Economics Bulletin

Volume 38, Issue 3

Assessing the relationship between total factor productivity and foreign direct investment in an economy with a skills shortage: the case of South Africa

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Abstract

This paper assesses the relationship between total factor productivity (TFP) and foreign direct investment (FDI) in a country with skills shortage. South Africa is used as a case study. Literature is inconclusive on how FDI should affect TFP. This paper shows that it is important to account for the interactivity between FDI and human capital when assessing the effects of FDI on TFP. Moreover, the empirical results show that, contrary to countries with abundance of skills, in countries with skills shortage, it is in fact the change in stock of human capital - or human capital accumulation – that matters in determining the effects of FDI on TFP.

Citation: Lumengo Bonga-bonga and Maphelane Phume, (2018) "Assessing the relationship between total factor productivity and foreign direct investment in an economy with a skills shortage: the case of South Africa", *Economics Bulletin*, Volume 38, Issue 3, pages 1395-1405
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Submitted: December 13, 2017. **Published:** July 18, 2018.

1. Introduction

Economic growth is widely considered as a primary objective of economic policy. Several studies have shown that economic growth is a prerequisite for countries to attain economic development, income redistribution, poverty reduction and full employment (See, for example, Bean and Pissarides 1993; Eriksson 1997). The primacy of economic growth has spawned a plethora of economic models attempting to explain its drivers. The Solow (1956) growth model, commonly referred to as the exogenous growth model, outlines a theoretical growth model that suggests that the accumulation of factors of production and technological changes are the main drivers of economic growth. Moreover, in the Solow growth model, the accumulation of factors of production is subject to diminishing marginal returns and therefore reaches a steady state. In the long term, according to Solow, factors of production cannot sustain economic growth. However, technological changes, or total factor productivity (TFP), which does not embed the diminishing marginal returns characteristic, is generally considered as the main and sustained driver of long-term economic growth (See, for example, Mankiw, Romer and Weil 1992; Solow 1957).

Another important growth theory is the endogenous growth theory. In this theory, TFP is endogenously determined within the economic system and human capital, amongst other variables, and is an important determinant of TFP. Human capital refers to the stock of knowledge, creativity and experience that subsists in labour and in entrepreneurs (See, for example, Romer 1986). Assessing whether TFP is exogenous or endogenously determined is a matter for empirical analysis.

While many studies in growth literature focus on determining the drivers of TFP, and make the assumption that it is in fact endogenously determined, very few studies endeavour to investigate whether TFP is in fact endogenously, or exogenously, determined. For example, Paquet and Robidoux (2001) use an ordinary least squares (OLS) regression technique to conclude the exogeneity of TFP in Canada. On the other hand, an endogeneity test in Liu and Wang (2003) concluded that TFP is in fact endogenously determined in the Chinese economic system. On balance, most studies support the endogeneity of TFP (See, for example, Caves 1974; Germidis 1977; Haddad and Harrison 1993; Kokko 1994; Miller and Upadhyay 2000; Xu 2000; Yannikkaya 2003).

The literature foregrounds the importance of foreign direct investment among other variables, to assess the determinants of TFP (See, for example, Miller and Upadhyay 2000; Yannikkaya 2003). For example, Kokko (1994) shows that FDI may create a channel for technological spillovers and knowledge transfers from foreign producers operating domestically to local producers, thus improving domestic TFP. However, empirical studies regarding the effects of FDI on TFP struggle to find consensus on how FDI affects TFP. Caves (1974), Kokko (1994), and Xu (2000) show that FDI positively affects TFP growth, whereas Germidis (1977), and Haddad and Harrison (1991), inter alia, show no spillovers between FDI and productivity. Other studies, such as Aitken and Harrison (1999), and Haddad and Harrison (1993), show a negative relationship between FDI and TFP growth.

A number of studies show that the availability of skilled labour or human capital in the economy plays an important role on determining how FDI affects TFP (See, for example, Aitken and Harrison 1999; Germidis 1977, inter alia). In fact, studies demonstrate the importance of the interaction between FDI and human capital in determining the effect of FDI on TFP. For example, Blomström and Kokko (2003) show that the spillover effects from FDI into host countries is constrained by the stock of human capital. Liu (2008) makes use of the endogenous growth framework to show how FDI generates externalities in the form of technology transfer necessary for economic growth. Liu shows that the spillover effect can work in the opposite direction and depends on the amount of resources devoted to human capital development in a specific economy.

In light of the uncertainty over how FDI affects TFP, this paper contributes to the literature on the determinants of TFP, by showing that it is in fact the interaction between human capital accumulation and FDI that determines how FDI transmutes to technological change in an economy with a skills shortage, such as South Africa. Studies have emphasised the interaction between FDI and the stock of human capital in determining the link between FDI and TFP (See, for example, Alfaro et al. 2009; Kokko 1996). However, this paper demonstrates that in economies with skill shortage, it is in fact the change in stock of human capital – human capital accumulation – that determines the threshold effect of FDI on TFP. In fact, this paper shows that it is the extent of the growth of human capital that determines how FDI affects TFP, in a country characterised by a skills shortage.

This paper also assesses whether TFP is endogenous or exogenous in South Africa. The assessment is conducted in order to investigate whether technological change is acquired or intrinsic to an economy with a skills shortage, such as the one in South Africa. Many studies allude to the fact that technology is transferred from developed to emerging or developing economies, rendering technological change exogenous in these economies (See, for example, De la Potterie and Lichtenberg 2001).

South Africa experiences a serious shortage of skilled labour. This shortage impacts negatively on the country's economic growth prospects and severely affects the country's socioeconomic and development goals. The shortage has been largely attributed to the poor quality of education and the failure of the training system to supply the economy with much-needed skills (See, for example, Allais 2012; Rasool and Botha 2011). While a number of studies make reference to the Chinese experience that shows that attracting FDI is an effective way of advancing technological change to host countries (Liu and Wang 2003), this paper shows that the effect of FDI on technological change or TFP, is constrained by the capacity for growth in the rate of human capital development in an economy with a shortage of skills.

This paper conducts the empirical analysis on the relationship between FDI and TFP by means of the cointegrated VAR model, which makes use of interaction variables to identify the threshold at which the effects of FDI on TFP changes. This paper demonstrates that FDI positively affects TFP in South Africa when human capital accumulates at an annual growth rate above 2.5%. Otherwise, the effects of FDI on TFP are negative.

A brief outline of the methodology and presentation of the data used and results obtained is presented next, followed by a considered conclusion and pointers for further study.

2. Methodology, data and discussion of results

In order to assess the determinants of TFP and uncover the effects of FDI on TFP, this paper makes use of the cointegrated VAR model (see, for example, Hansen and Johansen 1999). Following the literature on the determination of TFP (See, for example, Liu 2008; Romer 1997), the data used in the econometric analysis comprises the total factor productivity (TFP), the net foreign direct investment per GDP (FDI), human capital accumulation (DHC) and trade openness (OPEN)[1]. All the variables are in natural logarithm, except FDI, as the variable represents the net foreign direct investment and contains negative values. All the variables are obtained from the Penn World Table version 9 (PWT9). To maintain robustness, in addition to the TFP obtained from the PWT9, the TFP was estimated as a residual of the Cobb Douglas function, using growth accounting. Figure 1 shows that the TFP obtained from the PWT9 database (TFP) co-trend with the one obtained from the growth accounting procedure (TFP-GA).

Figure 1 The trend of TFP and TFP-GA for South Africa

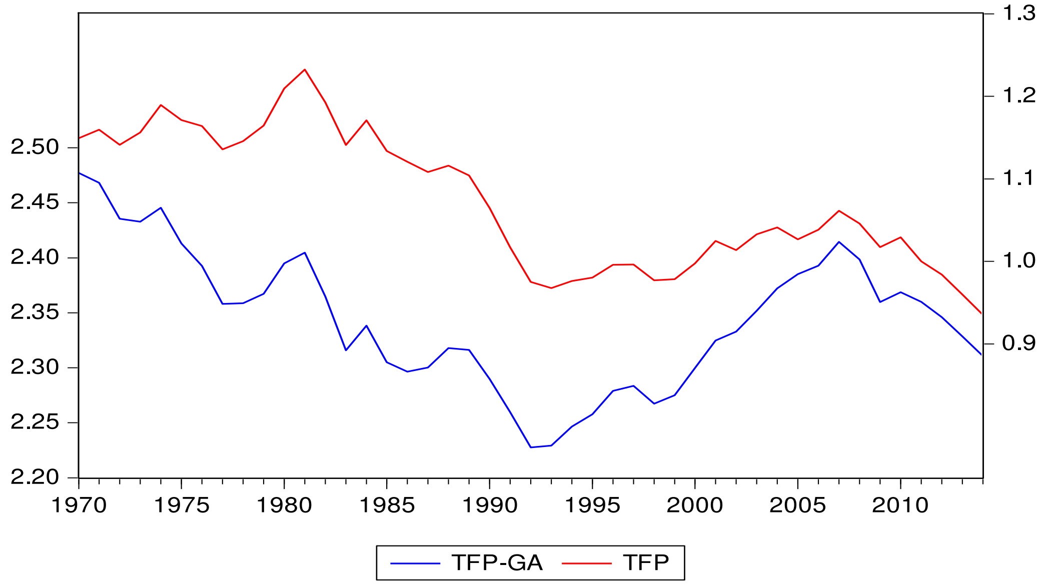

Figure 1 shows that the trend of TFP in South Africa is influenced by developments at national and international level. The trend observed from about 1994, marks the end of the apartheid era and reflects the opening up of the economy. In particular, the share of trade in GDP increases considerably, indicating the benefit of trade liberalisation and openness (See, for example, Jonsson and Subramanian 2001). The decrease in TFP observed in 2008, coincides with the global financial crisis that began in 2007. Given that global trade and FDI dwindle during a period of global financial crisis, it is logical to anticipate a decrease in TFP during that period.

To assess the long-term relationship between TFP and the variables discussed above, the level of integration of all the variables was first tested, given that the Hansen and Johansen technique of cointegration applies when variables are integrated of order one. The DF-GLS test was used for a unit root as proposed by Elliot, Rothenberg and Stock (1996). Studies have shown that the DF-GLS test has significantly greater power than the earlier versions of the ADF test (See, for example, Bonga-Bonga and Guma 2017). The results reported in Table 1 show that all the variables are integrated of order one - I(1).

[1] Although these variables may not be exhaustive for the determinants of TFP, each of them is correlated to some of the variables suggested in the literature. For example research and development (R&D) is found to be correlated to human capital. The selection made in this paper avoids any issue of multicollinearity.

Table I Unit root test: DF-GLS statistics

Variables	t-statistics level	t-statistics difference	Order of integration
TFP	-0.3461	-3.05	I(1)
FDI	-1.3174	-3.21	I(1)
OPEN	-1.2036	-6.11	I(1)
DHC	-2.3862	-3.36	I(1)
FDI*DHC	-1.5957	-3.63	I(1)

The variable FDI*DHC is included in the vector of variables to describe the interaction between FDI and DHC. Assuming that TFP is normalised in the co-integrating relationship, the equation that is intended to be estimated is represented by[2]:

$$TFP_t = C + \alpha OPEN_t + \beta FDI_t + \phi FDI_t * DHC_t + \varepsilon_t \quad (1)$$

It is important to note that the constant C in Equation 1 accounts for the possibility of autonomous technological change that is exogenous with respect to an economy under study.

From Equation 1, it is deduced that:

$$\frac{dTFP_t}{dFDI_t} = \beta + \phi DHC_t \quad (2)$$

Equation 2 shows that DHC is the source of non-linearity between FDI and TFP and that the way FDI influences TFP depends on the magnitude of DHC. To assess the long-term relationship between the variables represented in Equation 1, the test of cointegration between these variables proceeded. Making use of the Schwarz information criteria (SIC) to estimate the appropriate number of lags in the cointegrating vector, two lags are found to be appropriate. The results of the trace and maximum eigenvalue tests are presented in Tables 2 and 3, respectively. The tabulated critical values and some useful asymptotically equivalent statistics reported in Tables 2 and 3 are derived under the assumption of non-zero value of the constant (see, for example, Juselius 2006). The inclusion of the constant term in the cointegration space implies that the distance the system represented by Equation 1 is away from the equilibrium at any point in time may have non-zero mean. This is due to the presence of autonomous technological change.

Table II Trace test for cointegration

Null hypothesis	Trace statistic	Critical value	Probability
r = 0	81.734	47.85	0.0001
r = 1	29.028	29.79	0.061

[2] It is worth noting that DHC is not directly included in Equation 1. The results reported in Table A1 in appendix show that DHC is not statistically significant when added in the cointegrating relationship. This emphasizes the importance of the interaction of FDI and human capital accumulation (DHC) on total factor productivity (See, for example, Shahrivar and Jajri 2012)

Table III Maximum eigenvalue test for cointegration

Null hypothesis	Max eigen	Critical value	Probability
r = 0	52.706	27.58	0.00001
r = 1	18.68	21.13	0.1063

The results in Table 2 and 3 show that the trace and maximum eigenvalue test did not reject the null hypothesis of one co-integrating relationship, r=1, at 5% level of confidence. The maximum likelihood estimation of the co-integrating vector among the variables represented in Equation 1 is reported in Table 4. It is important to note that in this paper, TFP is normalised in the estimation of the cointegrating vector. The results reported in Table 4 can be represented as:

$$TFP_t = 0.675 OPEN_t - 0.239 FDI_t + 9.462 FDI_t * DHC_t - 1.63 \quad (3)$$

Table IV Estimation of the co-integrating vector

Variables	Coefficients	t-statistics	P-value
TFP	1.000		
OPEN	-0.675	-5.064	0.00000
FDI	0.239	5.405	0.00000
*FDI*DHC*	-9.462	-2.31	0.02204
C	1.63	3.246	0.00140

The results in Equation 3 demonstrate a positive relationship between OPEN and TFP. A number of studies allude to the benefit of trade openness on technological change. Yannikkaya (2003) shows that trade provides access for a country to technological advance and change. This idea is supported by the proponents of trade liberalisation, who see trade openness as an opportunity for a country to enhance efficiency and specialise in specific products (Balassa, 1965). The relation between FDI and TFP show that the two variables are linked with a slope that could be expressed as:

$$\frac{dTFP_t}{dFDI_t} = -0.239 + 9.462 DHC_t \quad (4)$$

It is clear from Equation 4 that the threshold from a negative to a positive impact of FDI on TFP is determined by the threshold of human capital accumulation at 0.025 or 2.5%. This shows that FDI can translate to technological progress if human capital accumulates at an average annual rate of 2.5%. Contrary to studies conducted on developed economies that link the impact of FDI on technological change to the stock of human capital, this study demonstrates that for South Africa – a low-skilled economy – it is in fact the growth of human capital (human capital accumulation) that matters in the relationship between FDI and TFP.

The rationale that informs the findings in this study is that in a low-skilled economy, the stock of human capital (stock of knowledge) of workers is below the required equilibrium level necessary to contribute to productivity through the transfer of knowledge. It is only when additional skills (training) and knowledge add to the existing stock of knowledge that such a transfer becomes beneficial. Acemoglu (1998) shows that the lack of capital accumulation may limit the actual potential to adopt new technology. This implies that the new technology infused through FDI may not be beneficial to an economy dominated by a low-skilled labour force.

To show that it is human capital accumulation rather than the stock level of human capital that matters on the relationship between FDI and TFP in an economy with skills shortage such as South Africa , we changed Equation 1 by replacing the variable of interaction between FDI and Human capital accumulation by the interaction between FDI and stock level of human capital (HC). The results reported in Table A2 in the appendix show that the interaction variable and FDI are not statistically significant at 10%, 5% and 1% level, respectively. However, the coefficient of openness is statistically significant and has the right sign, denoting the positive effect of openness on TFP.

The second consideration is to assess whether TFP is exogenous in South Africa. As stated earlier, this assessment is conducted out of concern that technology is superimposed upon small, open economies such as South Africa's. To this end, the paper applies the likelihood ratio-based test of weak exogeneity in the error correction model. The vector error correction model is represented in Equation 5 as:

$$\Delta Z_t = -\alpha\beta\, Z_{t-1} + \sum_{i=1}^{k-1} \Gamma_i\ \Delta Z_{t-i}\ + v_t \qquad (5)$$

Where in the present case,

$$Z_t = \begin{bmatrix} TFP_t \\ OPEN_t \\ FDI_t \\ FDI_t * DHCt \end{bmatrix},\ \alpha = \begin{bmatrix} \alpha_{TFP} \\ \alpha_{OPEN} \\ \alpha_{FDI} \\ \alpha_{FDI*DHC} \end{bmatrix} \text{ and } \Delta Z_{t-i} = \begin{bmatrix} \Delta TFP_{t-i} \\ \Delta OPEN_{t-i} \\ \Delta FDI_{t-i} \\ \Delta FDI * DHC_{t-i} \end{bmatrix}$$

And where α denotes the speed of adjustment and β is the estimated co-integrating vector. The test of the exogeneity of TFP is conducted by assessing whether the restriction $\alpha_{TFP} = 0$, is not rejected in the estimation of Equation 5.

The results of the error correction estimation of ΔTFP are reported in Equation 6 as follows, with p-values in brackets:

$$\begin{aligned} \Delta TFP_t = & -\underset{[0.0007]}{0.0039}(TFP_{t-1} + 0.239\, FDI_{t-1} - 0.675\, OPEN_{t-1} - 9.462\, FDI * DHC_{t-1} + 1.638) + \\ & \underset{[0.0000]}{0.59}\,\Delta TFP_{t-1} - \underset{[0.4805]}{0.0005}\,\Delta FDI_{t-1} - \underset{[0.8975]}{0.0056}\,\Delta OPEN_{t-1} + \underset{[0.6749]}{0.02}\,\Delta(FDI * DHC)_{t-1} + \\ & \underset{[0.0853]}{0.16}\,\Delta TFP_{t-2} + \underset{[0.8975]}{0.000093}\,\Delta FDI_{t-2} - \underset{[0.5295]}{0.0094}\, OPEN_{t-2} + \underset{[0.8323]}{0.0129}\,\Delta(FDI * DHC)_{t-2} \end{aligned} \qquad (6)$$

The results show that the speed of adjustment to the equilibrium of TFP is close to 0.39% which is quite low. Most importantly, whether the restriction $\alpha_{TFP} = 0$ is binding needs to be tested. The result of the likelihood ratio test of the restriction $\alpha_{TFP} = 0$, provides a χ^2 $(Chi - Square)$

value of 9.585, with a probability value of 0.00196. This indicates that the null hypothesis of $\alpha_{TFP} = 0$ is rejected at least at 1% level and that *TFP* is indeed endogenous. The finding that TFP is endogenous in South Africa confirms the importance of the regressors discussed above in its determination, especially the interactive role of FDI and human capital accumulation.

For a robustness test, TFP obtained from the PWT9 database was used. The results are the same as discussed above. This is expected, given the similar trend of TFP obtained from the PWT9 database and that obtained from growth accounting.

The findings of this study demonstrate the need for a continuous increase of human capital at a given rate in order for the latter to transmute technology embedded in FDI into an improvement in domestic productivity. Several studies acknowledge the need to continuously increase the supply of skills, an important element of human capital accumulation, in South Africa. For example, Pellicer and Ranchho (2012) suggest that broadening access to higher education can be viewed as a mechanism to enhance the supply of skilled labour not only in South Africa but also in most emerging or developing economies. The quality of education available, and not simply the quantity of that education, is vital to the effort to increase the pool of skilled labour, especially in a country such as South Africa, which endured a previous education system that institutionalised racial segregation.

3. Conclusion

This paper aimed to assess the relationship between FDI and TFP. Studies have failed to find consensus on whether or how FDI affects total factor productivity. One group of studies found that FDI negatively affects total factor productivity; another group finds a positive relationship between the two variables. It is worth noting that these two groups of studies fail to account for the interactivity between FDI and human capital in assessing the effects of FDI on total productivity. Studies that overcome this failure factored in the interactive role of the stock of human capital in determining the effect of FDI on total factor productivity, something that usually occurs in developed economies. This paper shows that in the case of low-skilled developed economies, such as South Africa, it is in fact the change in stock of human capital - or human capital accumulation - that matters in determining the effects of FDI on total factor productivity. The findings of this study show that if human capital accumulates at an annual rate above 2.5%, FDI will have a positive effect on total factor productivity. Below this annual rate, the effect of FDI on total factor productivity will be negative. Policy suggestion, such as broadening access to higher education, is proposed in order to derive the positive benefit of FDI on TFP. This paper makes use of co-integrated VAR with the use of interactive variables in its empirical analysis. However, for further study, the use of non-linear or threshold models to assess the effects of FDI on total factor productivity is suggested.

Appendix

Table A.I Estimation of the co-integrating vector adding human capital accumulation

Variables	Coefficients	t-statistics	P-value
TFP	1.000		
OPEN	-1.058	-2.466	0.01462
FDI	0.376	3.37	0.00092
DHC	-23.123	-1.0814	0.28099
*FDI*DHC*	-3.801	-0.313	0.37732
C	3.102	1.97	0.05040

The results show that DHC and FDI*DHC are not statistically significant at 10%, 5% and 1% level of significance, respectively.

Table A.II Estimation of the co-integrating vector using human capital stock in the interaction with FDI

Variables	Coefficients	t-statistics	P-value
TFP	1.000		
OPEN	-0.721	-4.816	0.00000
FDI	0.1814	1.398	0.16371
*FDI*DHC*	-0.0096	-0.163	0.87043
C	1.8134	3.185	0.00171

Table A.III Unit root tests of the residuals in Equation 1

	t-statistics
ADF test	-1.983**
DF-GLS test	-5.961***
PP test	-3.078**

***, and ** denote rejection of the null hypothesis of unit root at 1% and 5% levels, respectively

Table A3 reports the results of the unit root tests of the residual derived from the estimation of Equation 1, especially the Augmented Dickey-Fuller (ADF), the Dickey-Fuller GLS (DF-GLS) and the Phillips-Perron (PP) tests. All the three tests reject the null hypothesis of unit root of the residual, thus confirm its stationarity and the validation of the cointegrating relationship represented in Equation 1.

References

ACEMOGLU, D. (1998) "Why do New Technologies Complement Skills? Directed Technical Change and Wage Inequality" *Quarterly Journal of Economics CXIII, 1055-1090.*

AITKEN, BJ and A.E. HARRISON (1999) "Do domestic firms benefit from direct foreign investment? Evidence from Venezuela" *American Economic Review XX, 605-618.*

ALFARO, L , KALEMLI-OZCAN, S. and S. SAYEK (2009) "FDI, productivity and financial development" *The World Development 32, 111-135.*

ALLAIS, S. (2012) "Will skill save us? Rethinking the relationships between vocational education, skills development policies, and social policy in South Africa" *International Journal of Education Development 32(5), 632-642.*

BALASSA, B. (1965) "Trade liberalisation and "revealed" comparative advantage. The Manchester School, 33(2), 99-123.

BEAN, C. and PISSARIDES, C. (993). Unemployment, consumption and growth" *European Economic Review 37(4), 837-854.*

BLOMSTRÖM, M and A. KOKKO (1996) "The impact of foreign investment on host countries: A review of the empirical evidence" World Bank Policy Research Working Paper 1745.

BLOMSTRÖM, M. and KOKKO, A. (2003). Human Capital and Inward FDI. CEPR Discussion Paper No. 3762.

BONGA-BONGA, L and N. GUMA (2017) "The Relationship Between Savings and Economic Growth At The Disaggregated Level" *Economia Internazionale 70(1), 1-24*

CAVES, R.E. (1974) "Multinational firms, competition and productivity in host-country markets" *Economica 41(162), 176-193.*

DE LA POTTERIE, BVP and F. LICHTENBERG (2001) "Does foreign direct investment transfer technology across borders?" *The Review of Economics and Statistics 83(3), 490-497.*

ELLIOT, G ; ROTHENBERG, T J and J.H.STOCK (1996) "Efficient test for an autoregressive unit root" *Econometrica* 64(4), 813-836.

ERIKSSON, C. (1997) "Is there a trade-off between employment and growth?" *Oxford Economic Papers 49(1), 77-88.*

GERMIDIS, D. (1977) *Le transfert technologique par les firmes multinationales*, OECD : Paris

HADDAD, M. and A. HARRISON (1991) "Are there dynamic externalities from direct foreign investment? Evidence for Morocco" Energy Department Working Paper 48.

HADDAD, M and A. HARRISON (1993) "Are there positive spillovers from direct foreign investment? Evidence from panel data for Morocco" *Journal of Development Economics 42(1), 51-74.*

HANSEN, H. and S. JOHANSEN (1999) "Some tests for parameter constancy in cointegrated VAR models" *The Econometrics Journal 2(2), 306-333.*

JONSSON, G. and A. SUBRAMANIAN (2001) "Dynamic gains from trade: evidence from South Africa" IMF Working Paper 48.

Juselius, K. (2006) The cointegrated VAR model: methodology and application. Oxford University Press: Oxford.

KOKKO, A. (1994) "Technology, market characteristics, and spillovers" *Journal of Development Economics 43(2), 279-293.*

KOKKO, A, TANSINI, R and M.C. ZEJAN (1996) "Local technological capability and productivity spillovers from FDI in the Uruguayan manufacturing sector" *The Journal of Development Studies 32(4), 602-611.*

LIU, X. and C. WANG (2003) "Does foreign direct investment facilitate technological progress? Evidence from Chinese industries" *Research Policy 32(6), 945-953.*

LIU, Z. (2008) "Foreign direct investment and technology spillovers: theory and evidence" *Journal of Development Economics 85(1-2), 176-193.*

MANKIW, NG, ROMER, D and D.N. WEIL (1992) "A contribution to the empirics of economic growth" *The Quarterly Journal of Economics 107(2), 407-437.*

MILLER, SM and M.P. UPADHYAY (2000) "The effects of openness, trade orientation and human capital on total factor productivity" *Journal of Development Economics 63(2), 399-423.*

PAQUET, A. and B. ROBIDOUX (2001) "Issues on the measurement of the Solow residual and the testing of its exogeneity: Evidence for Canada" *Journal of Monetary Economics 47(3), 595-612.*

PELLICER, M. and V. RANCHHO (2012) "Inequality traps and human capital accumulation in South Africa" SALDRU Working Paper 86. University of Cape Town.

RASOOL, F. and C.J. BOTHA (2011) "The nature, extent and effect of skills shortage on skill migration in South Africa" *South African Journal of Human Resource Management 9(1), 1-12.*

ROMER, P.M. (1986) "Increasing returns and long-run growth" *Journal of Political Economy 94(5), 1002-1037.*

ROMER, P.M (1997) "The origin of the endogenous growth" *Journal of Economic Perspectives 8(1), 3-22.*

SHAHRIVAR, RB and I.B. JAJRI (2012) "Investigating the interaction between FDI and Human capital on productivity growth" *Research Journal of International Studies, 23, 76-93.*

SOLOW, R.M. (1956) "A contribution to the theory of economic growth" *The Quarterly Journal of Economics 70(1), 65-94.*

SOLOW, R.M. (1957) "Technical change and the aggregate production function" *The Review of Economics and Statistics 39(3), 312-320.*

XU, B. (2000) "Multinational enterprises, technology diffusion, and host country productivity growth" *Journal of Development Economics 62(2), 77-493.*

YANNIKKAYA, H. (2003) "Trade openness and economic growth: A cross-country empirical investigation" *Journal of Development Economics 72(1), 57-89.*