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26 November 2007

Online at <https://mpra.ub.uni-muenchen.de/5988/>
MPRA Paper No. 5988, posted 28 Nov 2007 06:18 UTC

US FDI flows to ASEAN-5: Do Geographic Neighbors Matter?

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This paper investigates the possibility of interdependence between flows of US FDI to the ASEAN region. The study incorporates information asymmetry into an FDI model to examine the influence of geographic neighbors on new flows of FDI from the United States. Spillovers are modeled using the cost structure of a multinational investing in a region where US firms are already present. The results show that there are negative spillovers of US FDI in the ASEAN region affecting mostly the non-manufacturing sector.

Keywords: Foreign Direct Investment, Spillovers, ASEAN.

1.0 INTRODUCTION

Foreign Direct Investment (FDI) has played a key role in the advancement of the Association of South East Asian Nations (ASEAN). Since the 1970s, ASEAN members have attracted large inflows of FDI, especially through major Multi National Corporations (MNCs) from the US, Japan, and the European Union (EU). This study examines flows of United States (US) FDI to five ASEAN countries (ASEAN-5 hereafter): namely Malaysia, Singapore, Thailand, Indonesia and the Philippines. Cheap productive labor, abundant raw materials, fiscal and economic incentives such as free trade zones (FTZ), and preferential trade agreements have attracted many foreign firms, which have relocated their operations to ASEAN countries. From 1980-1997, FDI inflows increased almost 800%. As massive FDI inflows entered the region, ASEAN countries began to benefit in terms of employment opportunities, human capital development, higher wages, technology transfer, and infrastructure improvement.

The countries under analysis in this study are the senior members of ASEAN with spectacular economic growth rates before the 1997 financial crisis (on average 7-10%). These are the nations that catch the attention of major MNCs, for example electric and electronic companies, consumer goods such as household cleaning products, shampoo and cosmetic items, and batteries. The MNCs looking for low cost offshore production sites have found the ASEAN-5 very attractive in the last 20 years. The US has constantly been one of the major FDI source countries in ASEAN. Dell Computers, Motorola, Texas Instruments, Intel, Western Digital, Exxon/Mobil, Caltex, Conoco Phillips, Dow Chemical and Baxter International are some of the examples of major US MNCs venturing in ASEAN. A number of these firms are involved in upstream and downstream activities, while others concentrate on certain components only.

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Since the 1997 financial crisis, however, the macroeconomic instability exposed the vulnerability of the region to short term investment flows. At the same time, China and India opened their markets to foreign investors by relaxing foreign equity ownership limits and currency exchange, and opening more industries and sectors for FDI. As the countries under investigation gradually progress into developed nations, on the road to recovery from financial crisis and facing new competition, it is important to examine the influence of geographic neighbors on flow of FDI going to individual countries of ASEAN-5. This paper investigates the interdependence between US FDI flows to five senior members of ASEAN.

This paper was guided by three research objectives that differ from other studies: First it investigates the possibility of interdependence between flows of US FDI to the ASEAN-5 as a region using dynamic panel data; Second, it incorporates information asymmetry into an FDI model to examine the influence of geographic neighbors on new flows of FDI to ASEAN-5 from the US; Third, it analyzes the geographical spillover of manufacturing and non-manufacturing FDI in the ASEAN-5. There is very little empirical work in the literature concentrating on the ASEAN-5 as a group using dynamic panel data model. This paper successfully fills this void.

3.0 DATA AND EMPIRICAL METHODOLOGY

A modified version of the FDI model used by Barrel and Pain (1996), Love (2003), and Rubio and Ribero (1994) is applied in this paper. The objective is to show that a high stock of investment in neighboring countries affects the likelihood of new flows into the host country. Here, monitoring costs reflect geographical spillover from investment stock in countries neighboring the host country.

3.1 Definition of Variables

The FDI equation can be written in an estimable form as

$$FDI_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 COSTK_{it} + \beta_3 COSTL_{it} + \beta_4 CHER_{it} + \beta_5 PR_{it} + \alpha STOKIN_{it-1} + NEIGHB_{jt-1} + \varepsilon_{it} \quad (1)$$

FDI_{it} is the annual flow of FDI from the US to country i at year t . FDI_{it} is used as an endogenous variable. It represents funds that US parent companies provide to their foreign affiliates. Provision of funds to foreign affiliate takes three forms: equity capital, inter-company debt, and reinvested earnings. Data were obtained from the Bureau of Economic Analysis (BEA) website. Publicly available BEA data excludes countries where less than \$500,000 is invested and avoids disclosure of individual firm data. The definition of FDI in this paper is consistent with the IMF definition of FDI flows (IMF Balance of Payment Manual 1993, p.41, item 177). Various studies in the macro-view perspective of FDI analysis look at aggregate flows and rely on similar definitions (Love, 2003; Barrel and Pain, 1996; Rubio and Ribero, 1994). FDI is also divided into FDI flows to the manufacturing sector (FDIM) [1] and FDI to the non-manufacturing sector (FDINM) [2]. FDIM and FDINM are used as alternate endogenous variables.

Independent variables consist of seven variables obtained from various sources. Appendix A and B provide data source, acronyms, descriptions, expected signs, and justifications for using the variables. First, $SIZE_{it}$ (size of country i at year t) represents the market size in the host country [3]. GDP_{it} is a proxy for $SIZE_{it}$, which data is obtained from the IMF. Second, $COSTK_{it}$ is the ratio of host country to US cost of capital i at year t . Data for COSTK are computed following Love (2003) and Rubio and Ribero (1994):

$$c_i = (K_d / GDP_d) * (\zeta + 0.10 - \chi), \quad (2)$$

where K_d is the gross fixed capital formation deflator, GDP_d is the gross domestic product deflator, and ζ the medium run nominal interest rate. Data on K_d and GDP_d are obtained from OECD data, while data on ζ are obtained from the IMF. The depreciation rate is 0.10 by assumption, and χ is the rate of change in K_d one year ahead. Third, $COSTL_{it}$ is the relative cost of labor in the host country. $COSTL_{it}$ is defined as the ratio of host country to US wage, in dollar per hour, published in the International Labor Office yearbook. Fourth, $CHER_{it}$ is one period change in the real exchange rate between the country i currency and the US dollar at year t . The real exchange rate (RER) is defined as

$$RER = ((E_n * 100) / P_d) / ((US_d * 100) / (USPPI)), \quad (3)$$

where E_n is the host country's nominal exchange rate in dollar, P_d is host country's price deflator, $USPPI$ is the US producer price index. All necessary data (country level data) are obtained from the IMF. Fifth, PR_{it} is the firms' profit in country i at year t , proxy by firm's market value. Sixth, $STOKIN_{it}$ is the lag level of K stock (Mt-1). Seventh, $NEIGHB_{it}$ is the sum of lagged US investment stock in the neighboring country to the host country i computed as $NEIGHB_{it} = \sum_{i \neq j} wM_{j,t-1}$. Therefore, $M_{j,t-1}$ is the stock of investment at time $t-1$ in country j within 1000 miles from country i .

The study uses annual data from 1982 to 2000. Summary statistics for the data are provided in Table 1.

Table 1 Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
FDI	94	505.448	805.574	-470	3863
FDINM	93	264.892	467.009	-318	2088
FDIM	94	242.212	542.180	-703	3648
SIZE	95	22123.41	14996.35	4759.376	73913.23
COSTK	91	3.061	3.368	1.043	20.999
RCOSTK	90	1.289	1.344	0.0076	4.507
COSTL	95	4.627	4.473	0.0005	16.417
RCOSTL	94	14.753	2.57205	9.848	18.889
PR	55	74.218	30.993	4.31925	120.35
STOKIN	95	4264.40	4315.666	780	24133
RER	95	0.215	0.2333	0.00004	0.7211
CHER	95	-0.0073	0.0319	0.1438	0.0507
NEIGHB	95	12560.68	9346.521	2941	38861

3.2 Econometric Methodology

The base equation contains only host country characteristics consistent with traditional analysis of FDI determinants. Long-term investment relationships (historical stock) and influence of neighbors are progressively added. The neighbor's influence term seeks to capture

the geographic diffusion of flows and stock of FDI over time. NEIGHB term simulates the spillover variable because it tests the extent to which important stock of investments in neighboring countries affects flows to the host country [4]. A neighbor is defined as a country within a geographical distance of 1000 miles from the host country. To check the sensitivity of the conclusion to the definition of neighbor, a robustness check was conducted for distances from 500 miles to 3000 miles. In terms of estimation technique, most studies of the relationship between FDI and its determinants are done using time series analysis (Barrel and Pain, 1996; Rubio and Ribeiro, 1994). Although some recent contributions used panel data analysis (Wheeler and Mody, 1992; Braunerhjelm and Svesson, 1996; Filipaios, Papanastassiou, and Pearce, 2003; Love, 2003), dynamic panel data analysis is rare.

The dataset in our study allows the development of a model with one cross section dimension ($i = 1, 2, \dots, N$), one time dimension ($t = 1, 2, \dots, T$), and one spatial term.

$$I_{it} = \beta X_{it} + \alpha M_{t-1} + \varphi \sum_{i \neq j} w M_{jt-1} + \varepsilon_t \quad (4)$$

$$\varepsilon_{it} = \mu_i + v_{it} \quad (5)$$

where I_{it} is the net annual FDI from US to a host country i at time t , X_{it} is the vector of exogenous variables which vary in cross section and time dimension such as profits and factor costs elements, M_t is the stock of investment in the country i at time t , $\sum_{i \neq j} w M_{jt-1}$ is the stock of

US FDI in the neighboring countries. Equation (5) describes the typical error structure; μ_i is the fixed effect (country specific effect), and v_{it} is the stochastic error term.

By incorporating lagged flows of investment into equation (4), it can be rewritten as

$$I_{it} = \alpha_1 I_{t-1} + \beta X_{it} + \alpha_2 M_{t-2} + \varphi \sum_{i \neq j} w M_{jt-1} + \varepsilon_t \quad (6)$$

Equation (6) is clearly a dynamic equation. Nickel (1981) argues that in this situation two basic econometric problems are created by the presence of a lagged dependent variable among the regressors. Those are the autocorrelation of the error term with the lagged dependent variable, and heterogeneity. Nickel (1981) adds that in this situation usual panel data technique are not appropriate because it will yield biased and inconsistent estimates, however, as the sample size increases the bias generated by the presence of lagged dependent will become small. Two major estimation techniques generally used to account for the estimation problem mentioned above. The Arellano and Bond (1991) GMM estimation technique is known to be more efficient, and the Anderson Hsiao estimator is known to be more consistent (Kiviet, 1995). Arellano and Bond dynamic panel data estimation technique is used in this study.

4.0 EMPIRICAL RESULTS

The first three columns of Table 2 provide estimates for the determinants of total FDI flows. The next three columns provide estimates for determinants of FDI to the manufacturing sector, and the last three columns provide estimates for the determinants of investment to the non-manufacturing sector. Each group of three columns includes host country characteristics, neighboring country effect, and an interaction variable added to control for country size and stock of investments in neighboring countries. Following Arellano and Bond dynamic panel data estimation procedure, the lag levels are used as instruments for all variables. The coefficient of the spatial term reflects shocks (accumulated over time) to neighboring countries that attract FDI to the host country. Because the spatial variable is a stock of flows accumulated over time, it

carries the idea of spillover that takes time to integrate into the host country's economy. The relevant diagnostic tests are shown at the bottom of the table. The three models adequately fit the data; as the values of the Wald statistics are high. Moreover, it is not possible to reject the null hypothesis of invalid additional restrictions; since the Sargan test is not significant. Furthermore, first order autocorrelation in the differenced residuals is not present, which suggests that the estimates are not inconsistent.

With the exception of the coefficients of COSTL and COSTK, all host country characteristics carry the expected signs. Furthermore, the inconsistency of the SIZE coefficient exists only in the most restricted formulation of the model. The variation of the sign of factor cost suggests different sensitivity of various type of FDI to host country characteristics. It may be argued that the specificities of neighbors strongly affect US investment decisions in ASEAN. This may be due to the presence of a very large country; Singapore or Malaysia in the sample.

Interpreting these results in terms of relative change in the independent variable leads to two points. First, the effect of a neighboring country is of comparable magnitude for both manufacturing and non-manufacturing investments. However it is statistically insignificant for manufacturing investments, which is expected, because most of US FDI is in the non-manufacturing sector. Second, relative wage rates negatively affect manufacturing investments, and relative lower wages seem to increase non-manufacturing investments in the ASEAN region. This can be seen as indication of managerial and other non-wage motive for locating non-manufacturing investments in the ASEAN (services to be located closer to customers). Third, higher US cost of capital increases non-manufacturing investments in the ASEAN countries; this result may be justified by the composite nature of US FDI, which includes equity, reinvested earning and inter-company debt. Fourth and most importantly neighbors negatively affect flows of investments to the host country. An increase in the stock of investment equal to \$1000 in neighboring countries reduces flows to the host country by about \$124.

Further, we perform a robustness check on the sensitivity of the results to the use of alternative measure of the SIZE variable. The empirical estimation results are presented in Table 3. The empirical estimation shows the negative relationship between absolute level of investments in neighboring countries and flows of FDI to the manufacturing and non-manufacturing sectors. Checking the sensitivity of the results with respect to various definitions of geographic neighbors leads to the same conclusion.

An Institute of Developing Economies (2003) study revealed that ASEAN members are competing among themselves in producing similar manufacturing products. This is one of the reasons for the staggering FDI attraction into the region. The study suggests that each member nation should upgrade the sectors/industries where it has a comparative advantage. Instead of competing with each other, concentrating on the industries where a country has a comparative advantage will prepare ASEAN-5 to compete with China and India. ASEAN-5 as a group should also devise a new set of regulations as well as incentives to retain current FDI and attract new FDI. ASEAN-5 should study carefully the advantages each member nation has in terms of foreign investments and concentrate on particular industries. Minimizing of competition with other ASEAN countries will benefit the region in the long run, given the trends in FDI.

Table 2 Regression results for the ASEAN-5

	FDI			FDI manufacturing			FDI non-manufacturing		
	I	II	III	I	II	III	I	II	III
CONSTANT	-0.874 (88.669)	48.71 (89.155)	-76.768 (119.57)	83.106 (69.276)	130.398 (83.094)	169.535 (112.705)	-65.139 (64.692)	-48.848 (68.133)	-218.944** (89.571)
FDI(-1)	-.421*** (.101)	-.366*** (.102)	-.391*** (.096)	-.152 (.179)	-.104 (.189)	-.097 (.196)	-.817*** (.114)	-.791*** (.119)	-.839*** (.111)
SIZE	-.017 (.02)	.049 (.041)	.089** (.047)	-.014 (.018)	.022 (.037)	.006 (.049)	-.003 (.014)	.019 (.031)	.073** (.035)
RCOSTK	-1.705* (1.031)	-4.253** (1.72)	-4.683*** (1.622)	-.441 (.932)	-1.789 (1.556)	-1.453 (1.729)	-2.234*** (.759)	-3.048** (1.278)	-3.709*** (1.196)
RCOSTL	-2082.742 (1634.996)	-4340.314** (2001.154)	-3913.13** (1878.901)	-5366.863*** (1423.738)	-6795.954*** (1956.144)	-6850.623*** (2028.854)	3740.471*** (1180.709)	3004.509** (1505.632)	3549.037** (1392.694)
CHER	-3806.616 (2726.139)	-2227.433 (2750.533)	-159.554 (2921.022)	-1026.324 (2403.557)	-494.885 (2512.63)	-1410.98 (3110.439)	-2484.334 (1972.587)	-1938.62 (2096.951)	847.454 (2188.644)
PR	9.93 (8.2)	9.103 (7.859)	10.206 (7.328)	-3.921 (7.197)	-4.664 (7.414)	-4.691 (7.68)	9.546 (5.936)	9.233 (5.974)	10.784** (5.496)
STOKIN	.324*** (.047)	.359** (.049)	.449*** (.077)	.304*** (.044)	.321*** (.047)	.29*** (.075)	.031 (.034)	.042 (.037)	.167*** (.058)
NEIGHB		-.124* (.068)	-.235** (.099)		-.068 (.062)	-.027 (.1)		-.041 (.051)	-.194*** (.075)
RSIZE			.003 (.002)			-.001 (.001)			.003*** (.001)
Wald	220.21	243.82	285.64	127.43	122.31	114.27	116.79	116.45	146.14
Sargan	26	25.13	27.11	31.5	28.73	26.49	22.6	21.75	18.99
Ar-bond(1)	-2.19	-1.96	-1.6	-2.11	-2.03	-2.19	-2.07	-2.03	-1.98
Ar-bond(2)	-0.39	0.17	0.51	0.28	0.09	0.16	-0.55	-0.22	0.39

Note: ***, **, and * denotes significance at the 1%, 5%, and 10% respectively.
Standard errors in parentheses

Table 3 Robustness Check

	FDI			FDI manufacturing			FDI non-manufacturing		
CONSTANT	-.874 (38.892)	48.71 (57.765)	-76.768 (75.459)	83.106 (51.016)	130.398*** (48.738)	169.535*** (42.488)	-65.139 (57.111)	-48.848 (66.025)	-218.944**
FDI(-1)	-.421*** (.049)	-.366*** (.073)	-.391*** (.045)	-.152 (.132)	-.104 (.144)	-.097 (.143)	-.817*** (.042)	-.791*** (.052)	-.839*** (.026)
SIZE	-.017 (.025)	.049 (.041)	.089** (.045)	-.014 (.026)	.022 (.037)	.006 (.056)	-.003 (.009)	.019 (.021)	.073*** (.023)
RCOSTK	-1.705* (1.029)	-4.253*** (.651)	-4.683*** (.747)	-.441 (1.039)	-1.789 (1.341)	-1.453 (1.34)	-2.234*** (.683)	-3.048*** (.397)	-3.709*** (.602)
RCOSTL	-2082.742 (2247.053)	-4340.314 (2766.573)	-3913.13* (2102.209)	-5366.863*** (1473.174)	-6795.954*** (1881.321)	-6850.623*** (2034.983)	3740.471*** (1167.044)	3004.509** (1435.099)	3549.037*** (717.284)
CHER	-3806.616* (2177.412)	-2227.433 (2195.245)	-159.554 (2143.683)	-1026.324 (1739.201)	-494.885 (1594.153)	-1410.98 (2431.812)	-2484.334*** (615.023)	-1938.62** (807.637)	847.454** (428.171)
PR	9.93 (7.575)	9.103 (7.419)	10.206 (6.196)	-3.921 (5.042)	-4.664 (5.15)	-4.691 (5.756)	9.546 (6.166)	9.233 (6.235)	10.784** (5.369)
STOKIN	.324*** (.049)	.359*** (.053)	.449*** (.065)	.304*** (.02)	.321*** (.024)	.29*** (.06)	.031 (.026)	.042 (.028)	.167*** (.028)
NINV		-.124*** (.042)	-.235*** (.082)		-.068 (.043)	-.027 (.084)		-.041* (.023)	-.194*** (.061)
RSIZE			.003 (.002)			-.001 (.001)			.003*** (.001)
Wald	129	26.19	853.48	463.37	31.61	62	48.49	10.47	38.78
Ar-bond(1)	-1.29	-1.46	-1.51	-1.5	-1.53	-1.68	-1.61	-1.49	-1.32
Ar-bond(2)	-1.06	0.65	0.77	1.56	0.88	1.56	-1.35	-1.12	1.15

Note: ***, **, and * denotes significance at the 1%, 5%, and 10% respectively.
Standard errors in parentheses

The ASEAN-China Free Trade Area and ASEAN-Japan Comprehensive Economic Partnership agreements show that progress is on track for globalization and liberalization of the region. Furthermore, the US, Korea, India, and some EU countries have expressed their interest in forming a Free Trade Area (FTA) with ASEAN. ASEAN-5 is still capable of attracting FDI, provided all the countries in the region want such investments as to facilitate their development process. It is time for ASEAN-5 members to develop a plan to further improve their cooperation with each other, especially concentrating on sectors/industries where each of them has a comparative advantage.

5.0 CONCLUSION

In summary, both stock of investments located inside the host country and outside the host country are relevant for US FDI location decisions in the ASEAN region. The results in this paper imply that flows going to individual countries are reduced by the presence of high stock of investments in neighboring countries. Moreover larger countries seem to receive more investments. Economically, it is possible that firms in the ASEAN region use resources in neighboring country to monitor FDI. It is also possible that they view two countries as substitute locations. However, if the assumption of randomness in the distribution of countries (underlying usual models) holds, there is no possible diffusion of investment from one country to the other because diffusion implies spatial contagion. Nevertheless, this paper shows that spatial diffusion happens in the ASEAN region. Thus analysis of the determinants of US FDI should consider diffusion from neighboring countries. To create a better investment climate in the ASEAN region, all member countries should form closer ties and work together to improve industrial endowments, technological capability, high-quality infrastructure and human resource development. In addition, minimizing competition between members in attracting FDI to similar industries will make the region stronger economically.

ENDNOTE

[1] “Food and kindred products, chemical and allied products, primary and fabricated metal, industrial machinery and equipment, electric and electronic equipment, transportation equipment, and other manufacturing” <<http://www.bea.doc.gov/bea/di/usdiacap.htm>>.

[2] FDI to the remaining sectors, including petroleum, wholesale trade, depository institutions, finance (except depository institutions insurance and real estate), services, and other industries.

[3] $Population_{it}$ was also used as proxy for country size. However, its coefficient displayed expected signs in the static model but counter intuitive signs more often than GDP in the dynamic model. This is not surprising since most ASEAN countries have more or less similar population.

[4] See Keller (2004) for a literature review on international diffusion of technology.

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Appendix A: Acronym, Description and Data Source

Acronym	Description	Data source
FDI	Foreign Direct Investment flows by country in millions of dollars	US Bureau of Economic Analysis
FDINM	Foreign Direct Investment flows non manufacturing by country in millions of dollars	US Bureau of Economic Analysis
FDIM	Foreign Direct Investment flows manufacturing by country in millions of dollars	US Bureau of Economic Analysis
SIZE	Gross Domestic Product in millions of dollar	International Monetary Fund
DIST	Distance as crow fly from Washington DC to the host country capital city	Indo.com
STOKIN	Foreign Direct Investment stock by country in millions of US dollar	US Bureau of Economic Analysis
NEIGHB	Sum of neighbors' stock of investment intensity in millions of US dollar	US Bureau of Economic Analysis
COSTK	Index computed following Bajo and Rivero Sosvilla (1994, p18) and Love (2003, p1267) as $(Kd/GDP)^*(I+.10- \pi1)$ Kd is the gross fixed capital formation deflator. I is the medium run nominal interest rate .10 is a depreciation rate $\pi1$ is the rate of change of Kd one period ahead.	Computed using IMF data computed from world bank data IMF
COSTL	Labor cost in dollar per hour	Yearbook of labor statistics-various issues. ILO
RER	Real Exchange Rate in local currency per dollar defined as $(E*USPPI)/(M)$ E is the nominal exchange rate USPPI is the US producer price index P is the host country price level	IMF World Bank World Bank
CHER	Change in real exchange rate	calculated
PROFIT	US firms profits	IMF

Appendix B- Variables and Expected Signs

Acronym	Variable Description	What it captures	Expected sign
SIZE	GDP	Size of the country Larger countries attract more FDI	+
RCOSTK	Relative capital cost (c_1/c_2)	Factor cost motive for FDI	+/-
RCOSTL	Relative labor cost (w_1/w_2)	Factor cost motive for FDI	+/-
RSIZE	GDP times neighbor's investment	Multiplicative effect of the neighbors and the size of the host country	+/-
CHER	Change in Exchange rate (Δe)	Price of goods and services in the host country relative to the US	+/-
PR	Firms profits	Profit motive for FDI	+
STOKIN	Lag level of K stock (M_{t-1})	Effects of prior US presence in the host country	+/-
NEIGHB	Neighbor's Investment	Neighborhood investment intensity	-