Research on the Impacts of Foreign Direct Investment to the Service Industry: Cointegration Analysis and Grainger Causality Test Based on Data of Henan Province during 1996~2014

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Abstract: Based on the theory that FDI will cause technology spillovers and capital will promote the substantial increase in production, FDI will contribute to the economic contribution of Henan's tertiary industry. By collecting the data from 1996 to 2014, the first two sets of time series are tested and the same order single-single meets the test premise of Engel-Grange method (EG). The data is analyzed by least squares regression analysis and then the residuals. The values were tested by ADF and finally the causal relationship between them was tested by the Granger causality test model. Determining FDI is the main reason for promoting the growth of Henan's tertiary industry. It is concluded that FDI can certainly promote the development of the tertiary industry in Henan Province to a certain extent. The comprehensive revitalization of Henan's economy requires the support of foreign direct investment.

1. Introduction

Foreign direct investment (FDI) is relative to international indirect investment in international capital flows and is an important form of international capital flows. The definition of the International Monetary Fund is: "An investment that has a continuing interest in a company operated by a country other than an investor aims to have an effective voice in the management of the enterprise [1]." Therefore, FDI is involved. The international investment in controlling the business activities of the manufacturer, such as the factory, the company or the land. The service industry is a collection of departments and enterprises that provide services for production and consumption. In a broad sense, it can be considered as removing other industries other than the first and second industries, also called the tertiary industry [2]. British economist Ellen Fisher first proposed the "service industry" in the book "The Conflict of Security and Progress" published in 1935; then, the British economist Colin Collak was in "The Conditions for Economic Progress" It is clearly confirmed that "service industry" is the service industry; since then, the concept of "service industry" has been widely used in the statistics and analysis of the world's national economy and has been confirmed by the United Nations [3, 4]. According to China's "National Economic Industry Classification" (GB/T4754-2002) on the service industry classification criteria, the research data on the service industry is derived from the Henan Statistical Yearbook.

2. The Status Quo and Characteristics of FDI in the Service Industry in Henan Province

Driven by economic globalization, the rapid application of information technology and the growth of trade in goods, the world economy has entered the stage of development of service industry and service trade, focusing on the production and consumption of "service products". At present, foreign direct investment in service industry has reached global investment. As much as

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70% of the total [5]. Researching the service industry FDI on the development of service industry in various regions and the overall national economic growth effect, how to effectively use FDI to promote the optimization and upgrading of industrial structure has become a hot spot for scholars. Since the early 1980s, Henan Province has adopted an investment promotion policy, and the scale of using FDI has been expanding. It has experienced a slow development phase (1992-1997), a short-term adjustment phase (1998-2000), and a rapid development phase (2001-2014) as shown in Figure 1 and widely diversified fields in the Tertiary Industry in Henan Province viewed from the data of 2014 as shown in Table 1 . Has its own characteristics:

Table 1 FDI in the tertiary industry in Henan province in 2014.

According to the national economy industry points	New sign agreement		Actual investment (Ten thousand U.S. dollars)
	Number of contracts	Amount of investment (ten thousand US dollars)	
Transportation, warehousing and postal services	8	15435	42160
Information transmission, computer services and software industry	7	8133	11293
Wholesale and retail	31	77447	56035
Accommodation and catering	10	47	2810
Financial industry	1	6834	5918
Real estate	7	20514	105787
Leasing and business services	23	50159	37683
Scientific research, technical services and geological prospecting	6	21085	10093
Water conservancy, environment and public facilities management	6	16209	8528
Resident services and other services	1	83	--
education	--	--	8
Health, social security and social welfare	--	--	--
Culture, sports and entertainment	5	2146	3798

Source: Henan statistical yearboo

(1) Since the 1990s, the use of FDI in Henan Province has increased substantially, and the field of foreign investment has also changed. Some industries that have been restricted by foreign investment have begun to be introduced [6]. According to the survey statistics, the foreign capital invested in Henan is still mainly concentrated in the labor-intensive manufacturing industry in the secondary industry [7]. There are few high-level capital and technology-intensive projects. In recent years, the proportion of FDI invested in service industry has been raise, but mainly concentrated in more mature industries such as real estate, and invest less in some emerging service industries and primary industry FDI.

(2) The gradual improvement of the investment environment has led to an increase in the intensity of investment, and the investment field has gradually shown a diversified trend [5]. However, it can be seen from the table that the sources of FDI in Henan Province are relatively concentrated, mainly in Asia, especially in Hong Kong, which has always occupied a mainstream trend, while other countries, especially developed countries, have a lower FDI share in Henan Province. In 2014, Hong Kong’s FDI was $10,615,500, accounting for 71.09% of FDI.

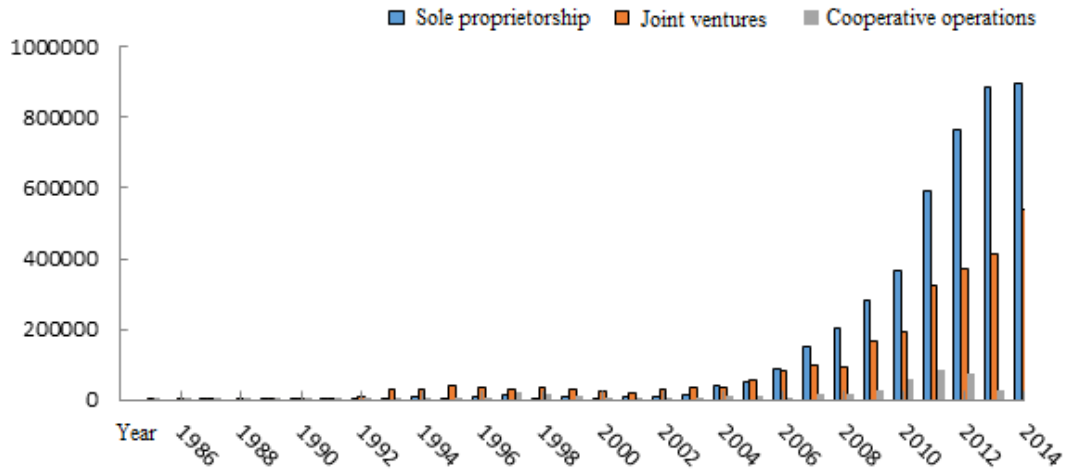

Figure 1 Changes in FDI patterns in Henan province in 1985 and 2014 Unit: $10,000

Source: Henan Statistical Yearbook.

Table 2 The situation of foreign direct investment in Henan province Unit: $10,000.

	2014			2010
	actual investment	proportion	The actual investment	proportion
Hong Kong	1061550	71.09	422585	67.64
Taiwan	88350	5.92	35036	0.56
Singapore	40934	2.74	9112	1.46
America	64223	4.3	12798	2.04
Japan	17764	1.19	6675	1.07
Germany	269	0.02	5678	0.09
England	1208	0.08	5650	0.09
Korea	16152	1.08	910	0.01
Canada	19446	1.3	35036	0.56

From Table 1, Taiwan and the United States have shown steady growth in investment in Henan Province, and the investment in other countries has generally increased slightly in fluctuations. Changes in the economic situation of these investment regions will also easily affect the Henan economy, and improvements in technology, scale and management will be subject to a single source of foreign investment in recent years.

(3) Joint ventures, cooperative operations and sole proprietorship are the main investment methods of FDI in Henan Province. In the past 30 years, the amount of FDI used by sole proprietorship and joint ventures has increased year by year, and the proportion of cooperative operations in the use of FDI has been low. The sole proprietorship utilization of FDI from 1987 to 2014, the average annual growth rate was 46.28%, the amount increased from 310,000 US dollars to 893.738 million US dollars; the average annual growth rate of joint venture operation using foreign capital was 26.87%, from 5.4 million in 1985 Reached $537.869 million in 2014. Taking 2004 as the boundary, the previous joint ventures dominated the use of FDI. After that, the proportion of FDI in the form of sole proprietorship increased year by year and the absolute amount also increased substantially, gradually surpassing the joint venture and occupying a dominant position.

3. An Empirical Analysis of the Impact of FDI on the Service Industry in Henan Province

As can be seen from the figure, the service industry GDP of Henan Province is roughly the same

as the trend of using FDI in Henan Province's service industry. It can be seen that there may be a certain relationship between them. According to AK model technology advancement or capital increase will lead to increasing production [8], then the technology spillovers and capital caused by the introduction of FDI will definitely increase the output of Henan, according to this theory to establish a model to study FDI on Henan service industry. Economic contribution.

3.1. Research design

Table 3 GDP and Utilization of FDI in the tertiary industry in Henan Province from 1996 to 2014.

year	Tertiary industry Total Production (SGDP) (Billion)	Tertiary Industry Foreign Direct Investment (SFDI) (Ten thousand U.S. dollars)	The average exchange rate of RMB against major foreign currencies(100dollars)	Tertiary Industry Foreign Direct Investment (SFDI) (Billion)
1996	789.03	10510	831.42	8.74
1997	951.83	15600	828.98	12.93
1998	1127.76	15161	827.91	12.55
1999	1314.71	9962	827.83	8.25
2000	1597.26	4386	827.84	3.63
2001	1788.22	5244	827.7	4.34
2002	1987.37	6852	827.7	5.67
2003	2358.86	9186	827.7	7.6
2004	2722.4	19545	827.68	16.18
2005	3181.27	29168	819.17	23.89
2006	3721.44	44271	797.18	35.29
2007	4511.97	79159	760.4	60.19
2008	5271.06	104439	694.51	72.53
2009	5700.91	131153	683.1	89.59
2010	6607.89	143081	676.95	96.86
2011	7991.72	248175	64588	160.29
2012	9157.57	322598	63125	203.64
2013	10290.49	339133	61932	210.03
2014	12961.67	284113	62166	176.62

Source: Henan statistical yearbook

Since the paper mainly investigates the degree of influence of FDI, the elasticity of FDI to GDP is set as a variable parameter, and the elasticity of other variables is set as a fixed parameter [3, 9]. According to the availability of data and the lag of the publication of the yearbook, the 19-year data from 1996 to 2014 were collected to empirically analyze the relationship between the use of FDI in Henan Province's service industry and the GDP of Henan's service industry. In order to reduce the fluctuation of data, this paper has logarithmized the data. In order to avoid the phenomenon of pseudo-regression [1], the unit root test is carried out to test whether the time series data of the service industry's GDP and FDI are stable. As long as they are the same order, there may be a cointegration relationship. Since the two sets of time series are tested and the same order is single, there may be a cointegration relationship, which satisfies the test premise of Engel-Grange method (EG), and the regression analysis of the data by least squares method is used to judge the utilizationof service industry in Henan Province. For every one percentage point increase in FDI, the corresponding.

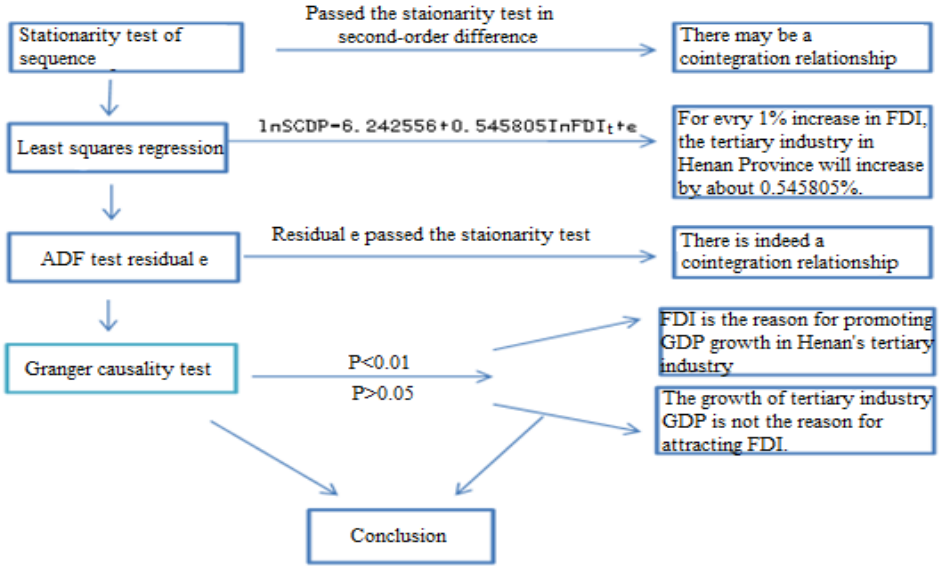

Figure 2 Empirical analysis logic.

GDP. After the least squares method, the residual value of the residual value is tested by ADF. The residual value of the test proves that there is indeed a cointegration relationship between them. Finally, the Granger causality test model is used to test the causal relationship between them, whether it is a unilateral causal relationship or a mutual causal relationship [3, 10].

3.2. Selection of Variables and Data

After collecting and sorting the data of the Yearbook of Henan Statistical Yearbook for 1996-2014, the time series data of FDI and service industry GDP are shown in Table 3. The actual direct investment amount of foreign service enterprises in Henan indicates FDI, and the service industry GDP of Henan Province from 1996 to 2014 is an indicator of the economic development of service industry in Henan Province.

3.3. Unit Root Test, Cointegration Test and Granger Causality Test

(1) Unit root test

Since the economic variable data involved in the economic model is basically time series data, since most economic time series are non-stationary, in order to avoid the phenomenon of pseudo-regression, this paper first adopts the most commonly used unit root test method - ADF. The test method performs the stationarity test on the time series data; in order to avoid the adverse effects caused by the heteroscedasticity, the natural logarithm of the data is taken separately, and the time series data of lnSGDP and lnSFDI are obtained and subjected to ADF test. The optimal lag length is determined by AIC [10]. The test results are shown in Table 4.

It can be seen from the test results that both the original sequence and the first-order difference series of the lnSGDP and lnSFDI time series are non-stationary sequences, and the second-order difference is stable. The necessary condition for the cointegration test is that the second-order difference sequences are stationary sequences, so that lnSGDP and lnSFDI can further perform cointegration analysis. To this end, the long-term co-integration analysis of the two variable sequences is carried out to determine whether there is a long-term equilibrium relationship between the two.

(2) Cointegration test

According to the cointegration theory, since both lnSGDP and lnSFDI are second-order and monolithic, the test premise of Engel-Grange method (EG) is satisfied. Therefore, we perform the least squares (OLS) regression with the variables lnSGDP and lnSFDI, and directly perform the EG test.

First we establish a long-term equilibrium model between SFDI and SGDP

$$\ln SGDP = \alpha + \beta InSFDIt + et \quad (1)$$

T shows the time

We can get this with using the common least-squares estimation model,

$$\ln SGDP = 6.242556 + 0.545805InSFDIt + et \quad (2)$$

$$(0.234964) \quad (0.064871)$$

T shows the time

(T value are shown in brackets)

R-squared= 0.806358

S-Adjusted R-squared= 0.794967

F-statistic= 70.79095

G-Prob(F-statistic)= 0.000000

DW=1.3322 d_{l+}=0.928 d_U=1.132. DW>$d_{U,}$

From the test results, the coefficient of determination is 0.806358, and the adjusted coefficient is also nearly 80%, indicating that the fitting effect of the equation is better. While F=70.79095, the corresponding P value is 0, which is less than 0.01, and the significance test of 0.01 level is passed, indicating that the model is overall remarkable. Since DW<dU, that is, there is no autocorrelation between them, the coefficient of determination, F value and t value reach the ideal level.

Next, an ADF test is performed on the residual e to determine whether there is a cointegration relationship between lnSGDP and lnSFDI. The ADF test statistic value of the residual sequence e is less than 5% significance level critical value, so the residual sequence e is a stable time series, and it is judged that the cointegration relationship does exist, that is, the development of Henan service industry does have a long-term investment with FDI. A stable relationship.

Table 4 The unit root test results of SGDP and FDI。

ADF	t-Statistic	1% level	prob	test results
lnSGDP(level)	15.57504	-2.699769	0.9999	Non-stationary
lnSGDP(First order difference)	-0.186732	-2.728252	0.6022	Non-stationary
lnSGDP(Second order difference)	-2.866003	-2.792154	0.0000	stationary
lnSFDI(level)	0.346687	-2.708094	0.7722	Non-stationary
lnSFDI (First order difference)	-2.232271	-2.708094	0.0286	Non-stationary
lnSFDI (Second order difference)	-4.552849	-2.717511	0.0002	stationary

From the regression equation, the elasticity between the service industry and FDI in Henan Province is 0.545805, that is, for every 1% increase in FDI, the service industry in Henan Province can increase by about 0.545805%. It shows that with the deepening of the opening up of Henan Province and the large introduction of FDI, the long-term effect is indeed to promote the development of the service industry in Henan Province, which will promote the GDP of Henan Province.

(3) Granger causality test

Through the EG test, we judge that there is a long-term equilibrium relationship between the two time series of FDI and Henan service industry, that is, FDI really promotes the development of service industry in Henan Province. However, further verification is needed to confirm whether this equilibrium relationship constitutes a causal relationship. From Table 5, the unit root test results of residual is smooth. From Table 6, the Granger causality test is then used to verify lnSGDP and lnSGDP to determine whether it is a unilateral causal relationship or a causal relationship (see Table

6 for the results of the test).

Since 0.0043<0.01, obviously, under the 1% significance test level, the null hypothesis that lnSGDP is not the Granger cause of lnSFDI, rejects the null hypothesis that lnSFDI is not the Granger cause of lnSGDP, indicating that FDI and Henan Province's service industry GDP There is a Granger causal relationship between them, and it is determined that the growth of FDI has promoted the growth of the service industry in Henan Province.

Table 5 The unit root test results of residual.

Sequence ADF	statistic	The critical value of the 1% level	Conclusion of test
e	-3.081552	-2.708094	smooth

Table 6 Granger causality test results.

null hypothesis	lag phase	F-value	P-value	Conclusion
InSGDP is not the granger cause of lnSFDI	2	0.60092	0.5640	Accept
InSFDI is not the granger cause of lnSGDP	2	8.89384	0.0043	Reject

4. Conclusions and Policy Recommendations

Based on the above analysis, FDI has a long-term stable equilibrium relationship with Henan's service industry GDP. The elastic coefficient of 0.545805 indicates that every 1% increase in FDI can promote the growth of Henan service industry by 0.545805%. FDI has a certain promotion to Henan's service industry GDP. Function, second-order difference stationary, EG test shows that there is a long-term equilibrium relationship between the two; and then through Granger causality test, it can be concluded that FDI is the main factor to promote the growth of Henan service industry. Although it cannot be concluded that FDI plays a decisive role in Henan's economic development, to a certain extent, this factor can indeed promote the development of Henan's service industry. The introduction of a large number of foreign investment in service industry will promote the development of Henan's service industry [5]. Therefore, it is necessary to construct a benign and effective institutional environment, introduce foreign leading service industry science and technology and management experience, improve the technical level and continue to expand the areas involved and open to the service industry, change the relatively lagging situation in the service industry, and optimize the service industry FDI. The source of funds and the structure of investment will promote the development of modern service industry and promote the overall revitalization of Henan's economy.

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