

## **FOREIGN DIRECT INVESTMENT, PRODUCTIVITY SPILLOVERS AND LABOR QUALITY**

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### **—Abstract —**

This study investigates whether there are productivity spillovers stemming from Foreign Direct Investment (FDI) in developed and developing countries over the period 1984-2008. The study uses two productivity measures: labor and total factor productivity. The study employs panel cointegration and panel estimation methods. The panel cointegration test results indicate that there are long-run relations between FDI and productivity variables. The study's main findings reveal that FDI triggers labor productivity in a significant way. However, in use of the total factor productivity variable, the effect of FDI on productivity is found too limited. Moreover, the magnitudes of the FDI effect on productivity differ remarkably across developed and developing countries. The findings also testify that the effects of FDI on productivity are higher in countries with high quality of labor force, which is measured by the labor quality index of Bonthuis (2010).

**Key Words:** *Foreign Direct Investment, Productivity Spillovers, Labor Quality, Panel Data*

**JEL Classification:** C33, F21, F43

### **1. INTRODUCTION**

FDI has been increasingly seen as an important stimulus for productivity and economic growth both for developed and developing countries. According to OECD, "FDI triggers technology spillovers, assists human capital formation, contributes to international trade integration, helps create a more competitive business environment, and enhances enterprise development" (OECD, 2002: 5). According to the Solow economic growth model, the capital stock of a country enlarges due to FDI inflows, henceforth this country would experience economic growth in the short run, which is known as the capital widening. On the other

hand, endogenous growth models add a further dimension that the latest technology and managerial skills in developed countries can be transferred to all countries via FDI that would trigger productivity and economic growth in host countries, which is defined as the capital deepening. In a nutshell, economic theory predicts that FDI triggers productivity and economic growth by different channels.

This study aims to investigate the prediction of economic theory by focusing on the impacts of FDI on productivity spillovers in developed and developing countries. The empirical findings in the literature are non-uniform about the impacts of FDI on productivity spillovers in different countries (Johnson, 2006: 3). The findings also point out that the impacts of FDI might differ notably across developed and developing countries that have different economic and institutional structures. Therefore, this subject needs to be analyzed with different models and samples to gain further insights.

The study mainly uses panel data approach in analyzing the impacts of FDI on productivity and differs from other studies in three respects. First of all, the study has two sample country groups: developed and developing countries. Therefore, it is clarified whether the impacts of FDI differ remarkably between developed and developing country groups. Secondly, the study uses the *labor quality index* as an absorption capacity variable, which is constructed by Bonthuis (2010). Thirdly, the study employs two productivity measures namely *labor productivity* and *total factor productivity* in the analysis, which increases the robustness of the analysis.

## **2. LITERATURE REVIEW**

This section presents some selected empirical studies on the impacts of FDI in which authors used similar methods and variables to our study.

Johnson (2006) examines whether FDI has a positive effect on economic growth by fostering technology spillovers and physical capital accumulation. He uses a panel dataset comprising 90 developed and developing countries over 1980-2002. He finds out that FDI enhances economic growth in developing economies but not in developed economies (Johnson, 2006: 43). Lee (2009) examines the long-run productivity convergence for a sample of 25 countries over 1975-2004 by using panel unit-root procedures with a special attention to trade and FDI links. He concludes that as FDI takes place it triggers productivity in host countries.

Hansen and Rand (2006) search for cointegration and causality relation between FDI, productivity and growth in a sample of 31 developing countries for the period 1970-2000 in which they confirm the existence of cointegration. The

results indicate that FDI has a lasting positive impact on GDP irrespective of level of development. Cecchini and Lai-Tong (2008) examine the links between trade, FDI, and total factor productivity by using a panel of seven Mediterranean countries over 1980-2000. They conclude that the beneficial effects of FDI on productivity exist but bounded by several factors, such as the degree of openness to international trade and the education level of the human capital of host countries.

There are also recent country-level studies that investigate the relation between FDI, productivity, and economic growth. For instance, Ma (2009) examines to what extent FDI triggered the growth rate of China by using data from 1985 to 2008. He estimates a positive and significant coefficient for the FDI explanatory variable. Even though the growth impact seems to be significant for China, the impact of FDI on productivity is found limited and sector-specific by several studies such as Sjöholm (2008) and Buckley et al. (2006). In addition, Sasidharan (2006) reaches a similar conclusion by using the Indian manufacturing sector data that FDI does not generate any significant technology spillovers effect in India.

### **3. THEORETICAL BACKGROUND AND EMPIRICAL MODELS**

#### **3.1 The Impacts of FDI on Productivity: Capital Deepening**

The impact of FDI on productivity is known as the capital deepening which implies the transfer of knowledge and technology together with FDI into a host economy. It is supposed that TNE (transnational enterprises) do not only bring physical capital into a host economy, but also they transfer the technology and managerial skills since they want to maximize their profits.

The neoclassical growth model of Solow (1956) assumes that capital falls into diminishing returns thereby the long-run growth rate equals to the growth rate of technology. The AK growth model of Frankel (1962) and Romer (1986) is known as the first wave of endogenous growth models. The proponents of the AK growth model assume that during the capital accumulation, *externalities* may help capital from falling into diminishing returns. In here, externalities are created by the *learning-by-doing* argument of Arrow (1962) and the knowledge spillovers effect. According to the AK model, as a country continues to attract FDI not only its capital stock enlarges (capital widening) but also productivity increases.

The product variety model of Romer (1990) argues that productivity growth comes from an expanding *variety* of specialized intermediate products (Aghion &

Howitt, 2009: 69).<sup>1</sup> Thus, it is expected that FDI induces economy-wide productivity and economic growth by expanding the variety of intermediate products.

The Schumpeterian model of Aghion and Howitt (1992) constitutes the second wave of endogenous growth models together with the product variety model of Romer (1990). A country would transfer the innovative technology with FDI inflows and the new quality improving mechanisms that would give rise to productivity and economic growth.

### 3.2 Empirical Models

Models 1 and 2 use the *labor productivity* as the dependent variable; employ FDI and labor quality (absorption capacity) as the independent ones. Model 3 and 4 employ the total factor productivity as the dependent variable instead of the labor productivity; use FDI and labor quality (absorption capacity) as the independent variables.

$$\log (LP_{i,t}) = \beta_0 + \beta_1 \log (FDI_{i,t}) + \text{error term} \quad (\text{Model 1})$$

$$\log (LP_{i,t}) = \beta_0 + \beta_1 \log (FDI_{i,t}) + \beta_2 \log (LQ_{i,t}) + \text{error term} \quad (\text{Model 2})$$

$$\log (TFP_{i,t}) = \beta_0 + \beta_1 \log (FDI_{i,t}) + \text{error term} \quad (\text{Model 3})$$

$$\log (TFP_{i,t}) = \beta_0 + \beta_1 \log (FDI_{i,t}) + \beta_2 \log (LQ_{i,t}) + \text{error term} \quad (\text{Model 4})$$

**FDI** : Value of inward stock of foreign direct investment  
 in country *i*, as % of GDP

**LQ** : The level of labor quality index

**LP** : The level of labor productivity

**TFP** : The level of total factor productivity

**i** : Ten developed and ten developing countries

**t** : 1984-2008

### 4. DATA

We collected the data of “inward FDI stock as a percentage of GDP” for FDI variable from the UNCTAD-FDI database. The labor quality data come from the Conference Board-Total Economy Database. Originally, the labor quality index is constructed by Bonthuis (2010), who uses the educational attainment as the key variable for labor quality with attaining special importance to cross-country

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<sup>1</sup> For example, Broda et al. (2006) show that international trade increases TFP levels on average 10% by applying the Romer model to a panel dataset of 73 countries over the period 1994-2003.

differences. The data for labor and total productivity are derived from the Conference Board-Total Economy Database, which are in 1990 US\$ (converted at Geary Khamis PPPs).<sup>2</sup>

The sample countries are chosen according to their classifications in UNDP Human Development Report (2009). Table 1 presents the sample countries.

**Table 1. Sample Groups**

<b>G1 (Developing countries)</b>	<b>G2 (Developed Countries)</b>
1. Brazil	1. Austria
2. China	2. Denmark
3. Colombia	3. France
4. Egypt	4. Italy
5. India	5. Japan
6. Mexico	6. Netherlands
7. South Africa	7. Sweden
8. Thailand	8. Switzerland
9. Turkey	9. UK
10. Uruguay	10. USA

## **5. METHODS AND ESTIMATION RESULTS**

### **5.1 Panel Unit Root Tests and Panel Cointegration Tests**

We use the IPS (Im-Peseran-Shin) and the Breitung unit root tests to test the null of non-stationary series. The results show that all series are integrated of order one that we can search for panel cointegration. The Johansen-Fisher panel cointegration test results confirm that there are long-run relations among the series used in four models (Johansen, 1988).

### **5.2 Estimation Results**

We run our models by using the panel OLS estimation method with fixed effects.

**Table 2. Estimation Results of Models 1 and 2**

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<sup>2</sup> See the discussion on total factor productivity and labor productivity in Tica and Druzic (2006: 11), Comin (2008: 1), Sargent and Rodriguez (2000), and Lee (2009).

Dependent: log (LP)	Model 1		Model 2	
	G1	G2	G1	G2
Intercept	<b>8.7979</b> (0.0000)	<b>10.2890</b> (0.0000)	<b>0.8164</b> (0.0023)	<b>3.1523</b> (0.0000)
log (FDI)	<b>0.2165</b> (0.0000)	<b>0.1479</b> (0.0000)	<b>0.1386</b> (0.0000)	<b>0.0731</b> (0.0000)
log (LQ)			<b>1.7464</b> (0.0000)	<b>1.5693</b> (0.0000)
Adjusted R-sq.	0.9063	0.8927	0.9176	0.9191

Notes: (1) **Bold numbers** are significant at 5% significance level. (2) Probabilities are in parentheses. (3) G1: Developing countries sample and G2: Developed countries sample.

Table 2 documents the estimation results of models 1 and 2 in which the dependent variable is log (LP). The coefficient of log (FDI) is estimated as positive and significant for both samples, as expected. It is 0.21 for developing and 0.14 for developed countries, which are significant at 5% level. Thus, a 1 percent rise in FDI stock/GDP ratio increases labor productivity by 0.21 percent in developing and by 0.14 percent in developed countries. This finding is consistent with the prediction of the economic growth theory and the convergence phenomenon. Although developing countries conduct relatively less research and developed activities, they have a bigger coefficient for log (FDI) variable, as predicted. Developing countries have a larger room to imitate the technology transferred via FDI because of the nature of the *horizontal* FDI. In addition, developing countries might partly imitate the transferred technology *illegally* due to the existence of weak property-rights. Hence, FDI might trigger labor productivity in developing countries to a higher extent. Briefly, positive and significant coefficient for log (FDI) variable for the samples of developed and developing countries confirms the existence of a *capital deepening* effect.

In model 2, the labor quality variable is added into model 1. The coefficient of log (LQ) is estimated as positive and significant at 5% level, which is 1.74 for developing and 1.56 for developed countries. In other words, the labor quality spurs labor productivity in a significant way. Thus, the importance of absorption capacity variable has been verified in both samples of developed and developing countries.

**Table 3. Estimation Results of Models 3 and 4**

Dependent: log (TFP)	Model 3		Model 4	
	G1	G2	G1	G2
Intercept	<b>4.5101</b> ( <b>0.0000</b> )	<b>4.6069</b> ( <b>0.0000</b> )	<b>3.3791</b> ( <b>0.0173</b> )	<b>1.6031</b> ( <b>0.0008</b> )
log (FDI)	0.0071 (0.3946)	<b>0.0365</b> ( <b>0.0000</b> )	-0.0290 (0.0959)	0.0050 (0.3682)
log (LQ)			0.2599 (0.3864)	<b>0.6604</b> ( <b>0.0000</b> )
Adjusted R-sq.	0.7598	0.8092	0.7673	0.8285

**Notes:** (1) **Bold numbers** are significant at 5% significance level. (2) Probabilities are in parentheses. (3) G1: Developing countries sample and G2: Developed countries sample.

Table 3 documents the estimation results of models 3 and 4 in which the dependent variable is log (TFP). In model 3, the coefficient of log (FDI) is estimated as 0.0071 and it is insignificant at 5% level for the sample of developing countries. This result is against our prediction. On the other hand, it is estimated as 0.0365 for the sample of developed countries, which is significant at 5% level. Thus, a 1 percent rise in FDI stock/GDP ratio increases total factor productivity by 0.03 percent in developed countries. Hence, one can conclude that log (FDI) does not significantly trigger total factor productivity in developing countries but weakly in developed countries. This conclusion might be explained by several econometric and economic factors:

- a) Sample-selection bias and country-heterogeneity in the sample of developing countries might lead to insignificant result for the coefficient log (FDI) in model 3.
- b) Miscalculation of total factor productivity data might also lead to insignificant result for the coefficient of log (FDI) in model 3. As it is known, calculation of TFP requires both the correctly estimated data of *capital* and *labor stock* of a country (Sargent & Rodriguez, 2000: 43).
- c) Several authors have found that the productivity impact of FDI is not significant in developing countries, such as in China and India (e.g. Sjöholm, 2008; Buckley et al., 2006; Sasidharan, 2006).

Model 4 adds the labor quality variable into model 3. According to the estimation results, the coefficient of log (LQ) is estimated as 0.25 and it is insignificant at 5% level for developing countries. Nevertheless, for developed countries, it is found as 0.66, which is significant at 5% level. The coefficient of log (FDI) is also estimated as insignificant at 5% level for both samples. Aforementioned poor TFP data quality discussion for developing countries might also be used in here to explain the positive but insignificant coefficient of log (LQ). Because, in model 2

we have found that labor quality significantly enhances labor productivity in developed and developing countries.

## 6. CONCLUSIONS

The study's major findings pinpoint several important results:

- Although long-run relations are found between “log (LP) and log (FDI)”, and “log (TFP) and log (FDI)” variables, the positive impact of FDI on productivity is only partly verified. By using labor productivity as the dependent variable, FDI enhances productivity in both developed and developing countries. In use of total factor productivity as the dependent variable, the positive and statistically significant impact of FDI on productivity is only found for the sample of developed countries, in model 3.
- The magnitudes of productivity impacts of FDI are limited that reflect the capital deepening effect.
- The labor quality (absorption capacity) is found as a significant factor in fostering productivity measures in developed and developing countries along with FDI.

The possible implications of these major findings can be summarized as follows:

- Attracting FDI is the half of the way whereas internalization and adoption of new working techniques is the other half for creating the productivity and economic growth impacts of FDI. Presumably, internalization and adoption of new working techniques gathered with FDI can be transferred with better educated labor force, which ultimately helps triggering economy-wide productivity and economic growth to a higher extent and in a short time. Thus, policies aiming to improve labor quality shall be the integral part of pro-FDI policies both for developed and developing countries.
- The finding of the limited impact of FDI on total factor productivity suggests that the contribution of foreigners to productivity of a country can be important but not as important as the contribution of research and development activities conducted domestically.

To sum up, the study's main findings show that FDI triggers (labor) productivity in a positive way. Nonetheless, the magnitudes of these impacts differ remarkably across developed and developing countries. Moreover, the findings strongly suggest that the impacts of FDI on productivity can be improved with high labor quality.

## BIBLIOGRAPHY

- Aghion Philippe and Howitt Peter (1992), "A Model of Growth through Creative Destruction", *Econometrica*, Vol. 60, No. 2, pp. 323-351.
- Aghion Philippe and Howitt Peter (2009), *The Economics of Growth*, London: MIT Press.
- Arrow, Kenneth J. (1962), "The Economic Implications of Learning by Doing", *Review of Economic Studies*, Vol. 29, No. 3, pp. 155-173.
- Bonthuis Boele (2010), "Measuring Labour Quality", *University of Groningen Working Paper*.
- Broda Christian, Greenfield Joshua and Weinstein David (2006), "From Groundnuts to Globalization: A Structural Estimate of Trade and Growth", *NBER Working Paper, No. 12512*.
- Buckley Peter, Clegg Jeremy and Wang Chengqi (2006), "Inward FDI and Host Country Productivity: Evidence from China's Electronics Industry", *Transnational Corporations*, Vol.15, No.1, pp.13-37.
- Cecchini Laurence and Lai-Tong Charles (2008), "The Links Between Openness and Productivity in Mediterranean Countries", *Applied Economics*, Vo. 40, No.6, pp. 685-697.
- Comin, Diego A. (2008), *Total Factor Productivity*, The New Palgrave Dictionary of Economics.
- Johansen Soren (1988), "Statistical Analysis of Cointegration Vectors" *Journal of Economic Dynamics and Control*, Vol.12, pp. 231-254.
- Johnson Andreas (2006), "The Effects of FDI Inflows on Host Country Economic Growth", *CESIS Electronic Working Paper Series 58*.
- Lee Jaehwa (2009), "Trade, FDI, and Productivity Convergence: A Dynamic Panel Data Approach in 25 Countries", *Japan and the World Economy*, Vol. 21, pp. 226-238.
- Ma Xiaohong (2009), "An Empirical Analysis on the Impact of FDI on China's Economic Growth", *International Journal of Business and Management*, Vol. 4, No.6, pp. 76-80.
- Romer Paul (1986), "Increasing Returns and Long-Run Growth", *Journal of Political Economy*, Vol. 94, No.5, pp. 1002-1037.

Romer Paul (1990), "Endogenous Technological Change", *Journal of Political Economy*, Vol. 98, No.5, pp. 71-102.

Sargent Timothy C. and Rodriguez Edgard. R. (2000), "Labour or Total Factor Productivity: Do We Need to Choose?", *International Productivity Monitor*, Vol. 1, pp. 41-44.

Sasidharan Subash (2006), "Foreign Direct Investment and Technology Spillovers: Evidence from the Indian Manufacturing Sector", *SSRN Working Paper 881528*.

Sjöholm Fredrik (2008), "The Effect of FDI on Employment and Technology in China", *IFN Working Paper*.

Solow, Robert. M. (1956), "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, Vol. 70, No.1, pp. 65-94.

Tica Josip and Druzic Ivo (2006), "The Harrod-Balassa-Samuelson Effect: A Survey of Empirical Evidence", *University of Zagreb, Working Paper Series No. 06-7/686*.

UNDP (2009), *Human Development Report 2009: Overcoming barriers: Human Mobility and Development*, New York and Geneva.