

Foreign Direct Investment Location Decision and Pollution: Evidence from Malaysia

Abdul Hamid Jaafar
Md. Elias Hossain

ABSTRACT

There is considerable development gap between regions in Malaysia. The objective of this paper is to examine the impact of regional environmental pollution condition on foreign direct investment location decision across regions in Malaysia. In this study, several regional environmental variables are included as determinants of foreign direct investment location decision. The study uses state level data from 1995 to 2004 on a random effects panel regression model. Results from this study indicate that while positive economic circumstances attract foreign direct investment, negative environmental conditions, especially air pollution, serve as push factors. This finding suggests that local regions should improve their environmental condition in order to stand a better chance of attracting foreign as well as local investment.

ABSTRAK

Ketakeimbangan wilayah yang berlaku di Malaysia agak membimbangkan. Objektif kertas ini adalah untuk mengkaji kesan pencemaran alam sekitar di peringkat wilayah terhadap penempatan pelaburan langsung asing mengikut wilayah di Malaysia. Dalam kajian ini beberapa pembolehubah alam sekitar diambilkira sebagai faktor penentu keputusan penempatan pelaburan langsung asing. Kajian ini menggunakan data negeri bagi tempoh 1995-2004 dan diaplikasikan kepada model regresi panel kesan ralat. Hasil kajian ini menunjukkan keadaan ekonomi yang baik menarik pelaburan langsung asing, manakala keadaan alam sekitar yang negatif seperti pencemaran air bertindak sebagai faktor penolak. Hasil kajian ini mencadangkan supaya setiap wilayah memperbaiki keadaan alam sekitar mereka untuk menarik lebih ramai pelabur asing dan juga pelabur tempatan.

INTRODUCTION

Malaysia has always been aggressive in its effort to attract foreign direct investment (FDI), and tapping these investments to spur economic growth, inducing technology transfer and job creation. Most FDI in Malaysia are in the manufacturing sector with output aimed for the global market in general; and for the Southeast and East Asia's market in particular.

Another facet to Malaysian development is unbalanced development between regions and states. The Ninth Malaysia Plan, 2006-2010, highlights this concern where it mentions that development gap between regions and states still persist. According to the Ninth Plan, factors attributable to the disparity is that new manufacturing investors are more attracted to invest in more advanced states in Malaysia because these advanced states have good infrastructure facilities and financial services. The Plan further mentions that one of the main development goals of the Ninth Malaysia Plan is to lessen this gap via, among others, intensified development of rural growth centres and urban conurbation or urban sprawl, and encouraging the private sector to invest in existing and potential growth areas (Malaysia 2006). However, the key question remains, that is, what could policy makers do to encourage foreign investors to invest in less advanced states or regions in order to rouse income-generating activities?

Most literatures have concentrated efforts in investigating how different degree of environmental regulations influence FDI location choice; for example Xing and Kolstad (2002), List and Co (2000), Levinson (1996), and McConnell and Schwab (1990). To our knowledge, no study has examined how existing environmental conditions of regions with the same environmental regulatory stringency influence FDI location decision.

The aim of this paper is to show that environmental variables of the region influence FDI location decision within Malaysia besides the usual income and infrastructural factors. Within the same theme and specific to Malaysia, earlier empirical study showed that the main determinants were labour productivity, income, and manufacturing infrastructure (see Karim et al. 2004). This paper extends the discussion by including several environmental variables as determinants of regional FDI location decision.

We assert that foreign manufacturing firms investing in or across regions in Malaysia do not look at Malaysia as a pollution haven. Instead, apart from availability the infrastructural facilities and access to financial services, the state of environmental pollution of a particular region also

influence foreign investing firms when deciding on their location choice. Since foreign investing firms in Malaysia comprise of well-known multinationals, we assert that these firms try to avoid being associated with negative environmental circumstances, thus prefer location with lesser pollution, *ceteris paribus*. Findings from this paper will be useful to policy makers in designing incentives to attract FDI to a particular region.

OVERVIEW OF FDI INFLOW IN MALAYSIA

Malaysia has a land area of 330 252 square kilometres and approximately 25.6 million population in 2004. Malaysia comprises of 13 states, (Johor, Kedah, Kelantan, Melaka, Negeri Sembilan, Pahang, Perak, Perlis, Pulau Pinang, Sabah, Sarawak, Selangor, and Terengganu) and three Federal territories (*i.e.* Kuala Lumpur, Putrajaya, and Labuan). Gross Domestic Product (GDP) of Malaysia in 2004 was RM 449 609 million (RM 248 954 million at 1987 price). Basic statistics of these states are shown in Table 1.

Beginning with the Investment Incentive Act of 1968, Malaysia has always maintained an open and liberal setting for foreign investment. Over the years, various incentives were instituted to attract FDI. As shown in Figure 1, inward FDI initially rose gradually. However, beginning 1987, FDI inflow insistently rose to a high of about RM 17 billions in 1990, 1991, and 1992. Then on, FDI fluctuated and peaked again in 1996 and again in 2000. During expansionary periods, FDI is about 60 to 65% of total investment while during recessionary period inward FDI is about 45% to 50% of total investment.

Much of Malaysian FDI inflows are from the U.K., U.S., Japan and Singapore. In 2003, FDI from these four countries constituted 54% of total FDI approved by Malaysia. Other countries that have significant investment in Malaysia are Taiwan, Republic of Korea, Thailand, and Germany (Figure 2).

Inward FDI has been unevenly spread across states in Malaysia and over time. As shown in Table 2, the central states of Malaysia received the bulk of FDI inflows in 1995 and 2000. However, almost half of FDI inflows made their way to the northern states of Peninsula Malaysia in 2004 with Johor coming in second. Between 2000 and 2004, absolute value of FDI inflows into Sarawak decreased, while in percentage term increased from 9.8% to 12.7%.

TABLE 1. Basic statistics, 2004

States	State GDP (RM million)*	Population (000)	Land area	
			Sq. km	Percent
Johor	29,801	3,029.3	18,987	5.75%
Kedah	10,397	1,813.1	9,425	2.85%
Kelantan	5,893	1,479.8	15,020	4.55%
Melaka	7,302	700.1	1,652	0.5%
Negeri Sembilan	8,243	929.6	6,657	2.02%
Pahang	9,476	1,399.5	35,965	10.89%
Perak	17,452	2,225.0	21,005	6.36%
Perlis	–	221.2	795	0.24%
Pulau Pinang	20,045	1,442.80	1,030	0.31%
Sabah	15,462	2,862.30	73,997	22.41%
Sarawak	20,609	2,262.70	124,450	37.68%
Selangor**	53,707	4,613.90	7,979	2.41%
Terengganu	16,100	990.6	12,955	3.92%
Kuala Lumpur	32,741	1,529.00	243	0.07%
Labuan	–	82.1	292	0.03%

* State GDP at 1987 price. ** Figures include Putrajaya

Sources: (a) State GDP: Md. Elias Hossain (2006)

(b) Population Department of Statistics (2005) Table 5.2.

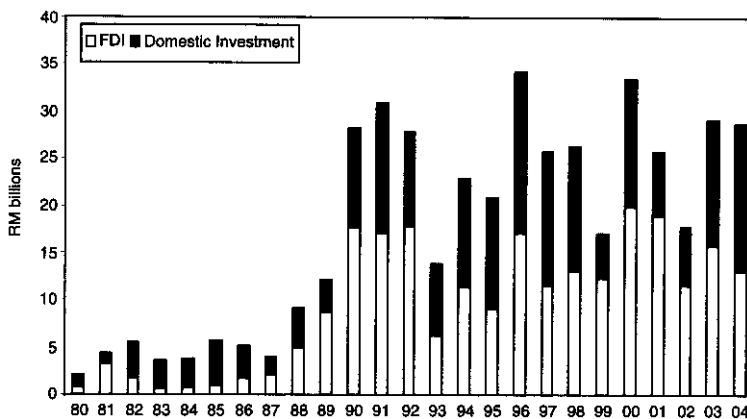


FIGURE 1. FDI inflows, 1980-2004

Sources: Summnerized from:

(a) 2001 and beyond: MIDA

website: www.mida.gov.my/beta/view.php?cat=13&scat=1612

(b) before 2001: personal communication with officers in MIDA

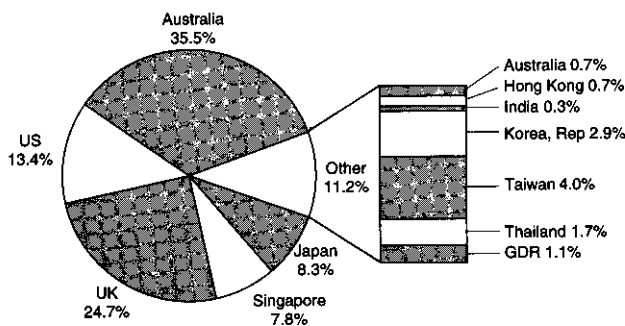


FIGURE 2. Sources of FDI

Sources: 2001 and beyond: MIDA

website: www.mida.gov.my/beta/view.php?cat=13&scat=1612

TABLE 2. Regional distribution of FDI in Malaysia

	FDI (RM million)					
	1995		2000		2004	
<i>Southern</i>						
Johor	2,379.20	26.1%*	1,861.70	9.4%	2,318.30	18.0%
<i>Northern</i>						
Kedah	1,310.10		861.40		4,752.50	
Perak	395.90		1,356.20		404.50	
Pulau Pinang	640.60		3,564.50		1,014.20	
Sub-total	2,346.60	25.7%	5,782.10	29.1%	6,171.20	47.9%
<i>Eastern</i>						
Kelantan	1.70		3.70		12.40	
Pahang	266.80		1,956.00		521.30	
Terengganu	146.10		4.50		28.70	
Sub-total	414.60	4.5%	1,964.20	9.9%	562.40	4.4%
<i>Central</i>						
Melaka	352.40		894.60		321.70	
Negeri Sembilan	1,396.90		2,011.80		393.20	
Selangor	1,716.70		5,254.90		1,353.50	
Kuala Lumpur	26.80		66.10		121.60	
Sub-total	3,492.80	38.2%	8,227.40	41.5%	2,190.00	17.0%
<i>East Malaysia</i>						
Sabah	262.20	2.9%	59.10	0.3%	20.60	0.2%
Sarawak	237.60	2.6%	1,954.10	9.8%	1,634.00	12.7%
Total	9,133.00		19,848.60		12,896.50	

* Percent from total

Source: Malaysian Industrial Development Authority, various years

MODEL SPECIFICATION AND DATA

To fulfil the objective, we use state level ten-year panel data between 1995 and 2004. In the estimation, we consider the classical pooled regression, fixed effects panel and random effects panel models. However, LM test indicate that the pooled model is inappropriate. Additionally, since the Hausman test fail to reject the random model, the estimation model is as in equation (1). For comparison, we also estimate local investment (LDI_{it}) behaviour with the same specification.

$$FDI_{it} = \alpha + \beta_1 PGDP_{it} + \beta_2 KLR_{it} + \beta_3 IS_{it} + \beta_4 CMP_{it} + \beta_5 PM10_{it} + \beta_6 BOD_{it} + \mu_i + \varepsilon_{it} . \quad (1)$$

$$LDI_{it} = \bar{\alpha} + \bar{\beta}_1 PGDP_{it} + \bar{\beta}_2 KLR_{it} + \bar{\beta}_3 IS_{it} + \bar{\beta}_4 CMP_{it} + \bar{\beta}_5 PM10_{it} + \bar{\beta}_6 BOD_{it} + \bar{\mu}_i + \bar{\varepsilon}_{it} . \quad (2)$$

In equation (1), α is the intercept, β_n 's are slope coefficients, μ_i is panel specific random element and ε_{it} is individual and time specific error term. The definition of corresponding coefficients in equation (2) is similar as those in equation (1). Dependent and explanatory variable descriptions are as follows.

FDI_{it} is amount of inward FDI approved for manufacturing and manufacturing related service industries in region i at time t (RM million 1987 price);

LDI_{it} is amount of domestic investment approved for manufacturing and manufacturing related service industries in region i at time t (RM million 1987 price);

$PGDP_{it}$ is amount of per capita GDP of region i at time t (RM 1987 price);

KLR_{it} is the value of fixed or capital asset of manufacturing and construction industries in region i at time t (RM 000 1987 price);

IS_{it} is percent of industrial share in state GDP in region i at time t ;

CMP_{it} is number of environmental related complaints per 100,000 person in region i at time t ;

$PM10_{it}$ is particulate matter of diameter less than 10 micron in region i at time t (mg/m^3); and

BOD_{it} is biological oxygen demand in region i at time t (mg/liter).

SOURCE OF DATA

We gather data on FDI and LDI from the Malaysian Industrial Development Authority. Data on *PGDP* and *I*, are gathered from (a) Economic Reports (Selangor, Negeri Sembilan, Terengganu, Melaka, Johor, Kuala Lumpur), (b) Yearbook of Statistics (Sabah and Sarawak), (c) Basic Data (Pahang), (d) Kedah Maju (Kedah), and (e) Economic Planning Unit (Perak and Kelantan). Data on *KLR*, is obtained from various issues of State Data Bank; Survey of manufacturing and construction industries. Data on *CMP* is obtained from the Department of Environment. Finally data on *PM* and *BOD* are gathered from Alam Sekitar Malaysia Sdn Bhd (a private organization engaged by the Department of environment to monitor environmental data station and provide environmental quality data to the agency).

Table 3 presents characteristics of all variables. In the following, we discuss rationales of each explanatory variable.

PGDP

The influence of market size, with real GDP or per capita GDP as proxy, has been robust in many FDI literatures (for instance see Dunning 1993; Shatz and Venables 2000; Wei 2005). High income indicates large market size of the host country. As such, if FDI is “market-seeking”, we expect that higher income will be positively related to FDI inflows. However, we assert that FDI inflows into Malaysia in general seek to lower their production cost with output catered towards the export market. Further, in the case of regional location choice, in particular in the context of Malaysia, the local regional economy is too small to exert any significant impact that could attract FDI. As such, it is not surprising if the coefficient of this variable is not significantly different from zero.

KLR

This ratio is taken as proxy for the following region specific attributes. Given capital, this ratio approximates the productivity of skilled labour. It also indicates the relative production technology between regions. It is expected that higher (skilled) labour productivity would attract more FDI (Dunning 1993; Karim 2004). The expected sign for this variable is positive.

IS

Industry share signify the structure of regional economy. The ratio is also taken to indicate the quality of infrastructure and degree of industrialisation, both of which are measures for agglomeration (Lim 2001). The expected sign is positive.

CMP, PM10 and BOD

We hypothesise that multinationals investing in Malaysia react negatively to adverse regional environmental condition when considering location choice within Malaysia. We used three variables as proxy to the environmental condition of a region. In particular, *PM10* for average air pollution of a specific region; *BOD* for average water pollution condition; and *CMP* as an overall indicator for the environment. Their signs are expected to be negative.

TABLE 3. Characteristics of the data (1995-2004)

Variable	Mean	Std. dev.	Maximum	Minimum
<i>FDI</i> (RM 000 87 price)	725 101.5	868 998.0	3 507 385.3	0.0
<i>LDI</i> (RM 000 87 price)	601 740.8	736 529.3	4 009 860.1	1 949.8
<i>PGDP</i> (RM 87 price)	12 989.8	6 959.0	34 885.8	4 039.1
<i>KLR</i> (RM 000 87 price)	12.5	8.9	85.6	0.5
<i>IS</i> (%)	32.7	13.1	67.5	15.4
<i>CMP</i> (no. per100,000 person)	14.7	10.4	58.2	1.9
<i>PM10</i> (mg/m ³);	52.2	14.0	114.0	32.0
<i>BOD</i> (mg/liter)	21.8	38.2	273.2	1.0

ESTIMATION RESULTS AND DISCUSSION

The estimated results of equation (1) and (2) are presented in Table 4. All variables in both equations have all the expected signs. For non-environmental variables, the results indicate that major concern of both foreign and local investors in deciding their location choice is agglomeration. Agglomeration will allow firms to increase their efficiency by locating close to one another. The significance of this pull factor indirectly affirms the importance of not only the availability of infrastructure, but also its quality, and the degree of industrialization in attracting FDI into a particular region. The magnitude of *IS* elasticity at the mean for both foreign and local firms is quite close. They are 1.52

TABLE 4. Coefficient estimates

Variables	Estimated coefficients Dependent variable: <i>FDI</i>	Estimated coefficients Dependent variable: <i>LDI</i>
Constant	636.237** (654.536)*	1465.408** 864.154*
<i>PGDP</i>	0.014** (0.0244)*	0.005** (0.032)*
<i>KLR</i>	2.605** (9.632)*	8.849** (12.859)*
<i>IS</i>	33.635** (14.515)*	39.937** (19.169)*
<i>CMP</i>	-22.033** (11.277)*	-12.223** (15.004)*
<i>PM10</i>	-15.661** (7.532)*	-22.993** (10.035)*
<i>BOD</i>	-3.744** (2.167)*	-5.568** (2.893)*
R^2	0.25	0.26
Observations	130	130

Note: Standard error in bracket.

** and * denote significant at least at 5 and 10 percent level respectively.

and 1.80 respectively (Table 5). A slight higher elasticity for local firms indicates that agglomeration effect is relatively more important to local firms than to foreign.

Among the environmental variables, the largest push factor of regional location decision for foreign firms, as well as local firms, is the state of air pollution. A one percent increase in air pollution reduces more than one percent of *FDI* or *LDI* invested in a particular region. Again, as shown in Table 5, *PM10* elasticity at the mean for local firm is slightly higher than that of foreign.

TABLE 5. Elasticity at the mean

Variables	<i>FDI</i>	<i>LDI</i>
<i>IS</i>	1.52	1.80
<i>CMP</i>	-0.45	
<i>PM10</i>	-1.13	-1.66
<i>BOD</i>	-0.11	-0.17

The next influential push factor is number of environmental related complaints registered with the Department of Environment. However, this variable is only significant in the *FDI* equation. Possibly local firms are immune to such complaints, thus do not influence their investment location choice. The least influential push factor is *BOD*. However, influences of the latter two determinants on *FDI* inflow are not large.

CONCLUSION

The objective of this paper is to examine the growth of *FDI* in Malaysia across regions, with particular focus on the impact of regional environmental pollution condition on allocation of *FDI* inflows. Unlike other *FDI*-environment studies, which focus mostly on pollution heaven hypothesis, this study includes variables to capture the specific role of environmental pollution status as a determinant of *FDI* location decision. We use data of Malaysian state level data between 1995 and 2004 to examine the issue. We used two types of environmental variables, *i.e.*, environmental complaints and ambient pollution levels to capture the average state of pollution in each region. The data were fitted on a random effects panel regression model. To examine whether local investment location decision also behave in similar fashion, the same specification is fitted on state level local investment data.

Results of this study give interesting insights into the behaviour of multinationals as well as local firms on their investment location choices. This study finds that while positive economic circumstances serve as *FDI* pull factors, negative environmental conditions are push factors of inward *FDI*. This is true at least in the Malaysian context or possibly in the context of developing countries with development level similar to Malaysia. Policy implication of these findings is obvious. That is, apart from providing infrastructural and financial facilities, regions that improve their environmental condition will stand a higher chance of attracting investments from both local and foreign sources.

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School of Economic Studies
Faculty of Economics and Business
Universiti Kebangsaan Malaysia
43600 UKM, Bangi
Selangor Darul Ehsan
Malaysia
e-mail:ahamid@pkrisc.cc.ukm.my

