International Journal of Business and Economics, 2014, Vol. 13, No. 2, 181-185

A PVAR Approach to the Modeling of FDI and Spill Overs Effects in Africa

Sheereen Fauzel[*]
Department of Finance & Accounting, University of Mauritius, Mauritius

Boopen Seetanah
Department of Finance & Accounting, University of Mauritius, Mauritius

R. V. Sannassee
Department of Finance & Accounting, University of Mauritius, Mauritius

1. Introduction

Foreign direct investment (FDI) has acquired considerable importance as a tool for the economic development of host countries and for accelerating their growth. As such, inward FDI boosts aggregate investment and the level of economic activity, thereby giving positive signals as to the soundness of the host economy. In addition, FDI has numerous benefits which include employment creation, improved productivity, enhanced exports, and technological and knowledge transfers. The significance of FDI lies in its primary difference with other forms of capital investment. In fact, empirical evidence suggests that FDI flows are relatively less volatile as compared to other capital flows (IMF, World Economic Outlook, 2007). Hence, it entails a longer duration of commitment (Barrell and Holland, 2000). Moreover, evidence suggests that, given specific country prerequisites, FDI indeed results in better growth outcomes (Borensztein et al., 1995; Alfaro, 2004).

Unsurprisingly sub-Saharan African countries have also laid a lot of emphasis on devising measures to attract FDI since the latter is often regarded as a source of economic prosperity above all other potential benefits. However, although the literature is fraught with studies analyzing the impact of FDI and technology transfer at the micro level, it could be argued that only few studies, such as Woo (2009), so far investigated the relationship between FDI inflows and productivity growth at the macro level. In this regard, this paper attempts to fill this gap and add to literature by investigating the extent to which FDI contributes towards total factor productivity for the case of sub-Saharan African countries.[1] The paper innovatively uses a dynamic vector autoregressive model (PVAR) to carry out the analysis; as such, a framework which encapsulates the dynamic behavior of our hypothesized link in a panel setting, while simultaneously accounting for endogeneity and causality issues.

[*]Correspondence to: Department of Finance & Accounting, University of Mauritius, Room No 2.29A, Reduit, Mauritius. E-mail: s.fauzel@uom.ac.mu.

Any feedback and indirect effects which might be present will also be detected within the PVAR.

2. Model Specification and Data Analysis

Based on the principles of some earlier studies (Caves, 1974; Globerman, 1979; Blomstrom and Sjoholm, 1999), the following functional form applies to the "productivity spillover model" used in this research. However, because of the variance stabilizing properties of log transformation, the log values of the variables are used:

$$L\ TFP = \alpha_0 + \beta_1 LFDI_{xt} + \beta_2 L\ TG_{xt} + \beta_3 LOPNS_{xt} + \beta_4 LHC_{xt} + \beta_5 LCPI_{xt} + \mu_{xt}. \quad (1)$$

Table 1. Variables Definition and Sources

Variables	Definition	Related Literature	Sources
TFP	Total factor productivity	Hee Ng (2007)	UNIDO World Productivity dataset
FDI	Foreign direct investment- Ratio of FDI to real GDP	Baltabaev (2014)	World Bank database
HC	Human capital- Secondary enrollment ratio	Borensztein et al., 1998	World Bank database
TG	Technological gap- The difference between the GDP of a particular country and the average GDP of all remaining countries in the sample	Iyer et al., 2006, Sjoholm, 1999, and Castellani and Zanfei, 2003 indicating the use of TG in their studies	***GDP***- the National Accounts Main Aggregates Database of the United Nations
OPNS	Openness- The ratio of exports plus imports to GDP	Loko et al. (2009)	World Bank database
CPI	Consumer price index	Baltabaev (2014)	World Bank database

Using the Im et al. (2003) panel unit root test, we found that the series follows an I(1) process. We estimated the coefficients of the system given in (1), and Table 2 reports the results of the model.

3. Analysis of Findings

Table 2 is a composite table where each equation can be viewed and analysed as an independent function. For instance, of primary interest is row 1, which is the TFPG equation. The coefficient of FDI is positive and significant. This suggests that FDI inflow has had a positive and significant effect on TFPG for our sample of sub-Saharan African countries over the years of the study. In particular, a 1% increase in FDI contributed to 0.12% increase in productivity. Our results support empirical findings of Li and Liu (2005) and Woo (2009), which reveal positive and significant effects from FDI on income and productivity, respectively. Channels through which such productivity spillovers occur include the demonstration effect, the competition

effect, and vertical linkages. However, the results are in contrast with the findings of Alfaro et al. (2004) and Azman-Saini et al. (2010). The variable TG is also of interest to us. For instance, we note that the coefficient for TG is positive and significant. This implies that, apart from the direct TFP enhancing effect of FDI, TFP can further increase in countries with a larger TG. This finding is in line with Kokko (1994), who was the first to study the influence of TG between local firms and multi-national corporations (MNCs). Thus the estimated coefficient supports the proposition that countries lagging far behind the technology frontier of MNCs benefit more from FDI in terms of spillovers. Theory further hypothesises that the degree of openness of the economy will have positive effect on productivity. Referring to the OPNS variable, we observed a significant and positive coefficient. This implies that countries with more liberal trade policies, and thus more open, will result in an increase in productivity. This result supports Lai et al. (2006). Also, we note that inflation has a negative impact on TFPG. This result is in line with Baltabaev (2014). In the present study, however, we obtain negative but insignificant results for HC.

Table 2. Results from the VAR Model[2]

Response to → / **Response of** ↓	**Constant**	**tfp_{t-1}**	**fdi_{t-1}**	**hc_{t-1}**	**$Opens_{t-1}$**	**cpi_{t-1}**	**tg_{t-1}**
tfp	0.51	0.98***	0.12**	−0.39	0.17*	−0.02**	0.008*
fdi	−1.82	0.25*	0.60***	0.51*	0.29*	−0.02*	1.35*
hc	0.21*	0.06**	0.01	0.91***	−0.06	0.004	0.12
opens	0.42*	0.12*	0.01*	0.014	0.87***	−0.01	−0.11
cpi	4.16	4.64***	0.04	−3.82**	0.68	0.45***	−1.14
tg	0.13	0.07	−0.01	0.11	0.19*	0.03	1.06***
No of Obs	424						
No. of Countries	17						

The VAR framework enables us to gauge more interesting insights on endogeneity issues and indirect effects as well. Referring to the FDI equation, it is observed that a reverse causation exists, and productivity appears to be also a determinant of FDI. This implies that the productivity level of countries plays an important role in attracting FDI, thus supporting a bi-causal and reinforcing

relationship between TFP and FDI. Also, FDI as a dependent variable is highly influenced by all the other control variables. Consequently, it is observed, in terms of magnitude, that past values of FDI, HC, OPNS, and TG are all important determinants of FDI. The impulse response analysis also tends to confirm the above results in general.

4. Conclusion

While most studies on FDI spillovers use firm-level data, this study uses macro-level data to try to capture the spillover effects outside the industry. Rigorous panel VAR procedures were employed mainly to examine this complex linkage between FDI and TFP over the years 1980–2010. By measuring FDI as the stock of FDI in real GDP and the dependent variable as TFP, we find support for FDI as an important factor in the TFPG model as evidenced by the positive and significant effect. The other control variables used in the study, such as OPNS and TG, also positively contribute to TFPG in the sample of economies under study. As expected, inflation is seen to negatively influence productivity. Results from the analysis indicated the presence of a bi-directional causality between total factor productivity growth and foreign direct investment. The PVAR approach has also enabled us to conclude that human capital, openness, total factor productivity, and a high technology gap are all together important determinants of foreign direct investment for the sample of countries used.

Notes

1. Angola, Benin, Botswana, Chad, Congo, Ghana, Madagascar, Mozambique, Malawi, Mauritius, Senegal, Nigeria, Seychelles, Togo, Uganda, Zambia, and Zimbabwe.
2. The lowercase variables are the natural log of the respective uppercase variables.

References

Alfaro, L. and A. Rodriguez-Clare, (2004), "Multinationals and Linkages: Evidence from Latin America," *Economia*, 4, 113-170.

Azman-Saini, W. N. W., A. Z. Baharumshah, and S. H. Law, (2010), "Foreign Direct Investment, Economic Freedom and Economic Growth: International Evidence," *Economic Modelling*, 27(5), 1079-1089.

Baltabaev, B., (2014), "Foreign Direct Investment and Total Factor Productivity Growth: New Macro-Evidence," *The World Economy*, 37(2), 311-334.

Barrell, R. and D. Holland, (2000), "Foreign Direct Investment and Enterprise Restructuring in Central Europe," *Economics of Transition*, 8(2), 477-504.

Blomström, M. and F. Sjöholm, (1999), "Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter?" *European Economic Review*, 43(4-6), 915-923.

Borensztein, E. J., J. De Gregorio, and J. W. Lee, (1998), "How Does Foreign Direct

Investment Affect Economic Growth?" *Journal of International Economics*, 45 (1), 115-135.

Caves, R., (1974), "Multinational Firms, Competition, and Productivity in Host-Country Markets," *Economica*, 41(162), 176-193.

Globerman, S., (1979), "Foreign Direct Investment and 'Spillover' Efficiency Benefits in Canadian Manufacturing Industries," *Canadian Journal of Economics*, 12(1), 42-56.

Im, K. S., M. H. Pesaran, and Y. Shin, (2003), "Testing for Unit Roots in Heterogeneous Panels," *Journal of Econometrics*, 115(1), 53-74.

Kokko, A., (1996), "Productivity Spillovers from Competition between Local Firms and Foreign Affiliates," *Journal of International Development*, 8(4), 517-530.

Li, X. and X. Liu, (2005), "Foreign Direct Investment and Economic Growth: An Increasingly Endogenous Relationship," *World Development*, 33(3), 393-407.

Woo, J., (2009), "Productivity Growth and Technological Diffusion through Foreign Direct Investment," *Economic Inquiry*, 47(2), 226-248.

Yang, X. and M. Lai, (2006), "FDI and Technology Spillovers: Theoretical and Empirical Research on the Role of Financial Development," *Journal of Quantitative and Technical Economics*, 23(6), 72-81.