

E C O N O M I C S B U L L E T I N

Does Foreign Direct Investment Promote Economic Growth? Evidence from a Threshold Regression Analysis

Wu Jyun-Yi

Department of Economics, National Central University

Hsu Chih-Chiang

Department of Economics, National Central University

Abstract

Using threshold regression techniques developed by Caner and Hansen(2004),this paper examines whether the effect of foreign direct investment (FDI) on economic growth is dependent upon different absorptive capacities. There are three absorptive capacities, namely, initial GDP, human capital and the volume of trade, that are used as threshold variables in our paper. The empirical analysis shows that FDI alone plays an ambiguous role in contributing to economic growth based on a sample of 62 countries covering the period from 1975 through 2000. Under the threshold regression, we find that initial GDP and human capital are important factors in explaining FDI. FDI is found to have a positive and significant impact on growth when host countries have better levels of initial GDP and human capital.

Citation: Jyun-Yi, Wu and Hsu Chih-Chiang, (2008) "Does Foreign Direct Investment Promote Economic Growth? Evidence from a Threshold Regression Analysis." *Economics Bulletin*, Vol. 15, No. 12 pp. 1-10

Submitted: June 9, 2008. **Accepted:** July 23, 2008.

URL: <http://economicsbulletin.vanderbilt.edu/2008/volume15/EB-08O10014A.pdf>

1 Introduction

Foreign direct investment (FDI) is usually viewed as a channel through which for technology is able to spread from developed countries to developing countries. This frequently leads to the following question: Does foreign direct investment (FDI) contribute to economic growth? The answer to this is uncertain. In the theoretical literature, the role of FDI is that of a carrier of foreign technology that can boost economic growth (Findlay (1978) and Romer (1993)). In the empirical studies on FDI, however, the evidence is still divided. Aitken and Harrison (1999), for instance, find that the net effect of FDI on productivity is quite small. Borensztein et al. (1998) and Carkovic and Levine (2005) also arrive at similar results by finding FDI does not have an unmitigated and positive effect on economic growth. On the other hand, Haddad and Harrsion (1993), Kokko et al. (1996), and Alfaro et al. (2004) point out that FDI can increase the rate of growth in the host economy through technology transfer.

Although the evidence on the relationship between FDI and economic growth is ambiguous, several studies argue that the host country's absorptive capacity plays an important role in explaining FDI. For instance, Blomström et al. (1994) state that FDI is positive and significant only for higher income countries and that it has no impact in lower income countries. Borensztein et al. (1998) point out that the contribution of FDI to economic growth is enhanced by its interaction with the level of human capital in the host country. Balasubramanyam et al. (1996) argue that FDI plays different role in the growth process due to the differing trade policy regimes. For these reasons, in this paper we choose three threshold variables which are the initial GDP, human capital and the volume of trade.

The main contribution of this paper is that it revisits the relationship between FDI and economic growth using threshold variables. We apply an instrumental variable estimation of an endogenous threshold model which as proposed by Caner and Hansen (2004). In their approach, the estimator for the threshold value involves a two-stage least squared (2SLS) and the estimates of the slope parameters are obtained using the generalized method of moments (GMM). Unlike previous studies, our paper resorts to endogenous threshold regression techniques rather than arbitrarily assuming cut-off values.

Using a cross-sectional survey of 62 countries over the 1975–2000 period, we find that FDI does not accelerate growth based on the least squares (LS) approach. Furthermore, in using the GMM method that takes endogeneity into consideration, FDI is not found to have a positive effect on growth. In threshold models, the results show that FDI can

influence growth to different degrees based on different threshold variables. In addition, FDI is found to have a positive and significant effect on economic growth when the host countries have higher level of initial GDP and human capital. Another important result is the convergence club. When the threshold variable is initial GDP, we find that the rich countries are becoming richer and the poor ones are becoming poorer.

The remainder of this paper is organized as follows. Section 2 lays out the IV regression model with the threshold that is proposed by Caner and Hansen (2004). Section 3 reports the data and the empirical findings. The conclusions are presented in Section 4.

2 Methodology

The pure cross-sectional analysis uses data averaged over 1975–2000. There is one observation per country. The basic regression takes the form:

$$y_i = \alpha F_i + \gamma X_i + u_i, \quad (1)$$

where y_i is the rate of growth, F_i equals FDI, and X_i presents a vector of conditional information set.

As is widely known that the effect of FDI on growth give rise to the possibility of both endogeneity and reverse causality of FDI, as a result of which both FDI and growth are simultaneously determined and FDI is correlated with the error term. We then apply the instrumental threshold regression proposed by Caner and Hansen (2004) to avoid the endogeneity problem and investigate the threshold effect of FDI on economic growth. Hence, equation (1) can take the following form:

$$y_i = (\alpha_1 F_i + \gamma_1 X_i)1(T_i \leq \tau) + (\alpha_2 F_i + \gamma_2 X_i)1(T_i > \tau) + u_i, \quad (2)$$

$$F_i = (\theta_1 W_i + \pi_1 X_i)1(T_i \leq \tau) + (\theta_2 W_i + \pi_2 X_i)1(T_i > \tau) + v_i, \quad (3)$$

where $1(\cdot)$ is the indicator function, T_i is the threshold variable and an element of the vector X_i , τ is the threshold parameter, W_i is a vector of instrumental variables and the order condition is satisfied.

We estimate the parameters sequentially. First, we estimate (3) using LS, by substituting the predicted values of the endogenous variable F_i into (2). Second, we estimate the threshold parameter, τ , using LS. Finally, we estimate the slopes using GMM on the split samples.

Table 1: Summary Statistics

	Mean	Std. Dev.	Maximum	Minimum
Growth	0.014	0.016	0.058	-0.022
FDI	0.018	0.016	0.083	-0.004
Initial GDP ²	7.884	1.432	10.150	5.368
Human capital ¹	1.827	0.475	2.540	0.434
Government consumption ²	-1.918	0.343	-1.100	-2.777
Black market premium ¹	0.185	0.306	1.555	-0.001
Inflation ¹	0.137	0.150	0.801	0.023
Trade volume ²	-0.546	0.527	0.579	-1.794

1. This variable is included as $\text{Ln}(1+\text{variable})$.

2. This variable is included as $\text{Ln}(\text{variable})$.

3 Empirical results

3.1 Data and Variables

This paper uses cross-sectional data for 62 countries over the period 1975–2000 to analyze the relationship between foreign direct investment (FDI) and economic growth. FDI (F_i) equals net FDI inflows as a share of GDP. The economic growth rate (y_i) equals the rate of real per capita GDP growth. We also control other determinants (X_i), namely, initial GDP, human capital, government consumption, black market premium, inflation, and the volume of trade. In order to deal with the endogenous problem, corruption, bureaucracy, the log of population, and institutional quality are used as instrumental variables (W_i) for FDI. A detailed description of all the variables is included in the Appendix.

Table 1 provides summary statistics for our sample. The mean of the per capita growth rate for the sample is 1.4 % and ranges from -2.2% for Sierra Leone to 5.7% for Korea. The mean of the FDI is 1.8% and ranges from -4.4% for Sierra Leone to 8.3% for Belgium.

3.2 Findings

Table 2 presents the results based on the LS and GMM methods. Each column of this table shows the results for a selection of the conditioning information, X_i , and adds the interaction terms into it. The interaction terms are $\text{FDI} \times (\text{initial GDP})$, $\text{FDI} \times (\text{human capital})$ and $\text{FDI} \times (\text{trade volume})$. Columns 2 to 4 show that the coefficients of FDI in these specifications are not statistically significant. If we ignore the problem of endogeneity in terms of the relationship between economic growth and FDI, FDI does not have a reliable impact on economic growth. We can find that the initial value of GDP is negative and

Table 2: Growth and FDI: the LS and GMM Regressions

	LS			GMM		
	(1)	(2)	(3)	(1)	(2)	(3)
FDI	0.521 (0.496)	0.614 (0.615)	0.072 (0.142)	-1.372 (2.308)	-0.941 (1.942)	2.027 (1.480)
Initial GDP	-0.005* (0.003)	-0.006* (0.002)	-0.006* (0.002)	-0.011* (0.005)	-0.008* (0.002)	-0.006 (0.010)
Human capital	0.029* (0.008)	0.032* (0.007)	0.029* (0.007)	0.040* (0.007)	0.031* (0.013)	0.015 (0.017)
Government consumption	-0.003 (0.005)	-0.004 (0.006)	-0.004 (0.006)	-0.004 (0.005)	-0.003 (0.006)	-0.003 (0.014)
Black market premium	-0.016* (0.006)	-0.016* (0.006)	-0.017* (0.006)	-0.012* (0.006)	-0.014* (0.005)	-0.005 (0.010)
Inflation	-0.022 (0.015)	-0.022* (0.013)	-0.017 (0.014)	-0.045* (0.020)	-0.042* (0.019)	-0.055 (0.042)
Trade volume	0.000 (0.004)	0.000 (0.005)	-0.002 (0.005)	0.004 (0.005)	0.003 (0.005)	-0.033 (0.025)
FDI \times Initial GDP	-0.051 (0.055)			0.161 (0.269)		
FDI \times Human capital		-0.260 (0.300)			0.460 (0.933)	
FDI \times Trade volume			0.221 (0.241)			-0.179 (0.936)

1. The instrumental variables are corruption, bureaucracy, the log of population, and institutional quality.

2. Standard errors are in parentheses. * indicates the estimates are significant at 5%.

statistically significant in this table. This finding points to conditional convergence, for it predicts a higher growth in response to a lower starting per capita GDP, and has an important influence on the growth rate (Barro and Sala-i-Martin (2003)). Human capital also has a significant impact with the expected sign, as explained in Borensztein et al. (1998). The black market premium is found to be significantly negative and hurts economic growth in all of the regressions.

Columns 6 to 9 of Table 2 report the results based on the GMM method that can avoid the endogeneity problem. We use corruption, bureaucracy, the log of population, and institutional quality as instruments. It is clear that FDI is not significantly linked with economic growth at all.

To further examine the contribution of FDI to economic growth, we analyze its relationship with different threshold variables and different regimes. Table 3 summarizes the results of the threshold regressions using Caner and Hansen (2004). Threshold values are estimated

Table 3: Growth and FDI: the Threshold Regressions

Threshold variable and value	Initial GDP	$\tau = 8.011$	Schooling	$\tau = 2.108$	Trade volume	$\tau = -0.813$
Observation	34	28	42	20	17	45
FDI	-6.386 (3.959)	13.820* (1.539)	2.642 (2.418)	8.416* (1.548)	2.473 (1.605)	0.962 (0.592)
Initial GDP	-0.015* (0.008)	0.025* (0.002)	-0.007* (0.003)	-0.020* (0.002)	-0.001 (0.002)	-0.008* (0.004)
Human capital	0.030* (0.007)	-0.022* (0.006)	0.042* (0.016)	0.061* (0.013)	-0.008 (0.007)	0.026* (0.010)
Government consumption	-0.004 (0.007)	0.003 (0.005)	-0.007 (0.008)	-0.005 (0.004)	0.021* (0.006)	-0.008 (0.006)
Black market premium	-0.011* (0.005)	-0.101* (0.029)	-0.010* (0.006)	-0.101 (0.067)	-0.007* (0.004)	-0.019 (0.015)
Inflation	-0.043* (0.022)	0.023* (0.012)	-0.040* (0.018)	-0.011 (0.028)	-0.018* (0.010)	-0.024 (0.045)
Trade volume	-0.013* (0.006)	0.003 (0.003)	-0.016* (0.005)	0.003 (0.002)	-0.030* (0.012)	-0.010 (0.021)
FDI \times Initial GDP	0.982* (0.572)	-1.462* (0.163)				
FDI \times Human capital			-1.192 (1.306)	-3.809* (0.689)		
FDI \times Trade volume					1.860 (1.243)	-0.298 (0.571)

1. See notes from Table 2.

using the 2SLS method and the coefficients are estimated using GMM. The instrumental variables are the same as for the GMM regression. The threshold value (τ) for initial GDP is 8.011, and there are 34 countries with values smaller and 28 countries with values larger than τ . For human capital, τ is 2.108 with 42 countries smaller than it and 20 countries larger than it. As for trade volume, τ is -0.813 with 17 countries smaller than it and other countries larger than it. Column 2 indicates that the direct effect of FDI for higher income countries is significantly positive and the same as the results of Blomström et al. (1994). Although the interaction term for higher income countries is both negative and significant, the direct effect of FDI is larger than the indirect effect. Therefore, local firms are advanced enough to learn from foreigners when the host country is a high income country. Another important finding concerns the initial GDP which has significantly different signs in different regimes. This means that there exist convergence clubs (for example, Quah (1997)). This points to a group of convergent economies and another group of divergent economies.

Columns 3 and 4 of Table 3 assess whether the level of human capital in the recipient country influences the relationship between FDI and economic growth. FDI is found to

significantly and positively enter countries with higher human capital countries. This result is the same as in Borensztein et al. (1998). They state that FDI has a positive growth effect once human capital is greater than average human capital. Besides, we can only find conditional convergence in this case and human capital can boost economic growth. Columns 5 and 6 assess whether the relationship between FDI and growth varies with the degree of the volume of trade. The coefficients for FDI and their interaction terms are not significant. We therefore cannot confirm the findings of Balasubramanyam et al. (1996) and Balasubramanyam et al. (1999) that FDI can promote economic growth in the presence of a liberal trade regime.

To sum up, we find that FDI alone plays an ambiguous role in contributing to economic growth when we use the LS and GMM regressions. Furthermore, we apply the threshold model proposed by Caner and Hansen (2004) to discuss the role of FDI for the different levels of threshold variables. The main result of this paper is that the effect of FDI on growth is dependent upon the extent of the host country's absorptive capacity. In particular, initial GDP and human capital are the most important factors for FDI. Apart from this, we find the convergence club using initial GDP as the threshold variable.

4 Conclusions

This paper examines the influence of FDI on economic growth using threshold variables that include the initial GDP, human capital, and volume of trade based a cross-sectional study of 62 countries covering the period 1975–2000. We adopt the instrumental variable estimation of a threshold regression approach developed by Caner and Hansen (2004). The empirical evidence suggests that there are conflicting effects of FDI. The results of the threshold regression show that FDI can promote economic growth when the host country has achieved a certain threshold of development, initial GDP and human capital. This is perhaps indicative of the recipient countries learning and/or benefiting from foreign investors. Thus, initial GDP and human capital are important factors for FDI that are consistent with Blomström et al. (1994), and Borensztein et al. (1998).

Appendices

The countries in the sample are listed in Table 4. The variables and sources are tabulated in Table 5.

Table 4: Countries in the sample

Argentina	Australia	Austria	Belgium	Bolivia	Brazil
Canada	Chile	Colombia	Costa Rica	Cyprus	Denmark
Dominican Republic	Ecuador	El Salvador	Finland	France	Germany
Ghana	Greece	Guatemala	Guyana	Haiti	Honduras
India	Ireland	Israel	Italy	Jamaica	Japan
Kenya	Korea	Malaysia	Malta	Mexico	Netherlands
New Zealand	Niger	Norway	Pakistan	Panama	Papua New Guinea
Paraguay	Peru	Philippines	Portugal	Senegal	Sierra Leone
South Africa	Spain	Sri Lanka	Sweden	Switzerland	Syria
Thailand	Togo	Trinidad and Tobago	United Kingdom	United States	Uruguay
Venezuela	Zimbabwe				

Table 5: Variables and sources

Variable	Definition	Source
Growth	The growth of real per capita GDP	World Bank (2007)
FDI	The net FDI inflows as a share of GDP	IFS
Initial GDP	The logarithm of real per capita GDP in the initial period	World Bank (2007)
Schooling	Human capital measured as the average years of secondary schooling for the overall population	World Bank (2007)
Government consumption	Total expenditure of central government as a share of GDP	World Bank (2007)
Black market premium	Ratio of black market exchange rate and official exchange rate minus one	World Bank (2007)
Inflation	Percentage changes in the consumption price index	IFS
Trade volume	Sum of exports and imports as a share of real GDP	World Bank (2007)
Corruption	Measure of corruption, with the scale readjusted to 0	Levine et al. (2000)
Bureaucracy	Average of three indices which are the efficiency of the judiciary system, red tape and corruption	Levine et al. (2000)
Log of population	The logarithm of the total population growth	World Bank (2007)
Institutional quality	The probability that the the government may expropriate private property	Alfaro et al. (2004)

References

- Aitken, B. J., and Harrison, A. E., 1999. Do domestic firms benefit from foreign direct investment? Evidence from Venezuela, *American Economic Review*, **89**, 605–618.
- Alfaro, L., Chanda, A., Kalemli-Ozcan, S., and Sayek, S., 2004. FDI and economic growth: The role of local financial markets, *Journal of International Economics*, **64**, 89–112.
- Balasubramanyam, V. N., Salisu, M., and Sapsford, D., 1996. Foreign direct investment and growth in EP and IS countries, *Economic Journal*, **106**, 92–105.
- Balasubramanyam, V. N., Salisu, M., and Sapsford, D., 1999. Foreign direct investment as an engine of growth, *Journal of International Trade and Economic Development*, **8**, 27–40.
- Barro, R. J., and Sala-i-Martin, X., 2003. *Economic growth*, 2nd, MIT Press.
- Blomström, M., Lipsey, R. E., and Zejan, M., 1994. What explains developing country growth? In Baumol, W., Nelson, R., and Wolff, E. (eds.), *Convergence and Productivity: Cross-National Studies and Historical Evidence*, 246–262, Oxford: Oxford University Press.
- Borensztein, E., De Gregorio, J., and Lee, J. W., 1998. How does foreign direct investment affect economic growth? *Journal of International Economics*, **45**, 115–135.
- Caner, M., and Hansen, B. E., 2004. Instrumental variable estimation of a threshold model, *Econometric Theory*, **20**, 813–843.
- Carkovic, M., and Levine, R., 2005. Does foreign direct investment accelerate economic growth? In Graham E. M., Moran, T. H., and Blomström, M.(eds.), *Does Foreign Direct Investment Promote Development: New Methods, Outcomes and Policy Approaches*, 195–220, Washington, D.C.: Institute for International Economics Press.
- Findlay, R., 1978. Relative backwardness, direct foreign investment and the transfer of technology: A simple dynamic model, *Quarterly Journal of Economics*, **92**, 1–16.
- Haddad, M., and Harrison, A., 1993. Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco, *Journal of Development Economics*, **42**, 51–74.

- Kokko, A., Tansini, R., and Zejan, M. C., 1996. Local technological capability and productivity spillovers from FDI in the Uruguayan manufacturing sector. *Journal of Development Studies*, **32**, 602–611.
- Levine, R., Loayza, N., and Beck, T., 2000. Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics*, **43**, 31–77.
- Quah, D. T., 1997. Empirics for growth and distribution: Stratification, polarization and convergence clubs, *Journal of Economic Growth*, **2**, 27–59.
- Romer, P., 1993. Idea gaps and object gaps in economic development, *Journal of Monetary Economics*, **32**, 543–573.
- World Bank, 2007. *World development indicators on CD-ROM*, The World Bank, Washington, DC.