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FDI, Exports and Growth: Evidence from Asian Countries

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ABSTRACT: The aim of this paper is to examine the causality relationship between foreign direct investment, Exports and economic growth in two panels of Asian countries (three developed and eight developing countries) over the 1986 to 2010 years. A panel-VECM causality based on Wald test employed for investigates a tri variate model of FDI, exports and GDP. The results of causality from developed panel indicate a unidirectional causality from GDP to export, FDI to export and also from GDP to FDI. Empirical result of developing panel indicates a unidirectional causality from GDP to FDI and bidirectional causality between GDP and export.

Keywords: FDI, Export, Economic Growth, Causality, Panel-VECM

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INTRODUCTION

In recent decades, many researchers focused on the relationship between exports, foreign direct investment and economic growth by employing various econometric methods, but there are no common consequences regarding these relationships among the different studies.

Nath (2009) examined the effects of trade and foreign direct investment on growth of per capita real GDP in 13 transition economies of Central and Eastern Europe, and the Baltic region during 1991 to 2005. He employed a fixed effect panel data approach and found a significant positive effect of trade on growth. But FDI does not have any significant impact on growth in these transition economies. However, Nath expressed when controlling the effects of domestic investment and trade on FDI, it appears to be a significant determinant of growth for the period after 1995.

Borensztein et al. (1998) attempted to examine the effect of foreign direct investment on economic growth in a cross-country regression framework, utilizing data on FDI flows from industrial countries to 69 developing countries. The results of this paper suggest that FDI is an important vehicle for transfer of technology, contributing relatively more to growth than domestic investment. They argued higher productivity of FDI holds only when the host country has a minimum threshold stock of human capital.

The study of Hsiao and Hsiao (2006) attempted to examine the granger causality relations between GDP, exports, and FDI in East and Southeast Asia by using time-series and panel data from 1986 to 2004 years. Empirical analyze of time-series indicated that each country has different causality relations and results of panel-VAR causality indicated that FDI has unidirectional effects on GDP directly and also indirectly through exports, and there also exists bidirectional causality between exports and GDP. Finally with respect to the panel data causality analysis, Hsiao suggested that exports may be a good substitute of, if not complementary to, human capital or financial development in its relation with FDI and GDP.

De Mello (1999) employed time series and panel data over the 1970 to 1990 years for a sample of OECD and non-OECD countries to investigate the impact of foreign direct investment on capital accumulation, output and total factor productivity growth. He found although expected that FDI boost long-run growth in host country, but the extent of growth depended on the degree of complementary and substitution between FDI and domestic investment.

The study of Miankhel et al. (2009) examined the causality between export, FDI and GDP for six emerging countries (Chile, India, Mexico, Malaysia, Pakistan and Thailand). They used a VECM framework for this purpose. The results support export-led growth (ELG) hypothesis. The results of long run indicate causality from GDP to other variables such as exports in Pakistan and FDI in the case of India. The results indicate bidirectional causality between GDP and FDI in Malaysia. The founding shows causality from exports to FDI and GDP for Latin American countries.

Chowdhury and Mavrotas (2006) employed the Toda-Yamamoto approach to examine the causality between FDI and economic growth for three developing countries (Chile, Malaysia and Thailand). They found unidirectional causality from GDP to FDI in Chile and strong evidence of bidirectional causality for Malaysia and Thailand.

The study of Makki and Somwaru (2004) examined the role of FDI and trade in promoting economic growth for 66 developing countries. They found that FDI, trade, human capital, and domestic investment are important sources of economic growth. Further they found a strong interaction between FDI and trade in advancing economic growth.

Adams (2009) studied the impact of foreign direct investment (FDI) and domestic investment (DI) on economic growth in Sub-Saharan Africa for the period 1990-2003. The results show that DI is positive and significantly correlated with economic growth and FDI is positive and significant only in the OLS estimation. The study also found that FDI has an initial negative effect on DI and subsequent positive effect in later periods for the panel of countries studied.

The study of Hansen and Rand (2006) attempted to analyze granger causal relationship between FDI and GDP in 31 developing countries. The empirical finding indicates bidirectional causality between FDI and GDP. This finding may be interpreted as evidence in favour of the hypotheses that FDI has an impact on GDP via knowledge transfers and adoption of new technology.

The study of Yao and Wei (2007) presented and tested two propositions on the role of FDI in economic growth for newly industrialized economies. First, FDI is a mover of production efficiency because it helps reduce the gap between the actual level of production and a steady state production frontier. Second, FDI being embedded with advanced technologies and knowledge is a shifter of the host country's production frontier. Due to its dual role as a mover of production efficiency and a shifter of production frontier, FDI is a powerful driver of economic growth for a newly industrializing economy to catch up with the world's most advanced countries.

The work of Lim (2001) summarized arguments and finding on relationship between FDI and economic growth. The study of Lim found that while substantial support exists for positive spillovers from FDI, there is no consensus on causality. On determinants, he found that market size, infrastructure quality, political/economic stability and free trade zones are important for FDI.

Zhang (2001) examine the relationship between FDI, export and economic growth for 11 countries of East Asia and Latin America. He expressed FDI tends to be more likely to promote economic growth when host countries adopt liberalized trade regime, improve education and thereby human capital conditions, encourage export-oriented FDI, and maintain macroeconomic stability.

However, this paper examines the causality relationships between foreign direct investment, Exports and economic growth in Asian developed and Asian developing countries. The rest of this paper is organized as follows: Section 2 discusses the data and methodology. Section 3 presents empirical analysis and finally conclusion presented in Section 4.

2. Model and Data

2.1 Model: To modeling the relationship between FDI, exports and GDP we follow the Hsiao and Hsiao (2006) and assume equilibrium in the money sector and the government sector, therefore equilibrium condition of the Keynesian model of aggregate demand and aggregate supply can be given as:

$$Y = C(Y) + I(Y, r) + F + X - M(Y, e) \quad (1)$$

Where Y, C, I, F, X, M, r, and we are the real GDP, real consumption, real domestic investment, real FDI inflows, real exports, real imports, interest rate, and exchange rate of foreign currency in term of the domestic currency, respectively. A more general implicit function form can be considering with ignoring the financial variables

$$H(Y, X, F) = 0 \quad (2)$$

Above function can be expanded in logarithm form, and then examining the causality relationship between the real variables Y, X, and F can be performed by a vector auto regression form for causality test. VECM representation of this model presents in section 4.

2.2 Data: In recent years, many studies on the different economic topic employed panel data rather than time series data to investigate economics data, due to advantages of panel data in contrast with time series data; such as: controlling for individual heterogeneity and give more informative data, more variability, less Collinearity among the variables, more degrees of freedom and more efficiency. (Baltagi, 2005).

With respect to this advantage, this paper applied balanced panel data of real inward foreign direct investment, real exports and real GDP from two panels of Asian counties, a panel of three developed countries: Hong Kong, Singapore and South Korea and a panel of eight developing countries: Bangladesh, India, Malaysia, Oman, Pakistan, Philippines, Srilanka and Thailand for 1986 to 2010 years. Note: Japan removed from developed panel due to negative values in FDI data.

Data of GDP and Exports of goods and services obtained from World Development Indicator (WDI) and FDI obtained from UNCTAD. Variable measured in constant 2000 US dollars with deflating by GDP deflator. The natural logarithms of variables are denoted as LFDI, LEX and LGDP.

MTEREALS AND METHODS

1. Panel Unit Root Test: Several Panel unit root test presented for understanding stationary properties of panel data. This paper applied four test proposed by Levin et al. (LLC, 2002), Im et al. (IPS, 2003), Breitung

(2000) and Fisher-type test proposed by Maddala and Wu (1999) and Choi (2001) to test the null hypothesis of having unit root.

Following Dickey and Fuller (1979, 1981), Levin and Lin (1993), and Levin, Lin and Chu (2002), consider a panel extension of the null hypothesis that each individual time series in the panel contains a unit root against the alternative hypothesis that all individual series are stationary.(Hsiao, 2003).

The adjusted t-statistic of LLC is:

$$t_{\rho}^{*} = \frac{t_{\rho} - N\tilde{T}\hat{S}_{N}\hat{\sigma}_{\tilde{\varepsilon}}^{-2}\hat{\sigma}(\hat{\rho})\mu_{m\tilde{T}}^{*}}{\sigma_{m\tilde{T}}^{*}} \quad (3)$$

Where $\mu_{m\tilde{T}}^{*}$ and $\sigma_{m\tilde{T}}^{*}$ are the mean and standard deviation adjustments provided by table 2 of LLC. Levin, Lin and Chu show that t_{ρ}^{*} is asymptotically distributed as *N* (0, 1).

The test of Im et al. (IPS, 2003) allow for a heterogeneous coefficient of yit-1 and propose an alternative testing procedure based on averaging individual unit root test statistics. IPS suggests an average of the ADF tests when uit is serially correlated with different serial correlation properties across cross-sectional units.

The t-statistic of IPS given as follows:

$$t_{IPS} = \frac{\sqrt{N}(\bar{t} - \frac{1}{N}\sum_{i=1}^{N} E[t_{iT} \mid \rho_i = 0])}{\sqrt{\frac{1}{N}\sum_{i=1}^{N} \mathrm{var}[t_{iT} \mid \rho_i = 0]}} \Rightarrow N(0,1) \quad (4)$$

Values of $E[t_{iT} \mid \rho_i = 0]$ and $\mathrm{var}[t_{iT} \mid \rho_i = 0]$ obtained from the results of Monte Carlo simulations carried out by IPS.

Maddala and Wu (1999) and Choi (2001) proposed a Fisher-type test of unit root which combines the *p*-values from unit root tests for each cross-section *i* to test for unit root in panel data. The Fisher test is nonparametric and distributed as chi-square with two degrees of freedom:

$$p\lambda = -2\sum log_{e}\pi_{i} \quad (5)$$

As mentioned in Baltagi (2005), Breitung (2000) found that the LLC and IPS tests suffer from a dramatic loss of power if individual-specific trends are included. Breitung suggests a test statistic that does not employ a bias adjustment whose power is substantially higher than LLC or the IPS tests using Monte Carlo experiments.

2. Panel Co integration Test: Several test proposed to examine the existence of co integration in panel data, this paper applied panel co integration test of Pedroni (1999, 2004) and Kao (1999).

Pedroni presented seven statistics for testing the null hypothesis of no co integration versus cointegration in panel data. Four statistics called panel cointegration statistics and based on pooling along what is commonly referred to as the within-dimension. And other three statistics developed by Pedroni called group-mean panel cointegration statistics, are based on pooling along what is commonly referred to as the between-dimension.

Kao (1999) introduced parametric residual-based panel cointegration. He expanded four DF-types and one ADF-type tests for testing the null hypothesis of no cointegration. The tests are based on the spurious least squares dummy variable (LSDV) panel regression equation with one single regressor.

3. Granger Causality Test: The causality between two variables in panel data can be studied by using the following bi-variate vector autoregressive (VAR) model and employing Wald test:

$$y_{it} = \lambda_i + \sum_{i=1}^{k} \alpha_{ik} y_{it-k} + \sum_{i=1}^{k} \beta_{ik} x_{it-k} + \varepsilon_{it} \quad (6)$$

$$x_{it} = \theta_i + \sum_{i=1}^{k} \gamma_{ik} y_{it-k} + \sum_{i=1}^{k} \delta_{ik} x_{it-k} + \upsilon_{it} \quad (7)$$

Where *i = 1, ..., N*; *t=1, ..., T*; *k* refers to the lag and ε_{it} and υ_{it} denote white-noise error terms.

RESULTS

1. Panel Unit Root Test: The results of Levin et al. (LLC, 2002), Im et al. (IPS, 2003), Breitung (2000) and Fisher-type panel unit root test of developed and developing countries, respectively, presented in table 1 and table 2. The results of several panel unit root tests for developed and developing countries indicate that any one of these tests cannot reject the null hypothesis of unit root in levels, that's means the LFDI, LEX and LGDP is non-stationary in levels, but results of panel unit root tests in first difference indicate that all variable become stationary after first differencing, In other words data series are integrated of order one I (1).

2. Panel Cointegration Test

Table 3 present the results of Pedroni panel cointegration tests for both developed and developing countries. Several statistics of Pedroni indicates existence of cointegration in both panels.

The results of Kao panel cointegration tests presented in table 4. For panel of developed countries DF_t statistic cannot reject the null hypothesis of no cointegration but other statistics reject the null hypothesis of no cointegration at the 1, 5 or 10 percent level of significance. For developing countries except DF_{ρ} and DF_t statistics that indicate existences of cointegration at the 15 percent level of significance,

other statistics indicates existence of cointegration at the 1 percent level. In overalls results of Pedroni and Kao tests support the existence of co-integration between LGDP, LEX and LFDI in developed and developing countries.

Table 1. Panel Unit Root Tests – Developed Countries

Variable	*LGDP*		*LEX*		*LFDI*	
Test	Levels	1st differences	Levels	1st differences	Levels	1st differences
LLC (2002)	-0.668 (0.25)	-3.799 (0.00)	0.805 (0.78)	-4.385 (0.00)	0.026 (0.51)	-3.148 (0.00)
IPS (2003)	0.535 (0.70)	-3.135 (0.00)	2.769 (0.99)	-3.581 (0.00)	0.669 (0.74)	-4.028 (0.00)
Breitung (2000)	-0.719 (0.23)	-1.929 (0.02)	-0.826 (0.20)	-2.499 (0.00)	-1.262 (0.10)	-1.462 (0.07)
ADF-Fisher	3.914 (0.68)	21.219 (0.00)	0.533 (0.99)	23.677 (0.00)	2.418 (0.87)	26.450 (0.00)
PP-Fisher	5.803 (0.44)	24.800 (0.00)	1.751 (0.94)	23.636 (0.00)	7.661 (0.26)	55.556 (0.00)

Note: Probability values denoted in parenthesis

Table 2. Panel Unit Root Tests – Developing Countries

Variable	*LGDP*		*LEX*		*LFDI*	
Test	Levels	1st differences	Levels	1st differences	Levels	1st differences
LLC (2002)	-0.857 (0.19)	-6.970 (0.00)	0.177 (0.57)	-7.830 (0.00)	0.487 (0.68)	-5.372 (0.00)
IPS (2003)	0.759 (0.77)	-6.083 (0.00)	2.534 (0.99)	-7.030 (0.00)	-0.205 (0.41)	-7.136 (0.00)
Breitung (2000)	2.290 (0.98)	-3.892 (0.00)	2.377 (0.99)	-5.004 (0.00)	-0.412 (0.34)	-1.363 (0.08)
ADF-Fisher	10.728 (0.825)	64.858 (0.00)	11.388 (0.78)	76.052 (0.00)	14.799 (0.53)	78.243 (0.00)
PP-Fisher	8.650 (0.92)	67.964 (0.00)	9.366 (0.89)	100.069 (0.00)	31.938 (0.01)	173.130 (0.00)

Note: Probability values denoted in parenthesis

Table 3. Pedroni Panel Co integration Test

Panel Group Statistics	Developed	Developing
Panel *v*-statistic	12.298 (0.02)	11.230 (0.00)
Panel ρ-statistic	-9.273 (0.03)	-17.291 (0.00)
Panel non-parametric (PP) *t*-statistic	-2.768 (0.01)	-6.445 (0.10)
Panel parametric (ADF) *t*-statistic	-34.380 (0.00)	-128.850 (0.00)
Group ρ-statistic	-10.012 (0.00)	-15.552 (0.00)
Group non-parametric *t*-statistic	-2.930 (0.00)	-5.474 (0.00)
Group parametric *t*-statistic	-2.735 (0.00)	-5.518 (0.00)

Note: Probability values denoted in parenthesis

Table 4.Kao Panel Co integration Test

Panel Group Statistics	Developed	Developing
DF_ρ	-1.285 (0.09)	-1.098 (0.13)
DF_t	-0.802 (0.21)	-1.163 (0.12)
DF_ρ^*	-3.654 (0.00)	-5.015 (0.00)
DF_t^*	-1.281 (0.10)	-1.961 (0.02)
ADF	-1.751 (0.03)	-2.735 (0.00)

Note: Probability values denoted in parenthesis

3. Panel Causality Test: As Granger (1969, 1988) points out, if there exists a cointegration between variables there is causality among these variables at least in one direction. Therefore to determine the direction of causality a panel-VECM causality which is based on Wald test applied in this paper.

A tri-variate panel-VECM for examine the causality between exports, foreign direct investment and economic growth can be written as follows:

$$\Delta LGDP_{it} = c_{1i} + \sum_{i=1}^{k} \alpha_{1ik}\, \Delta LGDP_{it-k} + \sum_{i=1}^{k} \beta_{1ik}\, \Delta LEX_{it-k} + \sum_{i=1}^{k} \gamma_{1ik}\, \Delta LFDI_{it-k} + \varphi_{1i} ECT_{t-1} + \varepsilon_{it} \quad (8)$$

$$\Delta LEX_{it} = c_{2i} + \sum_{i=1}^{k} \alpha_{2ik}\, \Delta LGDP_{it-k} + \sum_{i=1}^{k} \beta_{2ik}\, \Delta LEX_{it-k} + \sum_{i=1}^{k} \gamma_{2ik}\, \Delta LFDI_{it-k} + \varphi_{2i} ECT_{t-1} + \upsilon_{it} \quad (9)$$

$$\Delta LFDI_{it} = c_{3i} + \sum_{i=1}^{k} \alpha_{3ik}\, \Delta LGDP_{it-k} + \sum_{i=1}^{k} \beta_{3ik}\, \Delta LEX_{it-k} + \sum_{i=1}^{k} \gamma_{3ik}\, \Delta LFDI_{it-k} + \varphi_{3i} ECT_{t-1} + \epsilon_{it} \quad (10)$$

Where Δ is the first difference operator and ECT_{t-1} is lagged values of error correction term. Lag-length selection using Akaike's information criterion (AIC) and Schwarz information criterion (SC) indicated 2 lags for developed panel and 1 lag for developing panel. Results of panel causality displayed in table 5 and 6.

Table 5. Panel-VECM Causality – Developed Countries

Dependent variable	Independent variable		
	ΔLGDP	ΔLEX	ΔLFDI
ΔLGDP	-	0.194 (0.82)	1.656 (0.20)
ΔLEX	3.019 (0.05)	-	3.153 (0.05)
ΔLFDI	4.769 (0.01)	0.660 (0.52)	-

Note: Probability values denoted in parenthesis

Table 6. Panel-VECM Causality – Developing Countries

Dependent variable	Independent variable		
	ΔLGDP	ΔLEX	ΔLFDI
ΔLGDP	-	3.643 (0.05)	0.315 (0.57)
ΔLEX	5.987 (0.01)	-	1.374 (0.24)
ΔLFDI	1.94 (0.16)	0.839 (0.36)	-

Note: Probability values denoted in parenthesis

The results of panel causality in developed countries indicate unidirectional causality from GDP and FDI to exports and from GDP to FDI. Empirical results of developing countries indicate bidirectional causality between exports and economic growth and a weak causality from GDP to FDI.

DISCUSSION

There are many theoretical and empirical studies on the trivariate causality between FDI, exports and GDP but there are no common consequences regarding these relationships, so work on this issue is still debatable.

Therefore this paper examines the causality relationship between foreign direct investment, Exports and economic growth in two panels of Asian countries (three developed and eight developing countries) over the 1986 to 2010 years. At the first, panel unit root test performed and indicated that all variable integrated of order one.

Panel cointegration tests support the existence of co integration in both panels. Finally, Panel-VECM causality based on Wald test performed for developed and developing countries and displayed unidirectional causality from GDP and FDI to exports and from GDP to FDI in developed countries.

Further in developed counties, GDP has indirect effect on exports through relationship between GDP and FDI. Founding of causality in developing countries

indicated bidirectional causality between exports and economic growth and a weak causality from GDP to FDI.

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