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Effect of Foreign Direct Investment on China Economic Growth: A Granger Causality Approach.

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Abstract: *The paper focuses on the causal effect of Foreign Direct Investment (FDI) on Economic growth of China and study period spanned from 1995 to 2010. Times series data drawn from the primary, secondary and tertiary sectors of the economy were used for the analysis. Granger causality statistical method was used in testing causal effect among the variables; we used E-view statistical software (version7). The Kwiatkowski-Philips-Schmidt-Shin (KPSS) unit root tests for stationary indicates that the variables are stationary at level. The Granger causality test indicates that, utilized FDI do not cause economic growth in primary industry, FDI in secondary industry cause economic growth and Economic growth cause FDI inflows in secondary industry, while economics growth cause FDI flow to tertiary industry of the economy. We recommend as follows; (1) Countries intending to benefit from FDI should carry out necessary and sufficient research before rolling out the policy and do so strategically as no all industry has casual effect on economic growth (2) The authority of host nation should divide foreign investment market to encouraged, restricted and prohibited industries. (3) Host nation should provide necessary incentive to FDI flowing to secondary and tertiary industry of the economy where necessary.*

Key words: *Foreign Direct Investment, Economic Growth in China, Granger Causality Approach.*

I. Introduction

In the last three decade Foreign Direct Investment (hereinafter FDI) remained the potent force (Engine) that propel growth of Chinese economy by complimenting the domestic saving and investment which fall short of what is required for the economy transformation, technology transfer, spillover effect, superior management know-how, employment opportunity and acquisition of new skills from foreign organization has greatly increase income to saving and domestic investment and productivity in the economy, these trend has help transform the economy since the reformed and opening up policy in 1979, China's has attracted substantial amount of FDI flows to its economy and these has impacted positively to the growth of Chinese economy. Whalley and Xian (2006) conclude that, the contribution of FDI to Chinese growth is quite substantial on the order of 3-4 percentage points per year,

It is on this premise Chinese Government (Central, Provincials and Locals level) offered different degree of incentive to encouraged FDI flows to it economy. It's widely believed that the type of FDI and its structural composition matter at least as much for economic growth effects as does the overall volume of inward FDI. Agrawal and Shahani (2005) reckon that it is the quality of FDI that matters for a country rather than its quantity. FDI is often supposed to be of higher quality if it is export oriented, transfers foreign technologies to the host country, and induces economic spillovers benefiting local enterprises and workers (Enderwick, 2005). All the more surprisingly, the structure and type of FDI are hardly considered in previous empirical studies on the FDI-growth links in China.

This paper exploits the casual effect of FDI inflows across sector (Primary, Secondary and Tertiary) on China's economic growth, spanning from 1995-2010 covering the period immediately after the declaration of Socialist market economy by Chinese Communist party in 1992 and the accession to World Trade Organization (WTO) in 2001.

The article is structured as follows: The next section present literatures review, section three highlights the methodology employed in the study and the sources of data. Empirical results and analysis will be done in fourth section while the discussion is completed by conclusions and policy recommendation in section five.

II. Empirical Review

The impact of foreign direct investment on economic growth in china has been well research, however little has been done to explain its effect on sectoral level and the direction of causation in the economy. This paper will survey the literature on sectoral impact of FDI in China.

Tam, Vu and Ilan (2006) **s**how that, effect is not equally distributed across economic sectors. FDI only has a consistently positive effect on growth in the manufacturing sector; its effect on other sectors is usually statistically insignificant, in some cases even negative. Chang and Zhang (1995) examine the growth effect of FDI in China, use data for selected cities and provinces during the 1979-1991 periods. They regressed the log of GNP on FDI and found a positive growth effect. John and Xian (2006) assumed that, the marginal revenue per FDI dollar is equalized across aggregate sectors of the economy (agriculture, manufacturing, and services). Nadia (2006) used a sample of 60 countries analyzed sector (Manufacturing and service) specific effect of FDI on growth by dividing the countries into income level, and found a positive effect on growth in manufacturing and negative effect in service sector. Zhang (2001) uses data from 1984 to 1998 for 28 provinces and finds that, generally, FDI has positive effect on economic growth in China through its interaction with human capital. Jiang and Masaru (2010) used latest data from 30 industries in Jiangxi Province People Republic of China; the impact of FDI has a bias on industries. It concentrated in only several sectors. Both the interconnection and the induced capacity are high in those sectors. Wen (2003) shows that, FDI only has positive effects on economic growth in China's coastal provinces, which have more open policies toward foreign investors than the inland provinces by separating the Chinese economy into an FDI and a non-FDI sector. Edward and Erika (2001) used D-G&H to analyzed growth effect of FDI in Chinese provinces and found that total factor productivity growth in coastal province is strong while weak evidence of growth effect exists in Northwestern province. Whalley and Xian (2006) conclude that, the contribution of FDI to Chinese growth is quite substantial (on the order of 3-4 percentage points per year). James and Kam (2006) state that, FDI strongly promote income growth at national and provincial levels.

Nicole and Sandra (2006) analyzed the growth performance of FDI on Chinese cities with data of 1990-2002 using GMM and found a positive effect of growth from FDI in these cities. Huang (2003) uses the augmented Solow-Swan model of Mankiw, Romer and Weil (1992) data from provinces of China over the reform period 1978-2003, finds that FDI has a positive and statistically significant impact on economic growth as theory predicts and the augmented Solow-Swan model provides an excellent fit of the data. Lo (2004) examined the role of FDI in Economic development of China with broader literature and found the followings: First, that FDI tends to promote the improvement in allocative efficiency, while having a negative impact on productive efficiency. Second, insofar as FDI does promote overall productivity growth, this tends to be a matter of cumulative causation rather than one of single-direction causation. Third, in the context of a comparative analysis of two distinctive regional models, that the economic impact of FDI tends to be more favourable in the inward-looking, capital-deepening pattern.

In an empirical research, Wanda and Harm (2003) suggests that FDI has raised total factors productivity growth in china by 2.5 percentage points per year during the 1990s. Again, this effect was found to be strongest in provinces that have received most FDI. Thus, in sum, FDI has contributed nearly 2 percentage point of potential gross domestic product growth for China. Fung, Hitomi and Sarah (2002) state that: "There is a positive correlation between investments by Foreign invested enterprises and GDP growth at both national level and provincial level and increasing FDI inflow has been an important part of China's growth". (Chandana and Peter, 2006: p29), FDI is not a panacea for economic growth and employment creation (Christopher 2007:p26). Samuel (2009) observed that, FDI contributes to economic development of host country in two main ways; augmentation of domestic capital and enhancement of efficiency through the transfer of new technology, marketing and managerial skills, innovation and best practices and secondly; FDI has both benefits and costs and its impact is determined by the country specific conditions such as policy environment, ability to diversify, level of absorption capacity, targeting of FDI and linkages between FDI and domestic investment. FDI is the main engine of growth in Guandong Province and that the growth effect is divergent in this region (Lo 2005,p53),

All these works has been able to show positive effect of FDI in different region across china but none of these papers analyze the effect of FDI by distinguishing direct investment by industry and the direction of causal effect, hence the need for this work to bring to fold a new insight into importance of FDI on economic growth of host nation.

III. Methodology

3.1. Model Specification

3.1.1 Granger causality

Granger causality tests are conducted to determine whether the current and lagged values of one variable affect another. One implication of Granger representation theorem is that if two variables, say X_t and Y_t are co-integrated and each is individually I(1), then either X_t must Granger-cause Y_t or Y_t must Granger-cause X_t. This causality of co-integrated variables is captured in Vector Error Correction Model (VECM). The long and short-run parameters are separated. In the present study linear combinations of non-stationary variables are not found stationary, that is, the variables are not co-integrated. In absence of co-integration the unrestricted VAR in first difference is estimated, (Omoke and Ugwuanyi, 2010).

Granger causality is normally tested in the context of linear regression models. This can be stated as follow:

$$Y_{(t)} = \sum_{j=1}^{p} A_{11j}\, Y_{(t)11}(t-j) + \sum_{j=1}^{p} A_{12j}\, FDI_{tpri}(t-j) + \sum_{j=1}^{p} A_{13j}\, FDI_{tsec}(t-j) + \sum_{j=1}^{p} A_{14j}\, FDIt_{tter}(t-j) + E_1(t) \quad \text{.........................(1)}$$

$$FDI_{tpri} = \sum_{j=1}^{p} A_{21j}\, Y_{(t)21}(t-j) + \sum_{j=1}^{p} A_{22j}\, FDI_{tpri}(t-j) + \sum_{j=1}^{p} A_{23j}\, FDI_{tsec}(t-j) + \sum_{j=1}^{p} A_{24j}\, FDIt_{tter}(t-j) + E_1(t)) \quad \text{..................(2)}$$

$$FDI_{tsec} = \sum_{j=1}^{p} A_{31j}\, Y_{(t)31}(t-j) + \sum_{j=1}^{p} A_{32j}\, FDI_{tpri}(t-j) + \sum_{j=1}^{p} A_{33j}\, FDI_{tsec}(t-j) + \sum_{j=1}^{p} A_{34j}\, FDIt_{tter}(t-j) + E_1(t)) \quad \text{..................(3)}$$

$$FDI_{tter} = \sum_{j=1}^{p} A_{41j}\, Y_{(t)41}(t-j) + \sum_{j=1}^{p} A_{42j}\, FDI_{tpri}(t-j) + \sum_{j=1}^{p} A_{43j}\, FDI_{tsec}(t-j) + \sum_{j=1}^{p} A_{44j}\, FDIt_{tter}(t-j) + E_1(t)) \quad \text{..................(4)}$$

where p is the maximum number of lagged observations included in the model (the model order), the matrix A contains the coefficients of the model (i.e., the contributions of each lagged observation to the predicted values of $Y_{(t)}$, FDI_{tpri}, FDI_{tsec} and FDI_{tter}, E_1, E_2, E_3, and E_4 are residuals (prediction errors) for each time series. If the variance of E_1, or (E_2, E_3 and E_4) is reduced by the inclusion of the $Y_{(t)}$, *or* [FDI_{tpri}, FDI_{tsec}, FDI_{tter}] terms in the first (or second through fourth) equation, then it is said that $Y_{(t)}$ *or* [FDI_{tpri}, FDI_{tsec}, FDI_{tter}] Granger-(G)-causes $Y_{(t)}$ *or* [FDI_{tpri}, FDI_{tsec}, FDI_{tter}]. Other words, $Y_{(t)}$ G-causes FDI_{tpri}, FDI_{tsec}, FDI_{tter} if the coefficients in A_{12} are jointly significantly different from zero. This can be tested by performing an F-test of the null hypothesis that $A_{12} = 0$, given assumptions of covariance stationarity on $Y_{(t)}$, FDI_{tpri}, FDI_{tsec}, and FDI_{tter}. The magnitude of a G-causality interaction can be estimated by the logarithm of the corresponding F-statistic (Geweke 1982). Note that model selection criteria, such as the Bayesian Information Criterion (BIC, (Schwartz 1978)) or the Akaike Information Criterion (AIC, (Akaike 1974)), can be used to determine the appropriate model order p. (Seth 2007).

3.2. Description of Data and Source

The data used in this work are yearly actual utilized FDI in 21 sectors of China's economy and the data are then group into three industries namely Primary, secondary and tertiary industry according to the national industrial classification of china and all data are in tenths of millions US Dollars and the GDP is real Gross domestic product in US Dollar, data are annual time series data, the value are transformed to log forms.

IV. Result and Discussion

4.1. Stationary (Unit Root) Tests Summary

Table 4.1

Variable	$LFDI_t$	$LFDI_{tpri}$	$LFDI_{tsec}$	$LFDI_{tter}$
KPSS	0.153	0.153	0.125	0.145
Critical Value (*)	0.216	0.216	0.216	0.216
Result	***I(0)***	***I(0)***	***I(0)***	***I(0)***

Table 4.1 shows the result of unit root test of all the variables used in this work. The Result implies that all the variable are stationary at level as the KPSS test is smaller than the critical value at 1%, The overall conclusion is that we are dealing with a set of I(0) variables which, by definition, yields a long-run co-integrating vector. The estimated model is therefore suitable to perform our analysis on the medium-run Contribution of the exogenous variables to economic growth movements.

4.2. Granger Causality Test

Analyzing how the inflows of FDI would cause economic growth, we would like to know whether changes in FDI variable will have an impact on changes on the economic growth variable. The granger causality test assumes that the information relevant to the prediction of the respective variables is contained in the time series data on these variables. Since the variable as shown in the unit root test are stable at level, we would proceed with the analysis using the variables at level.

Table 4.2. Granger causality test result

Null Hypothesis:	Obs	F-Statistics	Prob	Decision
LnPri does not granger cause LnRGDP LnRGDP does not granger cause LnPri	14	0.35967 3.98328	0.5608 0.0713	Do not reject Do not reject
LnSec does not granger cause LnRGDP LnRGDP does not granger cause LnSec	14	0.14958 7.64192	0.0063 0.0184	Reject Reject
LnTer does not granger cause LnRGDP LnRGDP does not granger cause LnTer	14	1.21115 5.50915	0.2946 0.0387	Do not reject Reject

(Summary result of equation 1-4)

Table 4.2, shows that using the Granger causality test, from the first equation there is no casual effect running there is no causal effect running both ways between the FDI in primary industry to Real GDP growth and from Real GDP to FDI in primary industry of the economy, implying that neither causality is running form FDI in primary industry to Real GDP (LnPri $\rightarrow$LnRGDP or LnRGDP $\rightarrow$LnPri) this means that FDI in Primary Industry does not cause RGDP growth nor RGDP cause FDI in primary industry. This result is consistent with Lipsy, (2002) and UNCTAD (2001).

The second equation shows that causality is running bi-directionally from both FDI in secondary industry to Real GDP and from RGDP to FDI in primary industry of the economy (LnSec $\leftrightarrow$RGDP), implying that FDI in secondary industry cause growth of RGDP and also RGDP cause increase in FDI in secondary industry of the economy, which means FDI in secondary lead to economic growth and as the economic growth FDI utilization in secondary industry increase too. Our result agreed with Laura, (2003) and Nadia (2006).

And in the third equation causality is running from RGDP to Tertiary industry of the economy (LnRGDP $\rightarrow$LnTER) it then means that RGDP cause FDI in tertiary industry which implies that FDI flows into tertiary industry as a result of growth of the economy rather than the other way run as asserted by many people. This finding is in tune with the findings of Kashava (2008) and Jiang and Masaru (2010).

V. Conclusion

The study focuses on causal effect of FDI on economic growth of China, granger causality test and KPSS stationarity test was employed in the empirical analysis. Prior to the granger causality test a Stationarity test was carried out using Kwiatkowski-Phillips-Schmidt-Shin (KPSS), the variables was found to be stationary at level.

The Pairwise Granger Causality was carried out to determine the direction of Causality among the variables, at least in the short run. The Granger Causality test indicates no relationship exist between FDI in the primary industry and economic growth, implying that FDI in primary industry does not granger cause economic growth and economic growth does not granger cause FDI in the primary industry of the economy.

Furthermore, in the secondary industry there exist a bi-directional relationship between FDI in secondary sector and economic growth, imply that FDI in the secondary industry granger cause economic growth and as the economic growth FDI in secondary industry also increase too. And in the Tertiary industry there is a unilateral relationship from economic growth to FDI in this industry, implying that economic growth cause FDI in tertiary industry of the economy.

5.1 Policy Recommendation

Based on our findings we recommend as follows; (1) Countries intending to benefit from FDI should carry out necessary and sufficient research before rolling out the policy and do so strategically as no all industry has casual effect on economic growth, (2) The authority of host nation should divide foreign investment market to encouraged, restricted and prohibited industries. (3) Countries should provide necessary incentive to FDI flowing to secondary and tertiary industry of the economy where necessary.

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Appendixes

Appendix 1, Unit root test for log of real GDP

Null Hypothesis: LGDP is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.122315
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.173573
HAC corrected variance (Bartlett kernel)	0.152324

KPSS Test Equation
Dependent Variable: LGDP
Method: Least Squares
Date: 13/10/13 Time: 07:46
Sample: 1995 2009
Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.07364	0.220001	45.78913	0.0000
@TREND(1995)	0.219407	0.026745	8.203780	0.0000

R-squared	0.838111	Mean dependent var	11.60949
Adjusted R-squared	0.825658	S.D. dependent var	1.071802
S.E. of regression	0.447523	Akaike info criterion	1.353389
Sum squared resid	2.603602	Schwarz criterion	1.447796
Log likelihood	-8.150419	Hannan-Quinn criter.	1.352384
F-statistic	67.30201	Durbin-Watson stat	1.387744
Prob(F-statistic)	0.000002		

Appendix 2, Unit root test for log FDI in Primary Industry

Null Hypothesis: LPRI is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.152967
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.088174
HAC corrected variance (Bartlett kernel)	0.088174

KPSS Test Equation
Dependent Variable: LPRI
Method: Least Squares
Date: 13/10/13 Time: 08:02
Sample: 1995 2009
Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	11.44083	0.156803	72.96329	0.0000
@TREND(1995)	0.000592	0.019062	0.031034	0.9757

R-squared	0.000074	Mean dependent var	11.44497
Adjusted R-squared	-0.076843	S.D. dependent var	0.307375
S.E. of regression	0.318966	Akaike info criterion	0.676102
Sum squared resid	1.322613	Schwarz criterion	0.770509
Log likelihood	-3.070769	Hannan-Quinn criter.	0.675097
F-statistic	0.000963	Durbin-Watson stat	0.758020
Prob(F-statistic)	0.975714		

Appendix 3, Unit root test for log FDI in Secondary Industry

Null Hypothesis: LSEC is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.124840
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000

	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.050883
HAC corrected variance (Bartlett kernel)	0.094105

KPSS Test Equation
Dependent Variable: LSEC
Method: Least Squares
Date: 13/10/13 Time: 08:04
Sample: 1995 2009
Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.18494	0.119116	127.4805	0.0000
@TREND(1995)	0.009073	0.014480	0.626566	0.5418

R-squared	0.029314	Mean dependent var	15.24845
Adjusted R-squared	-0.045355	S.D. dependent var	0.236990
S.E. of regression	0.242304	Akaike info criterion	0.126321
Sum squared resid	0.763248	Schwarz criterion	0.220728
Log likelihood	1.052592	Hannan-Quinn criter.	0.125316
F-statistic	0.392585	Durbin-Watson stat	0.523614
Prob(F-statistic)	0.541791		

Appendix 4, Unit root test for log FDI in tertiary Industry

Null Hypothesis: LTER is stationary
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic		0.144744
Asymptotic critical values*:	1% level	0.216000
	5% level	0.146000
	10% level	0.119000

*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.303335
HAC corrected variance (Bartlett kernel)	0.345952

KPSS Test Equation
Dependent Variable: LTER
Method: Least Squares
Date: 13/10/13 Time: 08:06
Sample: 1995 2009
Included observations: 15

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.74015	0.290833	47.24411	0.0000

@TREND(1995)	0.069792	0.035355	1.973999	0.0700

R-squared	0.230618	Mean dependent var	14.22869
Adjusted R-squared	0.171434	S.D. dependent var	0.649938
S.E. of regression	0.591610	Akaike info criterion	1.911627
Sum squared resid	4.550030	Schwarz criterion	2.006034
Log likelihood	-12.33721	Hannan-Quinn criter.	1.910622
F-statistic	3.896673	Durbin-Watson stat	1.441877
Prob(F-statistic)	0.070020		

Appendix 5, Granger Causality Test
Pairwise Granger Causality Tests
Date: 13/10/13 Time: 04:10
Sample: 1995 2009
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNPRI does not Granger Cause LNRGDP	14	0.35967	0.5608
LNRGDP does not Granger Cause LNPRI		3.98328	0.0713
LNSEC does not Granger Cause LNRGDP	14	0.14956	0.0063
LNRGDP does not Granger Cause LNSEC		7.64192	0.0184
LNTER does not Granger Cause LNRGDP	14	1.21115	0.2946
LNRGDP does not Granger Cause LNTER		5.50915	0.0387
LNSEC does not Granger Cause LNPRI	14	0.12724	0.7281
LNPRI does not Granger Cause LNSEC		0.28202	0.6059
LNTER does not Granger Cause LNPRI	14	9.34076	0.0109
LNPRI does not Granger Cause LNTER		0.26248	0.6186
LNTER does not Granger Cause LNSEC	14	3.86000	0.0752
LNSEC does not Granger Cause LNTER		0.10105	0.7565