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Causal Relation Between Economic Growth And FDI: Evidence from South and East Asia

KEYWORDS: FDI, GDP, causality, South-East Asia

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ABSTRACT *This paper empirically teststhe direction of causality between the domestic economic product (GDP) growth and foreign direct investment (FDI) in twelve South East Asian countries using the vector error correction (VEC) model and the Granger causality test. The structural break test and the JohansonCointegrationtest are performed before applying VEC. The study finds that GDP growth tends to be more likely to promote FDI to growth. In eight countries, causality runs from GDP growth to FDI. In two countries, FDI Granger causes GDP growth.*

The differences in causal relation among these countries are probably due to enormous cross-national diversity in economic structures

I. INTRODUCTION

In all growth models, including Solow (1956), Romer (1990), Grossman and Helpman (1991), capital plays an important role in production in the following way:

$$Y_t = AL^{\alpha}K^{\beta} \qquad (1)$$

Where (1) is a Cobb-Douglas production; Y represents economic growth of output, A represents advances in technology, L is labor input, K stands for physical capital. In this paper, K consists of two components: domestic capital, K_d and foreign inflow of capital, K_f. K_f is a composite bundle of capital, technical know-how, and technology. Thus,

$$Y_t = AL^{\alpha} +) \qquad (2)$$

Where K_f, the composite bundle of capital, technical know-how, and technology is known as FDI.

The contentious issue in (2) is whether K_f (FDI) promotes economic growth, Y_t of a country through the transfer of foreign capital, technical know-how, and technology or it is the economic growth of a country, Y_t that attracts FDI. This paper empirically explores the direction of causality between economic growth, Y and K_f (FDI) for South East Asian countries.

There is need for fresh research in this field. Because, first, all previous studies of empirical relationship between FDI and economic growth for South East Asian countries (Bhagobati (1978), Balasubramanuam, Salisu, and Sapsford (1990),Zhang (2001), Hansen and Rand (2006), and Samad (2011)did not employ structural breaks in their models. Perron (1989) showed evidence that failure to allow a structural break in the series "leads to a bias that reduces the ability to reject a false unit root null hypothesis" (Glynn, Nelson, and Reetu, 2007). Parron successfully argues that 'most macroeconomic time series are not characterized by the presence of a unit root. Fluctuations are indeed around a deterministic trend function. The only shocks which have persistent effects are the 1929 crash and the 1973 oil price shock' (Parron, 1989, pp. 1361). Thus, conventional unit root test without structural breakis inappropriate in establishing casual relation between economic growth and FDI. Unlike other papers, this paper employs structural break tests in the data series for exploring causality direction between FDI and economic growth.

Second, this study covers the countries which the previous studies did not cover. This study covers a set of 12 South East countries,namely, Bangladesh, Brunie, China, Hong Kong, India, Indonesia, Malaysia, Phillippine, Singapore, South Korea, Sri Lanka, and Thailand. Samad (2011) studied theses countries but he, like other previous studies, did not apply structural break test.

The rest of the paper is organized as follows. Section 2 outlines a brief survey of FDI and economic growth literature. Section 3 provides data and methodology for testing causality. Empirical results, conclusions are in section 4.

II. LITERATURE REVIEW

Since the literature of FDI-economic growth nexus is wide, this paper divides the survey into two parts. The first part will provide the survey of studies dealing in part or directlywith South and East Asian countries and the second part then provides a brief survey of other research.

South East Asian Studies:

There are several important FDI and economic growth studies dealt with South East Asian countries. Baladubramanyam, Salisu, and Sapsfore (1996) examines the role of FDI in the economic growth within the framwork of economic growth theory. Their studies consist of forty-six sample countries of the world in which South East Asian countries were inculded. They tested the hypothesis of Jagdish Bhagwati which stated that the benefical effect of FDI on economic growth was stronger in those countries that followed outwardly trade policy than those countries that followed inwordly trade policy and found evidencein support of Bhagwati's (1978) hypothsis. They used simple regression anlysis and did not even test stationarity.

Zhang (2001) invested the causal relation between economic growth and FDI for a sample of East Asia and Latin America using unit root test and Error Correction Model. He tested both hypotheses: growth driven FDI and FDI led growth. His major finding was that the pattern of FDI led growth displayed significant differences between East Asia and Latin America, and "the differences probably reflect the enormous cross-national diversity in economic structures" (p. 185). However, he found that 'FDI tends to be more likely to promote economic growth when host countries adapt liberalized trade regime, improved education……'

He also suggested further research in this direction. His study did not cover South East Asia and did not apply the structural break tests

Hansen and Rand (2006) examined the causal links between

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FDI and growth in Asia, Latin America, and Africa for a sample of 31 countries. Thier study did not include all South East Asian countries but most othe countries. They examined the unit root test and used regression analysis. They found a strong causal link from FDI to domestic economic growth both in the short run and in the long run.

In their study they did not test the structural break of data series.

Chowdhury and Mavrotas (2006) explored the causality link between FDI and economic growth for a sample of countries in which Malaysia and Thailand were the only two Asian countries that were included. Thus, their study did not focus on South East Asian countries. He used VAR model and found strong evidence of bi-directional causality between FDI and GDP.

Choe(2003) investigated the direction of causal relationship between FDI, domestic growth and gross domestic investment (GDI) in 80 countries in which eight East and South East Asian countries were included. He applied the Granger causality test and foundbidirectional causality. However, GDP Granger cause FDIwas more apparent than from FDI to GDP.

Samad (2011) examined the causal link between FDI and economic growth in East and South East Asia and a group of Latin American countries using the Error Correction model. The study did not use the structural break test. Similar to Zhong (2001) findings, the study did not find any pattern of causal direction between FDI and economic growth.

Other studies

Using regression analysis, Borensztein, Greogorio, and Lee (1998) tested the effect of FDI on economic growth for 69 developing countries. They did not even check the stationarilty test for their data series. They found that FDI was an important tool for the tranfer of technoloy and it contributed more domestic growth than domestic) investment. Similarly, Yasin, Sukar, and Ahmed (2009), Sun and Parikh (2001), and De Mello (1997) found that foreign direct investment (FDI) have positive impact on the economic growth of host countries by opening the channel of trade, and creating favorable externalties. Alfaro et al (2004) emphasized on the role of financial development for FDI to have a positive and significant impact of economic growth. A similar finding was observed by Makki and Somwaru (2004) who argued that FDI had positve impact on economic growth contingent upon financial development. That is, financial development is an important factor for FDI to have a positive impact on the economic growth of a country.

Lall (2000) and Agasin and Mayer (2000) found that FDI has a negative impact on GDP growth. They found that FDI offset domestic investment through unfair competition.

Carkovic and Lavine (2009), and Alfaro (2003), found FDI impact on economic growth unclear.

Whereas Blostrom et al (1994) found that the causal direction running from FDI to economic growth, and Kumar and Pradha (2002) found bidirectional Granger causality.

It is interesting to note that all of the above studies did not appy the structural break test.

III. DATA AND ECONOMETRIC METHODOLOGY

3. 1. Data

The data for FDI and GDP are retrieved from the World Development Index from 1970 to 2006. Yearly data for both FDI and GDP are obtained for 12 countries of South East Asia. All the series are listed in U.S. dollars. The logarithmic GDP and FDI series are used in the empirical analysis.

3.2.1. Unit Root Tests

Since the publication of Nelson and Plosser (1982), it is widely recognized that most time series macroeconomic variables contain unit root i.e. variable $X_t \sim I(1)$. Testing the presence of a unit is an important concern. So, the paper, first, examines the existence of unit root in the GDP and FDI indices by using the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. In the following equation, the null hypothesis, $\alpha=0$ is tested against the alternative hypothesis, $\alpha<0$:

$$\Delta y_t = \alpha_0 + \beta t + \gamma y_{t-1} + y_{t-1} + \varepsilon_t \qquad (1)$$

Schwarz Bayesian Criterion (SBC) will be used to determine the lag length or K. The results of ADF and PP test are presented in the empirical section.

3.2.2 Structural Break Test

The issue of testing the presence of unit root gained further momentum when Parron (1989) emphasized the importance of structural break while testing the unit root test. The structural break test is needed because the most macroeconomic series suffers some kind of shock i.e. structural break. So, the unit root test is not enough. Perron (1989) argued that conventional unit root tests have low power to reject the null hypothesis of nonstationarity when there is a structural break in the series. To overcome this problem, Perron (1989) modified the augmented Dickey Fuller (ADF) test by adding dummy variables to account for structural breaks at known points in time. Zivot and Andrews (1992) suggested that structural breaks in the series may be endogenous and they extended Perron's methodology to allow for the endogenous estimation of the break date. We employ the following two alternative models proposed by Zivot and Andrews (hereafter ZA) to examine the presence of unit root with structural break in the stock market price series:

Model C:

$$\Delta p_t = \mu + \theta DU_t(\lambda) + \beta t + \gamma DT_t(\lambda) + \alpha p_{t-1} + \sum_{j=1}^{k} c_j \Delta p_{t-j} + e_t \qquad (2)$$

where p_t indicates stock market price index, DU_t and DT_t are indicator variables for mean shift and trend shift for the possible structural break-date (TB) and they are described as following:

$$DT_t = \begin{cases} t - TB & if\ t > TB \\ 0 & otherwise \end{cases}$$

The null hypothesis of unit root ($\alpha=0$) can be tested against stationary with structural breaks ($\alpha<0$) in Equations 1 and 2. Every time points are considered as a potential structural break date in the ZA unit root test and the break date is determined according to minimum one-sided t-statistic.

3.2.3. Cointegration Test

Having established that the variables are non-stationary i.e. I(1), there raises the possibility that they are co-integrated. Consequently, the co-integration properties of the variables are examined. That is, it is necessary to determine whether there is at least one linear combination of these variables that is I(0). To investigate multivariate cointegration, this paper applies Johansen (1991 and 1995) VAR based Trace and Maximum Eigenvalue tests. Johansen (1991 and 1995a) cointegration is a VAR test and written in general form as:

$$\Delta Yt = \pi Yt - 1 + \sum_{i=1}^{p-1} \tau i \Delta Yt - i + \beta Xt + \varepsilon t \qquad (3)$$

Where $\Pi = \sum_{i=1}^{p} \beta i - I$ and $\tau = -\sum_{j=i+1}^{P} \beta j$

Based on Granger's theorem, if the coefficient matrix ∏ has reduced rank r<k, then there exists k x r matrices α and β each rank r such that $\Pi = \alpha\beta'$ and $\beta' yt$ is I(0). r is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector. The null hypothesis is that number of cointegration:

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H_0 : r=0

H_a : r=1

3.2.4 Vector Error Correction and Unrestricted VAR
Finally, this paper uses VEC and unrestricted VAR model for direction of causality. VEC is applied when series are found cointegrated tested by Johansen (1991 and 1995) VAR based Trace and Maximum Eigenvalue tests. Unrestricted VAR is employed to determine the direction of causality if the series are not cointegrated.

In terms of two variables, GDP and d FDI, VECM can be written and estimated from:

$$\Delta GDP_t = \Sigma\alpha_1\Delta GDP_{t-l} + \Sigma\beta_1\Delta FDI_{t-l} + \lambda_1(GDP_{t-1} - \Phi FDI) + \upsilon_t \quad (4)$$

$$\Delta FDI_t = \Sigma\alpha_2\Delta FDI_{t-l} + \Sigma\beta_2\Delta GDP_{t-l} + \lambda_2(GDP_{t-1} - \Phi FDI) + \upsilon_t \quad (5)$$

Where $(GDP_{t-1} - \Phi FDI$ is the error correction term (ECT) and α, β, and λ are coefficient.

According to (Miller and Russek, 2001) the null hypothesis that FDI does not Granger cause GDP is rejected not only if $\Sigma\beta_1$ (from 4) are jointly significant but also if the coefficient λ_1 of ECT is significant. In the same way, the null hypothesis that GDP does not Granger cause FDI is rejected not only if $\Sigma\beta_2$ (from 5) are jointly significant but also if the coefficient λ_2 of ECT is significant. In the Error Correction Model, the causality inference is obtained through the significance of λ_i. That is, the null hypothesis that FDI does not Granger cause GDP is rejected if λ_1, (the coefficient of error correction term) is statistically significant even if β_1 (from 4) are not jointly significant.

VAR can be written and estimated from:

$$\Delta GDP_t = \alpha_{0+} \Sigma\alpha_1\Delta GDP_{t-l} + \Sigma\beta_1\Delta FDI_{t-l} + \varepsilon_t \quad (6)$$

$$\Delta FDI_t = \beta_0 + \Sigma\alpha_2\Delta FDI_{t-l} + \Sigma\beta_2\Delta GDP_{t-l} + \nu_t \quad (7)$$

Granger causality direction is obtained from VAR estimates by applying Granger Causality- Tests.

Reports of VEC and VAR are provided in the empirical section.

IV. EMPRICAL RESULTS
First, the paper tests the unit root hypothesis for both GDP and FDI series using the augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests and tests results are presented in Table 1.

Table 1: Unit Root Test Results

Country	GDP				FDI			
	Level		First differences		Level		First differences	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
Bangladesh	-4.67*	2.87	-10.93*	-11.71*	-2.65	-2.61	-8.68*	-8.85*
Brunei	-2.96	-2.92	-4.54*	-4.52*	-3.30	-1.29	-5.90*	-5.76*
China	2.71	-1.65	-3.88*	-3.86*	-13.51*	-6.36*	-20.20*	-17.25*
Hong Kong	-1.36	-1.36	-4.85*	-4.80*	-5.66*	-2.48	-8.83*	-11.06*
India	-2.00	-1.92	-5.35	-5.34*	-2.87	-2.82	-5.97*	-6.29*
Indonesia	-1.14	-1.30	-4.08*	-4.05*	-2.68	-2.77	-9.49*	-9.96*
Malaysia	-3.07	-3.16	-5.76*	-5.76*	-2.78	-2.79	-7.58*	-7.51*
Philippines	-1.82	-2.17	-3.12**	-3.12**	-5.28*	-5.30	-9.80*	-10.75*
Singapore	-1.86	-2.11	-4.48*	-4.41*	-3.52**	-3.44**	-6.73*	-7.09*
South Korea	-0.57	-0.56	-5.03*	-5.01*	-4.20*	-4.07*	-7.56*	-8.00*
Sri Lanka	-2.57	-2.96	4.78*	-4.78*	-3.06	-3.10	-8.31*	-9.65*
Thailand	-0.59	-1.18	-3.26*	-3.24*	-3.17	-3.24	-6.44*	-6.52*

Note: The optimal number of lags is selected according to the Schwarz BIC. *, ** and * indicate that the series in question is stationary at the 10%, 5% and 1% significance level, respectively.**

The test results, shown in Table 1, cannot reject the null hypothesis of unit root for all series in levels except for the GDP of Bangladesh. Similarly, for FDI the paper cannot reject the null hypothesis of unit root for all series in levels except for Hong Kong, India, Philippines, Singapore, and South Korea. On the other hand, when we consider first the differences of the series, the null hypothesis is rejected for all series either at 1 percent or 5 percent significance level.

Based on Parron (1989), linear unit root tests lack power when there are structural breaks in the series. Therefore, this paper turns now to the examination of the unit root process with structural break for the series using the Zivot and Andrews test and the test results are presented in Table 2.

Table 2: Zivot-Andrews Structural Break Test Results

Countries	GDP		FDI	
	Test Statistics	Break Period	Test Statistics	Break Period
Bangladesh	-1.46	1980	-3.45	1983
Brunei	-5.92*	1981	NA	
China	-3.48	1982	-8.93*	1992
Hong Kong	-2.97	1986	-6.08	1985
India	-3.82	1979	NA (Gap)	
Indonesia	-6.25*	1998	NA (Gap)	
Malaysia	-4.75	1993	-3.64	1989
Philippines	-5.18**	1983	-5.83*	1999
Singapore	-4.54	1993	-4.63	1979
South Korea	-3.41	1998	-7.68*	1992
Sri Lanka	-3.89	1987	NA (Gap)	
Thailand	-3.60	1992	-4.72	1988

Note: -4.58, -4.80 and -5.43 are critical values for Model A at 10%, 5%, and 1% significance levels respectively. -4.820, -5.08, and -5.57 are critical values for Model C at 10%, 5%,and 1% significance levels respectively.

Again, as shown in Table 2, we cannot reject the null hypothesis of unit root in levels and these results are consistent with ADF and PP tests results. All unit root tests results suggest

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that all series are stationary in first differences

Johansen Cointegration Test is applied to find the order of cointegration.

Table 3: Johansen Cointegration Test Results

Country	Hypothesized No. of CE(s)	Eigenvalue	Trace statistics	Max-Eigen Statistics
Bangladesh	None (r=0)	0.839	49.10*	47.54*
	At most one (r=1)	0.058	1.56	1.56
Brunei	None (r=0)	0.593	20.69**	17.99**
	At most one (r=1)	0.126	2.69	2.69
China	None (r=0)	0.709	35.02*	32.13*
	At most one (r=1)	0.105	2.88	2.88
Hong Kong	None (r=0)	0.466	29.69*	20.09*
	At most one (r=1)	0.259	9.60**	9.60**
India	None (r=0)	0.601	38.61*	29.44*
	At most one (r=1)	0.249	9.16**	9.16**
Indonesia	None (r=0)	0.422	18.02	14.83
	At most one (r=1)	0.111	3.19	3.19
Malaysia	None (r=0)	0.464	28.09*	21.83*
	At most one (r=1)	0.163	6.26	6.26
Philippines	None (r=0)	0.201	13.30	7.87
	At most one (r=1)	0.143	5.42	5.42
Singapore	None (r=0)	0.400	31.95*	17.92*
	At most one (r=1)	0.330	14.03*	14.03*
South Korea	None (r=0)	0.435	33.14*	20.03*
	At most one (r=1)	0.312	13.11*	13.11*
Sri Lanka	None (r=0)	0.422	26.46*	15.93**
	At most one (r=1)	0.304	10.52*	10.52*
Thailand	None (r=0)	0.297	21.05**	12.36
	At most one (r=1)	0.219	8.68***	8.68

***, **, and *** indicates rejection of hypothesis at the significance of 1% level, 5% level, and 10% level respectively.**

An examination of cointegration, reported in Table 3, indicates that GDP and FDI series are cointegrated for all countries except Indonesia and the Philippines. The presence of cointegration suggests long run equilibrium; and the direction of causal relationship is explored by the vector error correction (VEC) model. Results of VEC are reported in Table 4

Table 4: Vector Error Correction Estimates

Country	Error Correction	D(lnGDP)	D(lnFDI)	Comment
Bangladesh	Coefficient	0.012 [3.90]* R^2 = 0.57 Adj R^2 = 0.51 F-statistic = 9.73 AIC = -5.47 Log likelihood = 38.07	-0.13 [-0.53] R^2 = 0.13 Adj R^2 = 0.01 F-statistic =1.4 AIC =3.18	Causality runs from FDI→GDP
Brunei	Coefficient	0.013 [2.3]* R^2 = 0.50 Adj R^2 = 0.28 F-statistic = 2.28 AIC= -5.1 Log likelihood = 27.70	-0.74 [-1.34] R^2 = 0.24 Adj R^2 = -0.09 F-statistic = 0.71 AIC= 3.8	Causality runs from FDI→GDP
China	Coefficient	0.0002 [0.21] R^2 = 0.53 Adj R^2 = 0.41 F-statistic = 4.43 AIC = -4.86 Log likelihood =83.73	-0.02 [2.50]* R^2 = 0.79 Adj R^2 = 0.73 F-statistic = 14.65 AIC = -0.88	Causality runs from GDP→FDI
Hong Kong	Coefficient	0.05 [1.29] R^2 = 0.22 Adj R^2 = 0.06 F-statistic = 1.39 AIC= -3.3 Log likelihood =34.92	1.79 [3.08]* R^2 = 0.36 Adj R^2 = 0.22 F-statistic = AIC = 1.8	Causality runs from GDP→FDI
India	Coefficient	-0.005 [-0.85] R^2 = 0.11 Adj R^2 = -0.07 F-statistic = 0.59 AIC= -4.44 Log likelihood = 42.02	-0.45 [-2.43]* R^2 = 0.28 Adj R^2 = 0.13 F-statistic = 1.94 AIC= 2.44	Causality runs from GDP→FDI
Malaysia	Coefficient	-0.003 [-.28] R^2 = 0.04 Adj R^2 = -0.12 F-statistic = 0.26 AIC= -3.4 Log likelihood = 46.12	-050 [-2.66]* R^2 = 0.27 Adj R^2 = 0.14 F-statistic =2.07 AIC= 1.84	Causality runs from GDP→FDI
Singapore	Coefficient	0.013 [-0.43] R^2 = 0.8 Adj R^2 = -0.7 F-statistic = 0.53 AIC= -3.65 Log likelihood = 60.88	-0.99 [-3.63]* R^2 = 0.38 Adj R^2 = 0.27 F-statistic =3.50 AIC=1.1	Causality runs from GDP→FDI
South Korea	Coefficient	0.001 [0.13] R^2 = 0.05 Adj R^2 = -0.11 F-statistic = 0.30 AIC= -3.54 Log likelihood =30.69	-1.22 [-7.05]* R^2 = 0.66 Adj R^2 = 0.69 F-statistic =11.24 AIC=2.48	Causality runs from GDP→FDI
Sri Lanka	Coefficient	-0.008 [-0.55] R^2 = 0.05 Adj R^2 = -0.16 F-statistic = 0.26 AIC= -4.87 Log likelihood =57.24	1.31 [3.32]* R^2 = 0.39 Adj R^2 = 0.25 F-statistic = 2.77 AIC= 1.16	Causality runs from GDP→FDI

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Thailand	Coef-ficient	-0.06 [-1.44] R^2 = 0.33 Adj R^2 = 0.21 F-statistic = 2.82 AIC= -3.62 Log likeli-hood =49.40	1.78 [-3.25]* R^2 = 0.32 Adj R^2 = 0.20 F-statistic = 2.65 AIC= 1.42	Causality runs from GDP→F-DI

The result of the VER model, in the last column of Table 4, shows that causality runs from GDP to FDI in eight countries, namely China, Hong Kong, India, Malaysia, Singapore, Korea, Sri Lanka, and Thailand. In two countries, Bangladesh and Brunei, FDI Granger causes GDP growth.

The absence of cointegrationin Indonesia and Philippine suggests that they may have short run equilibrium. The direction of causality is obtained by applying the Granger Causality test. Results are reported in Table 5.

Table 5: Granger Causality Test

Coun-try	Null hypothesis	F -sta-tistics	prob-ability	Comments
Indo-nesia	LnGDP does not Granger cause LnFDI LnFDI does not Grang-er cause LnGDP	1.60 1.08	0.33 0.35	No causal-ity exists
Philip-pines	LnGDP does not Granger cause LnFDI LnFDI does not Grang-er cause LnGDP	1.55 0.22	0.22 0.79	No causali-ty exists

The result of the Granger causality test, in Table 5, shows that GDP and FDI are independent of each other for Indonesia and Philippines

CONCLUSIONS

This paper examines 12 South East Asian countries as to whether economic growth Granger causes FDI into an economy or FDI Granger causes economic growth by using the VEC model. Domestic GDP growth tends to be more likely to promote FDI to growth. This result issupported by Table 4. FDI Granger causes economic growth in Bangladesh and Brunei. On the other hand, GDP growth Granger causes FDI in China, Hong Kong, India, Malaysia, Singapore, Korea, Sri Lanka, and Thailand. GDP growth and FDI are independent for Indonesia and Philippines.

The differences in causal relation among these countries are probably due to enormous cross-national diversity in economic structures such as differences in education level, financial market development, development of economic infra-structures, anopenness to trade, and pursued domestic economic policy.

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