investment (FDI), export trade, Co-integration Analysis

1. Introduction

In recent years, Shaanxi's foreign trade and the use of FDI have a rapid development (NBS survey office in Shaanxi province, 2016). According to customs statistics, Shaanxi's export-and-import broke through the $30 billion in 2015, a total of $30.436 billion. Among them: the total volume of exports was $14.747 billion with a 5.87% increase from the previous year, which was about 11.62 times as much as that of 1996. As an inland province, Shaanxi in the aspect of using FDI started late. It was 1983 that Shaanxi started to sign direct investment contracts with foreign merchants, a total of two contracts were signed at that year, combined $8.23 million for the contract value, the actual use of FDI was only $250000. Its investment scale was small. Since the implementation of Western Development Strategy, Shaanxi has achieved good results in attracting FDI. In 2015, a total of 112 foreign investment contracts were signed, with $5.782 billion. The actual use of foreign investment with an increase of 10.6% was about $4.621 billion, which was 14 times than that of 1996. For the study of the contribution of FDI to export trade of Shaanxi, this paper makes a systematic analysis on the relationship between FDI and export.

2. Literature Review

Traditional international trade theory in the aspect of relationship between FDI and trade has two representatives: Robert Mundell and Kiyoshi Kojima. Mundell believed that there had a substitution effect between international trade and FDI. A commodity might enter a country's market by trade or investment, once you selected investment and trade would be replaced (Mundell， 1957). Kiyoshi Kojima suggested that there was a complementary relation between trade and FDI. FDI could create new trade opportunities and expand trade scale (Kiyoshi Kojima，1987). But they are lack of persuasive since there is no empirical validation.

After many scholars' exploration, domestic empirical research on the relationship between trade and FDI gradually increased. Many scholars have used different methods to study and research, such as Regression Analysis, Relationship Model （Pan Helin, Ma Jianping and Chen Qi，2011；Zhou Xueren，2012；Shen bin, Ma Zuoshan and Fu Minmin ，2011；He Qixin and Qin Qiwen，2013） ；Co-integration Theory, Error Correction Model (ECM), Granger Causality（Wang Shuli and Hu Zongbiao，2010；Hu Yifan and Xia Shuang ，2007；Wang Shengqiang and Wang Xiaoyun ，2009） and so on. Most of scholars agree that FDI has a certain promotion to the host country's export. This paper studies the inner link between FDI and export trade in Shaanxi province by Co-integration Analysis.

3. The Selection of Data and Analysis Process

3.1 The Selection of Data

This paper selects FDI and export data of Shaanxi from 1996 to 2015 as sample. The data is taken from *Shaanxi Statistics Yearbook 2015* and *The National Economy and Social Development Statistical Bulletin of Shaanxi Province in 2015*.

The change trend of FDI and export is shown in Figure 1, the change trend of FDI Growth Rate and export Growth Rate is shown in Figure 2.

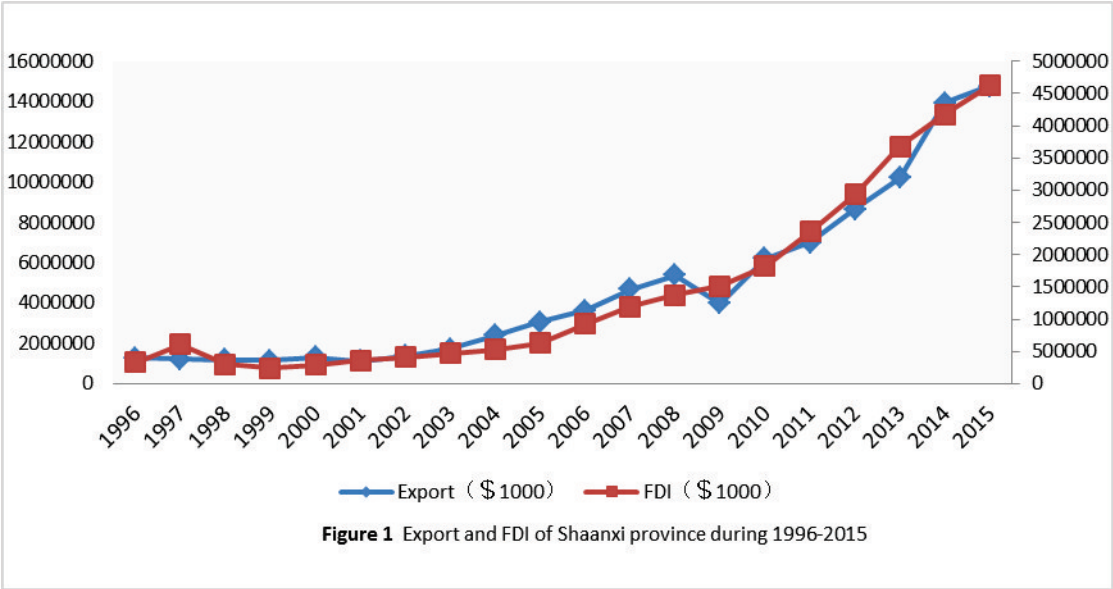

Figure 1 Export and FDI of Shaanxi province during 1996-2015

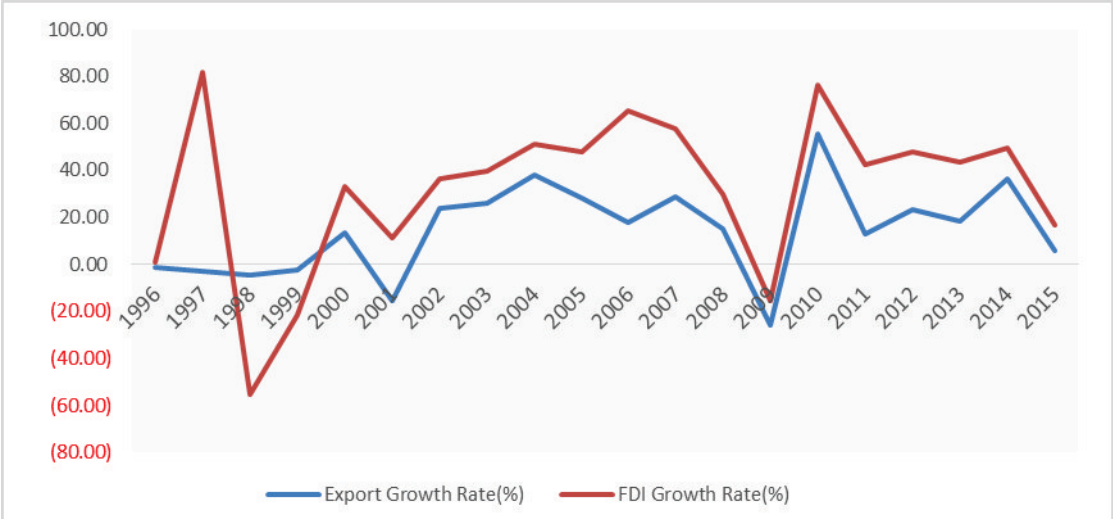

Figure 2 Export Growth Rate and FDI Growth Rate of Shaanxi province during 1996-2015

From Figure 1 and Figure 2, we can see that FDI and export not only have the same change trend in the total amount, but also in the growth rate. In order to confirm whether there is a long-term stable relationship between them, a Co-integration Test is made below.

3.2 Analysis Process

The premise of Co-integration Test is that explanatory variable and explained variable have single integration of the same order in Unit Root Test. So before Co-integration Analysis, it is necessary to test variables' smoothness to ensure the estimate is effective.

3.2.1 Unit Root Test

There are five kinds of methods of Unit Root Test. They are LLC, IPS, Breintung, ADF-Fisher and PP–Fisher. For convenience, generally only the same root unit root test LLC and different root unit root test Fisher-ADF are adopted. If they all refused to the original hypothesis of the existence of unit root, we can think this sequence is smooth, otherwise it is unsteady.

ADF-Fisher is augmented Dichkey-Fuller (DF) test. The original hypothesis of DF test is H_0: Sequence has a unit root, divided into 3 kinds of test regression models: without intercept item, with intercept item but excluding trend item, with both intercept item and trend item, as follows:

$$\Delta y_t = \gamma y_{t-1} + \varepsilon_t$$
$$\Delta y_t = a + \gamma y_{t-1} + \varepsilon_t$$
$$\Delta y_t = a + \sigma t + \gamma y_{t-1} + \varepsilon_t$$

Where a is intercept item, σt is Time-term, ε_t is independent and identically distributed and obey the normal distribution with the zero as the mean and of variance of σ^2. By examining whether γ in the formula is zero, we can judge the sequence is smooth or not. DF test is effective only when the sequence is AR (1). If the sequence is of higher order lag correlation, it goes against to the assumption that the random disturbance term is independent and identically distributed. So ADF test is generated, by adding the lagged differences of the dependent variable y_t on the right side of the regression equation in order to make the residual error term of the model is a white noise (mainly to ensure that there is no autocorrelation). Test regression models are as follows:

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{l} \beta_i \Delta y_{t-i} + \varepsilon_t$$
$$\Delta y_t = a + \gamma y_{t-1} + \sum_{i=1}^{l} \beta_i \Delta y_{t-i} + \varepsilon_t$$
$$\Delta y_t = a + \sigma t + \gamma y_{t-1} + \sum_{i=1}^{l} \beta_i \Delta y_{t-i} + \varepsilon_t$$

Where l is the lag order of dependent variable, the original hypothesis of ADF test is H_0: $\gamma = 0$, that is, variable has a unit root. The actual inspection starts from the third model to the first model. Until when the test rejects the null hypothesis that we can stop testing, that means the original sequence has no unit root and it is smooth. Only all three models' test results do not refuse the null hypothesis that we consider the sequence is unsteady, otherwise smooth.

LLC test from the start on the assumption that the sequence is of serial correlation， and use the type of ADF test. LLC assumes that all individuals are homogeneous in both the original and alternative hypotheses. The original and alternative hypotheses are as follows:

$$H_0: \gamma_1 = \gamma_2 = \cdots = \gamma_N = 0,$$
$$H_1: \gamma_1 = \gamma_2 = \cdots = \gamma_N < 0,$$

Under the null hypothesis, by calculating $\hat{\gamma}$, $\mathrm{se}(\hat{\gamma})$, $t_\gamma = \frac{\bar{\gamma}}{se(\hat{\gamma})}$ and t_γ^*, then judge whether refuse to the null hypothesis. The unit root test of FDI and export of Shaanxi province in 1996-2015 is done by Eviews7. Test results are shown in Table 1.

Table 1 Group unit root test

Method	Test for unit root in	Statistic	Prob	Cross-sections	Obs
Levin, Lin & Chu t*	Level	1.56683	0.9414	2	38
ADF-Fisher Chi-square		0.09737	0.9989	2	38
Levin, Lin & Chu t*	1st difference	-4.02345	0.0000	1	18
ADF-Fisher Chi-square		15.8070	0.0004	1	18

Results of the level test by LLC and ADF do not meet the requirement that P should be less than 0.05 degrees of confidence, and we cannot reject the null hypothesis. Continue to examine 1st difference, the results of LLC and ADF test are in line with the P less than 0.05 degrees of confidence at this time. So we can refuse to the null hypothesis and consider that 1st difference of the two variables is stationary series. Then, we can test co-integration relationship between the two variables.

3.2.2 Co-integration Test

Co-integration Test aims to test the unit root for residuals of the regression equation. If the residual sequence is smooth, there is a co-integration relationship between the dependent variable and the explanatory variable, and the main contents are as follows:

In order to reduce volatility, takes the logarithm of EX and FDI, the sequence log (EX) and log (FDI) are obtained. Then test the stability and establish the following equation:

$$\log(X_t) = C_0 + C_1 \log(FDI_t) + \varepsilon_t$$

Estimating the equation above, we can get the regression residuals, $\hat{u_t} = \log(X_t) - C_0 - C_1 \log(FDI_t)$, test the unit root test for $\hat{u_t}$. If the residual $\hat{u_t}$ is smooth, it indicates that $\log(X_t)$ and $\log(FDI_t)$ is co-integrated.

Unit root test of the residual sequence needs to use the model to generate the residual sequence to test. The inspection report is as Table 2 follows:

Table 2 Unit root test report residual error sequence

		t-Statistic	Prob
Augmented Dickey-Fuller test statistic		-3.50672	0.0195
Test critical values:	1% level	-3.83151	
	5% level	-3.02997	
	10% level	-2.65519	

From the table 2, we know T statistic is equal to -3.50672, P equals 0.0214 which is less than 5% test level. So the null hypothesis that the residual sequence has unit root is rejected, that is, the residual sequence is smooth. According to the definition of co-integration relationship, it can be concluded that the relationship between log (EX) and log (FDI) is co-integrated, and co-integration vector is (1, 0.8979). The estimated parameters of the equation are very significant, adjusted R-squared equals 0.9512, very close to 1, shows that the model fitting effect is good. The coefficient estimation value of log (FDI) is 0.8979, indicates FDI increased by 1%, export amount will increase 0.8979%, there's a promoting relationship between FDI and export.

Suggestion

Empirical analysis shows that there is a long-term equilibrium relationship between FDI and export trade in Shaanxi province: FDI has a driving effect on export trade. Under the background of Western Development, the Belt and Road, to improve the level of absorption, utilization, conversion FDI and drive the rapid growth of export trade of Shaanxi province, the following points should be considered:

Investment subject: Shaanxi should give the priority to large Multinational companies and make full use of the technology spillover effect. Through the introduction of foreign investment, local enterprises can digest and absorb the advanced technology brought by FDI investor, further enhance the product technology level and international competitiveness of local enterprise. In addition, it is necessary to promote the negotiation ability to countries and regions related to our export market, reduce trade barriers and expand foreign market capacity for laying a foundation for further attracting foreign investment in the future.

Investment content: Shaanxi needs to expand the scale and improve the quality of the actual use of foreign investment. Focus on the introduction of foreign advanced technology and modern management experience，encourage foreign investors set up research center in the province, at the same time, own technical staffs participate in the research and development in order to grasp more advanced technology and independent intellectual property rights.

Investment industry: Statistics shows that most of FDI flows to the secondary industry in Shaanxi, its progress speed has been greatly improved. But from the experience of developed countries and regions, the development of the secondary industry can't break away from the support of primary industry and tertiary industry. Therefore, more attention should be paid to the equilibrium problem between industries, while expanding the secondary industry, Shaanxi still need to speed up the openness and development of the tertiary industry and improve the level of using FDI. The government should guide FDI to technology intensive industries, especially high value-added industries, such as mechanical and electrical industry, new high-tech industry.

Investment environment：The various preferential policies of the introduction of FDI still need to continue to implement. Shaanxi should focus on constantly improving the investment environment and the level of openness,

so as to accelerate the development of export trade.

In short, the impact of Foreign Direct Investment on export is a more profound question. How to improve the absorption, utilization and conversion of FDI level? How to play the positive role of FDI, and constantly enhance the competitiveness of foreign trade in Shaanxi Province? All of these need to be further studied in the future.

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