Growth Impact and Determinants of Foreign Direct Investment into South Africa, 1956-2003

J.W.Fedderke* and A.T.Romm†

December 2004

Abstract

The paper is concerned with the growth impact and the determinants of foreign direct investment in South Africa. Estimation is in terms of a standard spill-over model of investment, and in terms of a new model of locational choice in FDI between domestic and foreign alternatives. We find complementarity of foreign and domestic capital in the long run, implying a positive technological spill-over from foreign to domestic capital. While there is a crowd-out of domestic investment from foreign direct investment, this impact is restricted to the short run. Further we find that foreign direct investment in South Africa has tended to be capital intensive, suggesting that foreign direct investment has been horizontal rather than vertical. Determinants of foreign direct investment in South Africa lie in the net rate of return, as well as the risk profile of the foreign direct investment liabilities. Policy handles are both direct and powerful. Reducing political risk, ensuring property rights, most importantly bolstering growth in the market size, as well as wage moderation, lowering corporate tax rates, and ensuring full integration of the South African economy into the world economy all follow as policy prescriptions from our empirical findings.

Keywords: Foreign Direct Investment; South Africa

JEL classification: F21; F41; F43

1. Introduction

Identifying determinants of long run economic growth remains central to the South African policy debate. Numerous contributions have investigated both the changing structure of economic growth in South Africa,[1] and addressed the impact of a number of its determinants.[2] While a number of studies have examined the contribution of aggregate investment expenditure to economic growth, few have addressed the distinction between domestic and foreign investment expenditure, and the impact of foreign direct investment on long run development in particular.[3] Similarly, to date little

*School of Economics, University of Cape Town, *E-mail address:* jfedderk@commerce.uct.ac.za;

†School of Economic and Business Sciences, University of the Witwatersrand, *E-mail address:* romma@sebs.wits.ac.za

[1] See for instance Fedderke (2002a) and Lewis (2002).

[2] Examples are the impact of public policy in Mariotti (2002), of financial deepening in Kularatne (2002) and of the determinants of TFP growth in Fedderke (2001).

[3] Kularatne (2002) and Mariotti (2002) both place aggregate investment into a multiple equation framework of South African growth.

attention has been paid to the determinants of infrastructural investment in South Africa.[4]

The obvious question is why foreign as opposed to domestic investment should have an impact on long run development that is any different from domestic investment. The literature suggests that one source of such difference might arise due to technological spillovers and knowledge transfers resulting from the presence of multinationals originating in more technologically advanced countries.[5] Much of the evidence confirms a positive impact of foreign direct investment on efficiency and growth.

The related question is then how foreign direct investment comes to be determined. Again, the literature on the determinants of foreign direct investment has identified both policy and non-policy factors as drivers of foreign direct investment. Non-policy factors include: market size, distance, factor proportions and political and economic stability. Policy factors include: openness, product-market regulation, labour market arrangements, corporate tax rates and infrastructure.

For South Africa both questions have come to be of increasing importance. First, concerns about the investment rate in South Africa raise the obvious possibility of augmenting domestic with foreign investment expenditure. Moreover, since the structure of South African growth has shifted substantially from factor accumulation to efficiency gains as measured by total factor productivity,[6] the potential of technology and skills transfers as a spill-over from foreign direct investment assumes increased importance. Yet to the best of our knowledge to date no work has addressed either the question of the growth impact of foreign direct investment on the South African economy, nor how foreign direct investment might be encouraged through an identification of relevant policy handles.[7] Second, the prospects of an increased relaxation of capital controls further raises the need for clarity concerning the determinants of both portfolio capital flows, as well as direct investment flows. Capital flight as a response to the lifting of the controls would be unfortunate - and an improved understanding of the drivers of the flows prior to the relaxation of the controls should prove useful in phasing in the lifting of the restrictions on capital movements. Again, to date attention on direct capital movements has been limited, and structural analysis has focussed primarily on

[4] We are not aware of any studies that address this question. By contrast, attempts to isolate the determinants of long run private sector investment expenditure are relatively plentiful – see for instance Fielding (1997, 2000) and Fedderke (2004).

[5] See for example Ramirez (2000), Barrell and Pain (1997), Balasubramanyam et al (1996), Blomström (1983), Blomström and Wolf (1994).

[6] See Fedderke (2001, 2002a).

[7] Cassim (2000) is the only precursor were are aware of - but the focus here is descriptive rather than providing a structural analysis.

portfolio flows of capital.[8]

This paper is concerned primarily with the provision of structural analysis of the growth impact of foreign direct investment, as well as its determinants.

For the analysis of the growth impact of foreign direct investment we follow the precedent in the literature of employing a spill-over model. In the case of the determinants of foreign direct investment, we develop a model of the location of the investment activity as an explicit choice in an intertemporal context of locating the new capital stock either domestically or in an alternative foreign location. The predictions of the model is not only in terms of the impacts of the net rate of return on foreign direct investment, and the impact of risk on the foreign direct investment decision, but also in terms of the policy interventions that might affect the locational choice.

We test for the growth impact as well as the determinants of foreign direct investment on aggregate South African data over the 1956-2003 period.

Section 2. of the paper provides a brief descriptive account of foreign direct investment in South Africa over the sample period. In section 3. we develop the theory underlying our estimations, while section 4. presents the empirical methodology and results. Section 5. concludes.

2. A Brief Exploration of the South African Data

Figure 1 reports total foreign direct investment liabilities as a percentage of GDP over the 1956-2001 period. A number of points need to be mentioned in connection with the FDI series. The series consists of four categories: Equity capital, Other long-term capital, Other short-term capital, Real estate. As such the category does not include total foreign liabilities in that it excludes Total Portfolio Investment (Equity Securities and Debt Securities), and Other Investment (IMF, long-term loans, short-term loans & trade finance, deposits). The criterion primarily used in defining direct investment is that the investor is capable of exercising significant influence over the activities of the enterprise in which he has invested. Investment by foreigners in South Africa is considered direct investment if it comprises ownership of a branch or participation in a partnership in South Africa; ownership of at least 10% of voting rights in an organization in South Africa; ownership of less than 10% of the voting rights, provided the foreigner is able to exercise effective influence over

[8] See Fedderke and Liu (2002).

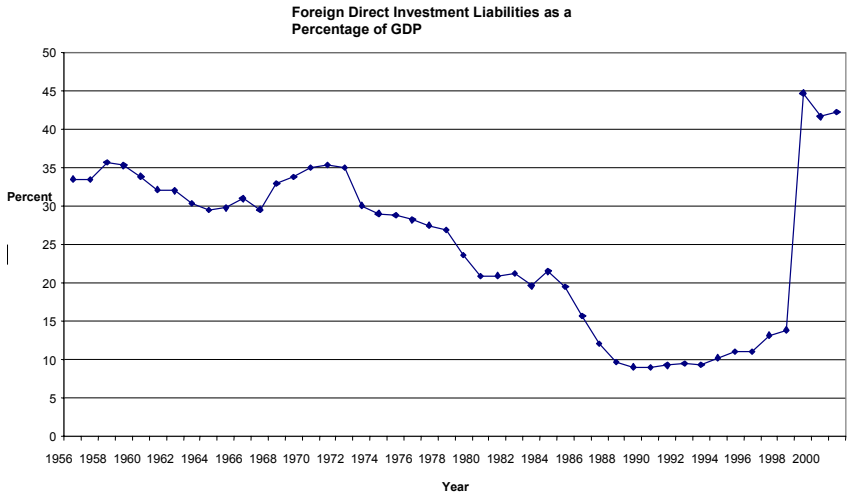

Figure 1: Foreign Direct Investment Liabilities as a Percentage of GDP

the policies of the organization, for example, in terms of royalty and management agreements. By contrast, portfolio investment consists of international equity and debt securities not classified as direct investment (viz. by the above definition).

Figure 1 reveals two features of the data series. First, there is a long-term decline in FDI liabilities (as defined above) as a percentage of GDP from 1956-1994, from approximately 35% of GDP, to approximately 10% of GDP.[9] Second, we note a slow rise after 1994 to 1998, from 10% to 15% of GDP, and a very sharp once-off increase in 1999 to approximately 42 % of GDP. The sharp increase in 1999 is a reflection of the re-listing of three companies from the Johannesburg to the London stock exchange.[10]

[9] We also note that at least for the manufacturing sector, total foreign liabilities are dominated by total foreign direct investment, rather than portfolio holdings during the late 1990's; though portfolio investment and other investment do constitute a sizeable proportion of total foreign liabilities. Finally, note also that as a proportion of total direct investment in the manufacturing sector, equity capital dominates all other categories.

[10] Anglo-American, Old Mutual, and South African Breweries moved their listing from the JSE to the LSE in 1999. DIDATA followed suit in 2000; Investec listed on the LSE in 2002; BHP Billiton obtained an Australian listing in 2001.

3. Theory

3.1. FDI and its Impact on Economic Growth

The first question to be asked is why the role of FDI needs to be distinguished from that of domestic investment. Both result in the augmentation of the physical capital stock. The obvious question is then why the impact of FDI needs to be distinguished from that of the domestic expansion of plant and machinery. The literature has identified an impact of foreign direct investment through a differentiated impact of FDI on productivity of both domestic labour and domestic capital, through the transmission of superior technology. The theoretical structure is therefore in the spirit of Romer (1986). The importance of FDI can then be understood as closing the gap identified by Romer (1993) as the main obstacle facing developing countries trying to keep up with or advance on more advanced countries: the gap in knowledge or human capital, rather than the gap in physical capital.

In the spirit of De Mello (1997) and Ramirez (2000) we model the externality associated with the stock of FDI via an augmented Cobb-Douglas production function:

$$Y = Af[L, K_p, E] = AL^{\alpha}K_p^{\beta}E^{(1-\alpha-\beta)} \tag{1}$$

where Y is real output, K_p is the domestic capital stock, L is labour, and E refers to the externality ($\lesseqgtr 1$) generated by additions to the stock of FDI. α and β are the shares of domestic labour and capital respectively, and A captures the efficiency of production. Assume $\alpha + \beta < 1$. For simplicity, let the externality, E, be represented by a Cobb-Douglas function of the type:

$$E = [L.K_p.K_f^{\gamma}]^{\theta} \tag{2}$$

where K_f denotes the foreign-owned capital. Combining equations (1) and (2) , we obtain

$$Y = AL^{\alpha+\theta(1-\alpha-\beta)}K_p^{\beta+\theta(1-\alpha-\beta)}K_f^{\gamma\theta(1-\alpha-\beta)} \tag{3}$$

Note that from (2) we have $(\partial K_p/\partial K_f)(K_f/K_p) = -\gamma$, such that $\gamma \gtreqless 0$ implies domestic and foreign capital to be substitutes and complements respectively (corresponding to crowd-out and -in respectively). Under $\gamma > 0$,[11] foreign direct investment crowds-out domestic investment at least in the first instance. By contrast, θ captures the spill-over of foreign investment on the productivity

[11] See De Mello (1997:13), and Ramirez (2000:145).

of capital and labour - given $(\partial Y/\partial L)/(L/Y) = \alpha + \theta(1-\alpha-\beta), (\partial Y/\partial K_p)/(K_p/Y) = \beta + \theta(1-\alpha-\beta)$. Note that $\theta \gtrless 0$ implies positive and negative spill-overs from foreign direct investment respectively, such that whichever of $\gamma \gtrless 0$ prevails, the long run effect of FDI on output may remain positive. It is therefore possible to interpret γ as the instantaneous (or marginal), θ as the long-term (or intertemporal) elasticity of substitution between domestic and foreign capital. Finally we can generate the dynamic production function by taking logarithms and time derivatives of equation (3):

$$g_y = g_A + [\alpha + \theta(1-\alpha-\beta)]g_L + [\beta + \theta(1-\alpha-\beta)]g_{Kp} + [\gamma\theta(1-\alpha-\beta)]g_{Kf} \tag{4}$$

where g_i is the growth rate of $i = Y, A, L, K_p$ and K_f.

The specification carries two peculiarities in empirical implementation. First, under (3), for $K_f \to 0, Y \to 0$. While this is implausible in the general case, we may consider the framework under (1) through (3) for the widespread case under which $K_f > 0$.[12] Second, note that both (3) and (4) are underidentified, such that $\gamma\theta(1-\alpha-\beta) > 0$ is consistent both with $\gamma > 0, \theta > 0$, and with $\gamma < 0, \theta < 0$, given $\alpha + \beta < 1$. This leaves undecided the question of whether foreign capital is a complement to domestic capital in the short or the long run. Further, $\gamma\theta(1-\alpha-\beta) < 0$ is similarly consistent both with $\gamma > 0, \theta < 0$, and with $\gamma < 0, \theta > 0$, leaving indeterminate whether domestic and foreign capital are substitutes or complements.

A final point relates to the interpretation of the coefficients of any estimation of equations (3,4). Define $M \equiv \alpha + \theta(1-\alpha-\beta), N \equiv \beta + \theta(1-\alpha-\beta)$. Provided that $\alpha + \beta < 1$, under $M + N < \alpha + \beta$, $\theta < 0$, and $\theta \to 0$ as $M + N \to \alpha + \beta$. Conversely, under $M + N > \alpha + \beta$, $\theta > 0$, and $\theta \to 0$ as $M + N \to \alpha + \beta$.

While certain empirical studies have not found a definite association between FDI and growth, the majority of studies have found that FDI, or FDI in combination with some other factor/s is positively related to growth. Blomström, Lipsey, and Zejan (1994) found, among developing countries, from 1960 to 1985, ratios of FDI inflows to GDP in a five-year period were positively related to growth in the subsequent five year period. Borensztein, De Gregorio, and Lee (1998) found, among 69

[12] Certainly for a case such as South Africa, the expectation that $K_f \to 0$ has been implausible for a period of well over a century. Representation of production behaviour in the absence of foreign direct investment, while of general concern, is of little practical importance. A representation that would address the concern raised by the looming zero output restriction under $K_f \to 0$, could be addressed by the formulation given by $Y = AL_t^{\alpha}K_t^{\beta}$, with $K_t = K_0 \exp[a\delta + b\lambda]\, t$, $L_t = L_0 \exp[g_L + c\lambda]\, t$, where notation follows the convention of this paper, and δ, λ, are the domestic and foreign investment rates respectively. The b, c, coefficients thus represent the externalities of FDI with respect to capital and labour respectively.

developing countries from 1970 to 1989, that FDI inflows, by themselves, only marginally affected growth, but FDI interacted with the level of education of a country's labour force had a significant positive effect on growth. Balasubramanayam et al (1996) tested the hypothesis that the efficiency of FDI in promoting growth would be increased by an export promotion policy and decreased by an import substitution policy. The authors found that in 10 -18 export promotion policy developing countries, higher inward FDI flows were associated with higher growth. No effect was found in the developing countries following import substitution policies. Ramirez (2000) found that for Mexico, FDI spillovers has a positive effect on labour productivity growth.

3.2. The Determinants of Inward FDI

3.2.1. A Portfolio Theoretical Approach to the Determination of FDI

Since the discussion of the link between FDI and economic growth suggests that FDI is beneficial to economic development, provided only that $\theta > 0$, the pressing question then concerns the determinants of FDI.

We propose a model of foreign direct investment in the spirit of the intertemporally optimizing portfolio theoretic framework of Fedderke (2002b).[13] The core drivers of FDI then fall into two classes of determinants - rates of return and risk factors, with positive responses to rates of return, negative responses to risk. We employ a standard variational approach, and begin by defining the expected return on a portfolio of capital assets faced by an agent,[14] which we denote as $E(R)$, as:

$$E(R) = D^R - D^C + F^R - F^C \tag{5}$$

where D^R and F^R are defined as the expected return on domestic and foreign capital assets respectively. D^C and F^C are defined as the cost of adjustment of domestic and foreign capital asset holdings respectively. Costs of adjustment are held to arise due to information and transactions costs associated with altering the composition of capital asset portfolios.

[13] The Fedderke (2002b) paper contains a fuller elaboration of the model. One question might concern the appropriateness of a portfolio theoretic approach to lumpy decisions such as those concerned with investment in physical capital. Since FDI is often the outcome of decisions of multinational companies, with production capacity in a range of alternative settings, the appropriateness of considering a portfolio of physical assets becomes apparent. Since a substantial proportion of FDI in any event takes the form of holding share capital (though enough to grant considerable influence), the distinction between FDI and standard portfolio theoretic contexts becomes further ameliorated.

[14] While in general the agents of the model might be presumed to be firms rather than households or individual agents, generality suggests the more inclusive designation. It is the convention we adopt for our exposition.

Returns on domestic assets are distinguished from returns on foreign assets by having a non-zero probability of "expropriation," denoted by $0 \leq \pi_d \leq 1$.[15] Expropriation may be held to include factors such as the nationalization of assets, periods of domestic instability which might lower the returns to domestic investment (to zero in the case of bankruptcy), capital controls, and the direct or implicit taxes faced by foreign and domestic investors. We also assume that there exist at least some countries (say developed economies or tha Asian tigers) in which "expropriation" risk factors are either negligible or at least substantially lower than in the domestic economy.

We therefore postulate:

$$\begin{aligned} D^R &= \left[\alpha\left(K^d\right) - \beta\left(K^d\right)^2\right](1-\pi_d)\ , 0 < \pi_d < 1, \alpha, \beta > 0 \\ F^R &= \left[\gamma\left(K^f\right) - \delta\left(K^f\right)^2\right]\ ,\ \gamma, \delta > 0 \end{aligned} \tag{6}$$

where K^d, K^f denote domestic and foreign capital asset holdings respectively.[16]

For adjustment costs we assume that the cost of adjustment is increasing in the magnitude of adjustment for both domestic and foreign capital assets. Thus we have:

$$\begin{aligned} D^C &= a\left(K^{d'}\right) + b\left(K^{d'}\right)^2,\ a, b > 0 \\ F^C &= c\left(K^{f'}\right) + d\left(K^{f'}\right)^2,\ c, d > 0 \end{aligned} \tag{7}$$

Note that variation in the adjustment costs of domestic capital asset holdings is perhaps the prime policy handle available to domestic policy makers, together with the ability to change expropriation risk. All of a, b, π_d, might be affected by policy intervention that raises the friction costs of moving capital assets across international boundaries.

Net present value of the expected return on a portfolio of capital assets over an infinite time horizon is then:

$$N\left[K^d, K^f\right] = \int_0^\infty E\left(R\right) e^{-\rho t} dt \tag{8}$$

[15] Strictly, the relevant dimension is therefore the expectational value. For purposes of notational convenience, and since it does not materially affect the exposition, we suppress the expectations operator.

[16] In both instances an upper bound defined by the first order conditions $\frac{\partial D^R}{\partial K^d} = 0$, $\frac{\partial F^R}{\partial K^f} = 0$, is present for returns on domestic and foreign assets, given the decreasing rate of return to both classes of assets, $\frac{\partial^2 D^R}{(\partial K^d)^2} < 0$, $\frac{\partial^2 F^R}{(\partial K^f)^2} < 0$. Implausibility of unbounded returns to asset holdings drives the choice of functional form.

with the solution to the Euler equation for the K^d state variable given by:

$$K^{d^*}(t) = \left(K_0^d - \overline{K^d}\right) e^{\frac{1}{2}\left(\rho - \left(\rho^2 + \frac{4\beta(1-\pi_d)}{b}\right)^{\frac{1}{2}}\right)t} + \frac{(1-\pi_d)\,\alpha - a\rho}{2\beta\,(1-\pi_d)} \tag{9}$$

such that the optimal time path of investment in domestic assets follows as:

$$I^{d*}(t) = K^{d^{*'}}(t) = \frac{1}{2}\left(\rho - \left(\rho^2 + \frac{4\beta\,(1-\pi_d)}{b}\right)^{\frac{1}{2}}\right)\left(K_0^d - \overline{K^d}\right) e^{\frac{1}{2}\left(\rho - \left(\rho^2 + \frac{4\beta(1-\pi_d)}{b}\right)^{\frac{1}{2}}\right)t} \tag{10}$$

where $I^{d*}(t) \gtreqless 0$ as $\left(K_0^d - \overline{K^d}\right) \lesseqgtr 0$ as appropriate.

Similarly, the solution to the Euler equation for the K^f state variable is given by:

$$K^{f^*}(t) = \left(K_0^f - \overline{K^f}\right) e^{\frac{1}{2}\left(\rho - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}\right)t} + \frac{\gamma - c\rho}{2\delta} \tag{11}$$

with the optimal time path of investment in foreign assets given by:

$$I^{f*}(t) = K^{f^{*'}}(t) = \frac{1}{2}\left(\rho - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}\right)\left(K_0^f - \overline{K^f}\right) e^{\frac{1}{2}\left(\rho - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}\right)t} \tag{12}$$

At this point we have characterized the intertemporal equilibrium and the optimal time paths to intertemporal equilibrium for both the foreign and the domestic capital assets. We note that both the optimal time paths in asset holdings (as characterized by the investment paths), and optimal asset holdings (as characterized by the two intertemporal equilibria) are asymmetrical between domestic and foreign assets, by virtue of the presence of expropriation risk on domestic asset holdings.

The model has the advantage of being able to handle both steady state, and the dynamics of adjustment to steady state. Our real concern here is the *mix* of the two capital assets in the portfolio of agents. We distinguish between the mix of foreign and domestic assets in intertemporal equilibrium, and the mix of assets agents hold in the adjustment to intertemporal equilibrium. The characteristics of the asset mix in equilibrium and on the time path to equilibrium are distinct in a number of important respects, which carry important policy implications.

The mix of foreign and domestic assets in the portfolio of agents in intertemporal equilibrium can be readily identified from the ratio of the two particular intergrals in the solutions to the two Euler equations. Define ϖ_K as the ratio of the *stock* of foreign to domestic capital holdings after agents have adjusted to optimal capital holdings. Then:

$$\varpi_K \equiv \frac{\overline{K^f}}{\overline{K^d}} = \frac{\beta\,(\gamma - c\rho)\,(1-\pi_d)}{\delta\,[(1-\pi_d)\,\alpha - a\rho]} \tag{13}$$

rendering the portfolio mix a function of marginal rate of return, marginal cost of adjustment and expropriation risk factors. The ϖ_K-ratio has intuitively appealing characteristics noted below.

Given the marginal rate of return on domestic and foreign capital asset holdings of $\frac{\partial D^R}{\partial K^d} = \left[\alpha - 2\beta K^d\right](1-\pi_d)$ and $\frac{\partial F^R}{\partial K^f} = \left[\gamma - 2\delta K^f\right]$, an increase in returns on domestic capital assets at the margins follows from $d\alpha > 0$ and $d\beta, d\pi_d < 0$. Such changes have the plausible consequence of increasing domestic relative to foreign capital asset holdings, given $\frac{\partial \varpi_K}{\partial \alpha} < 0, \frac{\partial \varpi_K}{\partial \beta} > 0, \frac{\partial \varpi_K}{\partial \pi_d} > 0$. Equally plausibly, an increase in the marginal rate of return on foreign capital assets ($d\gamma > 0, d\delta < 0$) raises the ϖ_K-ratio, given $\frac{\partial \varpi_K}{\partial \gamma} > 0, \frac{\partial \varpi_K}{\partial \delta} < 0$.

To the extent that our interest lies in the ability of policy makers to influence capital flows, our focus must be on the marginal costs of adjusting capital holdings which lie in the ambit of policy intervention. The marginal costs of adjustment of domestic and foreign capital asset holdings are given by $\frac{\partial D^C}{\partial K^{d'}} = a + 2bK^{d'}$ and $\frac{\partial F^C}{\partial K^{f'}} = c + 2dK^{f'}$. An increase in the marginal cost of adjustment thus follows from $da > 0$, $db > 0$, $dc > 0$ and $dd > 0$. However, in the absence of international policy coordination, only $da > 0$, $db > 0$ lie within the ambit of domestic policy makers. It follows immediately that the imposition of any friction[17] on capital flows will have a negative impact on the proportion of domestic capital assets held in intertemporal equilibrium. This follows from $\frac{\partial \varpi_K}{\partial a} > 0$, $\frac{\partial \varpi_K}{\partial b} = 0$. In effect, domestic policy makers in isolation have no means of employing friction or capital controls in order to improve the proportion of domestic capital assets held in agent's portfolios, except by *lowering* such policy intervention by $da < 0$.

International policy coordination is the only means by which friction can plausibly improve the intertemporal equilibrium holdings of domestic relative to foreign capital assets. This follows from $\frac{\partial \varpi_K}{\partial c} < 0$, $\frac{\partial \varpi_K}{\partial d} = 0$, such that as long as $\left|\frac{\partial \varpi_K}{\partial c}\right| > \left|\frac{\partial \varpi_K}{\partial a}\right|$ the net impact of increased friction would improve the relative holdings of domestic capital assets. But this is a fragile gain. The gain to domestic capital asset holdings is a loss to foreign capital asset holdings, and the incentive for foreign policy makers in turn is not to impose, but to lower friction on capital flows. This is evident from the fact that one means to ensure that the $\left|\frac{\partial \varpi_K}{\partial c}\right| > \left|\frac{\partial \varpi_K}{\partial a}\right|$ condition is met is to set $da = 0$ (or better still $da < 0$ if domestic policy makers are poorly monitored in the policy coordination) while

[17] Here defined as any policy intervention which impacts on the marginal cost of altering the portfolio of capital assets. To the extent that capital controls are imperfect, and serve to increase the cost of moving capital between countries, the impact of capital controls is symmetrical to that of policy interventions that explicitly strive to influence the marginal cost of capital movements.

foreign policy makers are forced to impose friction, such that $dc > 0$. But since this response is rational for all policy makers, the most likely outcome is a steady erosion of the policy intervention.

Presuming for the moment that policy coordination between policy makers is present and binding, however, the condition that $\left|\frac{\partial \varpi_K}{\partial c}\right| > \left|\frac{\partial \varpi_K}{\partial a}\right|$ requires $(1-\pi_d)\left[\alpha\left(1-\pi_d\right)-a\rho\right] > (\gamma - c\rho)$. But reference to the determinants of $\overline{K^d}$ and $\overline{K^f}$ demonstrates that this is effectively the requirement that factors influencing the rate of return on domestic capital assets (net of expropriation risk, and cost of adjustment) exceed those on foreign capital assets. Thus the efficacy of friction in the presence of international policy coordination follows if and only if the fundamentals determining the rate of return on domestic assets is such that domestic assets are in any event attractive to investors.

While ϖ_K identifies the determinants of the ratio of the stock of foreign to domestic capital assets held in intertemporal equilibrium, this does not yet characterize the relative flow of capital to foreign and domestic assets in reaching steady state. In order to characterize equilibrium capital flows, we define ϖ_I as the ratio of the flow of funds to foreign capital assets, to the flow of funds to domestic capital assets, readily obtained from equations 10 and 12. Thus:

$$\begin{aligned} \varpi_I &= \frac{I^{f*}(t)}{I^{d*}(t)} \\ &= \left(\frac{\rho - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}}{\rho - \left(\rho^2 + \frac{4\beta(1-\pi_d)}{b}\right)^{\frac{1}{2}}}\right)\left(\frac{K_0^f - \overline{K^f}}{K_0^d - \overline{K^d}}\right) e^{\frac{1}{2}t\left[\left(\rho^2 + \frac{4\beta(1-\pi_d)}{b}\right)^{\frac{1}{2}} - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}\right]} \end{aligned} \tag{14}$$

rendering the ratio of the *flows* of foreign direct investment to domestic and foreign assets a function of three components: what we term the initial *divergence* effect, given by $\sigma_2 = \left(\frac{K_0^f - \overline{K^f}}{K_0^d - \overline{K^d}}\right)$; what we term the *impetus* effect, given by $\sigma_1 = \left(\rho - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}\right) / \left(\rho - \left(\rho^2 + \frac{4\beta(1-\pi_d)}{b}\right)^{\frac{1}{2}}\right)$; and what we term the *time path* effect, given by $\sigma_3 = \exp \frac{1}{2}t\left[\left(\rho^2 + \frac{4\beta(1-\pi_d)}{b}\right)^{\frac{1}{2}} - \left(\rho^2 + \frac{4\delta}{d}\right)^{\frac{1}{2}}\right]$.

For the most part, ϖ_I behaves symmetrically to ϖ_K. Thus, $\frac{\partial \varpi_I}{\partial \alpha} < 0, \frac{\partial \varpi_I}{\partial \beta} > 0$, implying that an increase in the marginal rate of return on domestic capital assets implies a relative shift of capital flows to domestic assets. Symmetrically, $\frac{\partial \varpi_I}{\partial \gamma} > 0, \frac{\partial \varpi_I}{\partial \delta} < 0$, implying that an increase in the marginal rate of return on foreign capital assets entails a relative shift to foreign assets. Moreover, increasing the marginal cost of adjustment in domestic assets will induce funds to shift to foreign

assets, $\frac{\partial \varpi_I}{\partial a} > 0$, and symmetrically for marginal costs of adjustment to foreign asset holdings, $\frac{\partial \varpi_K}{\partial c} < 0$.

Thus the conclusions that emerged concerning the impact of friction on intertemporal equilibrium capital asset holdings appear to transfer symmetrically to the optimal adjustment path of capital *flows* to the intertemporal equilibrium. But there are three findings that do distinguish ϖ_I from ϖ_K. These are that $\frac{\partial \varpi_I}{\partial b} \lessgtr 0, \frac{\partial \varpi_I}{\partial d} \lessgtr 0, \frac{\partial \varpi_I}{\partial \pi_d} \lessgtr 0$, i.e. the effect of changes in the marginal cost of adjusting the portfolio of capital assets, or the risk of expropriation become ambiguous in their effect on the distribution of funds between domestic and foreign capital assets.

Of special interest here is the case in which $\frac{\partial \varpi_I}{\partial b} < 0$,[18] since the implication is that capital transfer friction might potentially come to be efficacious in stemming disinvestment from the domestic economy. Given $\frac{\partial \varpi_I}{\partial b} = \frac{\partial \sigma_1}{\partial b} db + \frac{\partial \sigma_2}{\partial b} db + \frac{\partial \sigma_3}{\partial b} db$, since $\frac{\partial \sigma_2}{\partial b} = 0$, and $\frac{\partial \sigma_1}{\partial b} \gtrless 0$,[19] $\frac{\partial \varpi_I}{\partial b} < 0$ is feasible since $\frac{\partial \sigma_3}{\partial b} < 0$.[20] While initially the impact of the impetus effect may predominate, as $t \to \infty$ so the time path effect will increase in importance. It is therefore possible that where the impact of frictions emerges through $db > 0$, *either* the relative strength of the equilibrium flow of capital funds switches from foreign to domestic destinations over the full time path to intertemporal equilibrium, *or* that initially the weight of flows to foreign relative to domestic destinations increases, possibly to be reversed as time passes.

To the extent that policy is concerned with the short term stabilization of capital flows, the increase of immediate capital outflows would be a counterproductive result. The implication is thus that for policy purposes, interventions that increase friction on capital flows have to be finely balanced in order to achieve their purposes: they have to increase enough but not by too much in order to prevent the trigger of immediate outflows.

We also note that rising expropriation risk has a notable impact on investment flows. That $\frac{\partial \varpi_I}{\partial \pi_d} \lessgtr 0$ follows from the fact that in $\frac{\partial \varpi_I}{\partial \pi_d} = \frac{\partial \sigma_1}{\partial \pi_d} d\pi_d + \frac{\partial \sigma_2}{\partial \pi_d} d\pi_d + \frac{\partial \sigma_3}{\partial \pi_d} d\pi_d$, $\frac{\partial \sigma_1}{\partial \pi_d}$, $\frac{\partial \sigma_2}{\partial \pi_d} > 0$, and $\frac{\partial \sigma_3}{\partial \pi_d} < 0$. As in the case of an increase in the marginal adjustment cost of capital therefore, while

[18] Though the case of $\frac{\partial \varpi_1}{\partial d}$ is symmetrical.

[19] Given by $-2\frac{\rho - \sqrt{\left(\rho^2 + 4\frac{\delta}{d}\right)}}{\left(\rho - \sqrt{\left(\rho^2 + 4\beta\frac{1-\pi_d}{b}\right)}\right)^2 \sqrt{\left(\rho^2 + 4\beta\frac{1-\pi_d}{b}\right)}} \beta \frac{1-\pi_d}{b^2}$. Since ρ denotes the rate of time discount, $\frac{\partial \sigma_1}{\partial b} < 0$ is at least feasible, given appropriate δ, d values.

[20] Given by $\frac{t}{b}\beta(-1+\pi_d)\frac{\exp\left(-\frac{1}{2}t\frac{-\sqrt{\left(\rho^2 b^2 + 4b\beta - 4b\beta\pi_d\right)}d + \sqrt{\left(\rho^2 d + 4\delta\right)}\sqrt{d}b}{bd}\right)}{\sqrt{\left(\rho^2 b^2 + 4b\beta - 4b\beta\pi_d\right)}}$

initially the impact of the impetus effect may predominate, as $t \rightarrow \infty$ so the time path effect will increase in importance. Simulation demonstrates that the initial outflow of capital rises with rising expropriation risk, so that the apparent improvement in capital flows that emerges through the time path effect is merely an indication of portfolios that have already adjusted substantially to intertemporal equilibrium. Moreover, this effect is stronger the greater the marginal cost of adjustment of capital stock.

To the extent that the imposition of policy measures increasing the friction on investment flows become a predictable policy response to rising capital outflows, anticipated policy intervention designed to increase friction on capital flows may come to be reflected in increased perceptions of expropriation risk, thereby triggering immediate capital outflows worse than in the absence of the anticipated policy intervention, and hence increasing the necessity of the policy intervention. Anticipated recourse to the policy tool may thus increase both the frequency of capital outflow, and hence the frequency with which the policy has to be deployed.

3.2.2. Providing Empirical Content to the Theoretical Model

The literature on FDI has proposed numerous variables that can be considered proxies for relative rates of return and risk on domestic and foreign assets.whose influence might differ depending on whether FDI is horizontal or vertical. Horizontal FDI is held to occur when multinational companies (MNC's) have headquarters at home and production plants both at home and abroad that produce the same goods. Vertical FDI occurs when MNC's fragment different stages of production by having headquarters at home and production plants in different foreign countries that produce different intermediate or final goods.

Non-policy related factors relevant to FDI fall into a number of categories. First, market size of the host country, usually measured by GDP, is considered an important determinant of horizontal FDI, because the returns from such investment depend on economies of scale at the firm level.[21] Second, the effect of distance and transport costs on FDI are viewed as ambiguous. While they imply transaction costs for the investors, FDI may also carry advantages over trade when dealing

[21] See Globerman and Shapiro (1999) and Sethi et al (2003) for evidence on Canada and 17 West European countries and 11 Asian countries that had investments from US MNC's respectively.

with distant countries.[22] The role of distance in influencing FDI is only relevant in a cross-country analysis. It should not play a role in a time series analysis for a single country - though time-varying transport costs might be of importance. Third, differences in factor endowments between countries is often held to encourage vertical FDI because they make possible the exploitation of comparative advantage. Horizontal FDI by contrast is discouraged by differences in factor endowments because they make production of the same good in different countries difficult.[23] Finally, political and economic instability are predicted to deter FDI since they creates uncertainty which raise the risk premia on the returns to FDI.[24]

Policy related factors determining FDI also fall into a number of categories. Openness of the domestic economy is influenced both by direct FDI restrictions as well as trade barriers. FDI restrictions clearly raise barriers to FDI and are likely to influence the choice MNC's make with regards to investment location. Two views of the motives for FDI give contradictory predictions regarding the effects of trade liberalization on FDI. The view of FDI and trade being substitutes, sees "tariff-jumping" as a motive for FDI, and hence trade liberalization should negatively affect FDI. In a liberalized trade environment, exporting goods from the home country is relatively more attractive than FDI as a way to serve the regional market. The alternative view sees the motive for FDI as MNC's different affiliates specializing according to the locational advantages of the host country. This applies, in particular, to vertical FDI where a liberal trade environment is a prerequisite for the international division of labour at the firm level.[25] Second, countries where domestic product-market regulations impose unnecessary costs on business and create barriers to entry, discourage FDI.[26] Third, labour market conditions that impose extra costs on investors will tend to curb the inward FDI position of a country. Strict employment protection legislation and high labour tax wedges will discourage inward FDI in the host country, when the costs of job protection and labour taxation are not fully shifted onto lower after-tax wages. Strict employment protection legislation

[22] See the evidence in Markusen (2002) and Nicoletti et al (2003) that find a negative effect of distance and transport costs.

[23] See Helpman (1984) and Helpman and Krugman (1985).

[24] See the discussion in Sethi et al (2003) and Cushman (1985). Note that Barrell, Gottschalk and Hall (2004) show that market power reduces the negative impact of uncertainty on investment. They also show that by exploiting correlations between exchange rates in alternative locations, firms reduce the impact of uncertainty on their investment portfolio.

[25] See the discussion in Nicoletti et al (2003). See also Globerman and Shapiro (1999), and Blomström and Kokko (1997).

[26] See Nicoletti et al, (2003) and Smith (2002).

not only lowers the returns expected from FDI, but also their variability, since it makes it more difficult for MNC's to respond to supply and demand shocks. This increases the risk that investors face in the host country.[27] Fourth, the impact of corporate tax rates is straightforward. Since higher tax rates applied to corporate profits lowers FDI returns, it will discourage inward FDI. Devereux et al (2002) show that OECD countries do indeed compete with each other over corporate taxes in order to attract investment. Finally, the availability and quality of infrastructure (transportation, communications and energy supply) may positively affect inward FDI, because good infrastructure lowers transaction costs thereby affecting comparative and absolute advantage.[28]

4. Empirical Analysis

4.1. Empirical Methodology

We estimate both the growth impact of FDI, and the determinants of FDI by means of a VECM structure. The estimation technique is standard, so that our exposition is brief.[29]

Consider the general VAR (Vector Autoregressive Estimation) specification given by:

$$z_t = A_1 z_{t-1} + ... + A_m z_{t-m} + \mu + \delta_t \tag{15}$$

where z_t is a $n \times 1$ matrix, m is the lag length, μ deterministic terms and δ a Gaussian error term. Reparametrization provides the VECM specification:

$$\Delta z_t = \sum_{i=1}^{k-1} \Gamma_i \Delta z_{t-i} + \Pi z_{t-k+1} + \mu + \delta_t \tag{16}$$

where

$$\Pi = \alpha\beta' \tag{17}$$

We refer to α as the loading matrix, containing the short-run dynamics, while β is the matrix containing the long run equilibrium (cointegrating) relationships. The rank, r, of the matrix represents

[27] See Sethi et al (2003) and Nicoletti et al (2003).

[28] Nicoletti et al (2003) show the effect of infrastructure on FDI in the OECD not to be very large - though this may simply demonstrate that the level of infrastructure across OECD countries to be sufficiently high, so as no longer to exercise a significant influence on FDI location decisions.

[29] See the more detailed discussion in Johansen (1988), Johansen and Juselius (1990, 1991, 1992).

the number of cointegrating vectors and is tested for using the standard Trace and Maximal Eigenvalue test statistics. Where $r > 1$ issues of identification arise.[30] Just identification can proceed by means of restrictions on α, β, or Γ space.[31]

Our concern is with two models, in order to specify the potential growth impact of FDI in South Africa including isolation of the potential positive spill-over effects of FDI on labour and physical capital, and to identify the drivers of FDI.

Equation (3) predicts that the impact of FDI on GDP can be identified by means of the following specification:

$$\Pi z_{t-k+1} = \begin{bmatrix} \alpha_{11} \\ \alpha_{21} \\ \alpha_{31} \\ \alpha_{41} \end{bmatrix} \begin{bmatrix} 1 & -\beta_{12} & -\beta_{13} & -\beta_{14} \end{bmatrix} \begin{bmatrix} LNRGDP \\ LNTE \\ LNGPSFCS \\ LNRDIY \end{bmatrix}_{t-k+1} \tag{18}$$

such that our prior is of $r = 1$.

For the determinants of FDI, equation (13) in conjunction with the empirical finding of section 3.2.2. provides the following specification:

$$\Pi z_{t-k+1} = \begin{bmatrix} \alpha_{11} \\ \alpha_{21} \\ \vdots \\ \alpha_{81} \\ \alpha_{91} \end{bmatrix} \begin{bmatrix} 1 & -\beta_{12} & \cdots & -\beta_{18} & -\beta_{19} \end{bmatrix} \begin{bmatrix} LNRDIY \\ LNRGDP \\ RATIO \\ TAX \\ LNAVEWAGE \\ LNPROP \\ LNINSTAB \\ OPENM \\ OPENX \end{bmatrix}_{t-k+1} \tag{19}$$

again with the prior of $r = 1$.

4.2. The Data

We employ annual time series data for South Africa from 1960 to 2002. Table 1 provides a summary of variable names, their description, their source, and the time period for which the variables were available. In general all variables are sourced from the South African Reserve Bank, with the exception of the political instability and the property rights variables, which are obtained from Fedderke et al (2001), and the corporate tax rate obtained from Fedderke, Kularatne and Mariotti (2004).

[30] See Wickens (1996), Johansen and Juselius (1990, 1992), Pesaran and Shin (1995a, 1995b), Pesaran, Shin and Smith (1996).

[31] See Greenslade et al, 1999:3ff.

Variable Name	Variable description	Source	Time Coverage
LNRGDP	Log of real gross domestic product	SARB	1960-2002
LNTE	Log total employment	SARB	1960-2002
LNGPSFCS	Log private sector fixed capital stock	SARB	1960-2002
LNRDIY	Log of real foreign direct investment liabilities (stock)	SARB	1960-2002
TAX	Corporate tax rate	Fedderke et al (2004)	1960-1997
RATIO	Labour capital ratio	SARB	1960-2002
LNAVEWAGE	Log of the average wage rate	SARB	1960-2002
LNPROP	Log of the property rights index	Fedderke et al (2001)	1960-1997
LNPOL	Log of political rights index	Fedderke et al (2001)	1960-1997
LNINSTAB	Log of political instability	Fedderke et al (2001)	1960-1997
OPENX	Exports as a percentage of GDP	SARB	1960-2002
OPENM	Imports as a percentage of GDP	SARB	1960-2002

Table 1: Summary Variable Description

VARIABLE	$\sim I(0)$		$\sim I(1)$	
	τ_μ	τ_τ	τ_μ	τ_τ
LNRGDP	-2.61	-1.71	-3.58*	-4.39*
LNTE	-2.61	-1.89	-4.19*	-4.76*
LNGPSFCS	-2.52	0.25	-4.43*	-4.76*
LNRDIY	-2.74	-2.71	-3.71*	-3.62*
TAX	0.74	-2.45	-6.21*	-6.46*
RATIO	-0.58	-3.51	-5.37*	-5.43*
LNAVEWAGE	-0.99	-3.26	-4.10*	-1.65
LNPROP	0.14	-2.13	-6.86*	-5.56*
LNPOL	-1.47	-2.42	-5.97*	-4.93*
LNINSTAB	-2.88	-2.82	-6.48*	-6.37*
OPENX	-2.67	-3.30	-4.22*	-4.08*
OPENM	-2.73	-2.77	-5.69*	-5.62*
* denotes rejection of the null of nonstationarity at the 5% level				

Table 2: ADF tests

Augmented Dickey-Fuller test statistics confirm that all variables are I(1).[32] Table 2 reports the results.

4.3. The Relationship between FDI and Growth

The first set of estimation results concerns the effect of FDI on growth. Our prior is given by the specification reported in (18), with $r = 1$.

Table 3 reports the trace and maximal eigenvalue test statistics for the number of cointegrating

[32] There is some ambiguity on the OPENX variable's stationarity characteristics. We employed a range of tests (ADF, Phillips-Perron, spectrum, autocorrelation function) to settle the matter.

		VAR=2; Unrestricted Intercept; No Trend			VAR=2; Unrestricted Intercept; Restricted Trend		
Null	Alternative	Max Eigen	95% Crit Val	99% Crit Val	Max Eigen	95% Crit Val	99% Crit Val
$r = 0$	$r = 1$	35.2421*	27.4200	24.9900	37.6407*	31.7900	29.1300
$r \leq 1$	$r = 2$	20.3972	21.1200	19.0200	20.3974	25.4200	23.1000
$r \leq 2$	$r = 3$	11.9022	14.8800	12.9800	16.8308	19.2200	17.1800
$r \leq 3$	$r = 4$	3.3808	8.0700	6.5000	6.4851	12.3900	10.5500
Null	Alternative	Trace	95% Crit Val	99% Crit Val	Trace	95% Crit Val	99% Crit Val
$r = 0$	$r = 1$	70.9224*	48.8800	45.7000	81.3540*	63.0000	59.1600
$r \leq 1$	$r = 2$	35.6803*	31.5400	28.7800	43.7133*	42.3400	39.3400
$r \leq 2$	$r = 3$	15.2831	17.8600	15.7500	23.3159	25.7700	23.0800
$r \leq 3$	$r = 4$	3.3808	8.0700	6.5000	6.4851	12.3900	10.5500
* indicates rejection of null at 5% level							

Table 3: Maximal Eigenvalue and Trace Statistics

vectors under two alternative estimation specifications. The first specification is under unrestricted intercepts, but zero restricted trends. The second is in the presence of a trend restricted to the long run specification. Inclusion of the trend in estimation is on grounds provided by other studies exploring South African growth performance in a time series context. Mariotti (2002), Kularatne (2002), Romm (2004), and Fedderke and Luiz (2005a,b) all explore time series models which include an output equation amongst others. Mariotti (2002) investigates the impact of economic policy on economic growth, Kularatne (2002) of financial deepening, Romm (2004) the interaction of aggregate savings and investment with output, Fedderke and Luiz (2005a,b) of a range of institutional variables.[33] These studies confirm that policy, financial structure, savings and investment, institutional structure all determine, and to some extent are determined by economic development. The immediate implication is that equation (18) is underspecified. Ideally estimation should proceed in the presence of a full structural model, incorporating the additional dimensions specified in the identified studies. The small sample size faced by the present studies renders such an approach unrealistic. Inclusion of a time trend is one (admittedly unsatisfactory) means of addressing the impact of the additional factors parsimoniously instead.

On either the long run relationship with restricted trend or the zero restricted trend specification the maximal eigenvalue test statistic confirms the presence of a single, the trace statistic of two cointegrating vectors at the 5% level of significance.

[33] Fedderke (2003) provides a synoptic overview.

In the first instance, however, given the theoretical prior we are testing, we proceed on the assumption that $r = 1$. The results of the estimation are reported in columns (1) and (2) of Table 4, for the specification without and with trend respectively. While all regressors prove both statistically significant, and have the anticipated positive sign, results under the two specifications prove to be distinct. Under the specification reported in column (1), the implied value of θ suggests that FDI and domestic investment are *substitutes* rather than long run complements, provided only that $\alpha + \beta > 0.84$. By contrast, under the estimation reported under column (2) the implied value of θ strictly entails that that FDI and domestic investment are long run *complements*, for all $\alpha + \beta \rightarrow 1$. Symmetrically, the implication is that under the column (1) results, the implied value of γ suggests that FDI and domestic investment are *substitutes* rather than short run complements for $\alpha + \beta < 0.84$, and short run *complements* for $\alpha + \beta > 0.84$. Again, under the estimation of column (2), the implied value of γ suggests that FDI and domestic investment are *substitutes* rather than short run complements, for all $\alpha + \beta \rightarrow 1$. Given that the probability of $\alpha + \beta > 0.84$ is relatively high for South Africa, the contrast between the results of columns (1) and (2) is thus stark. Under (1) FDI and domestic investment are short run complements, and long run substitutes, with the implication of negative long run spill-over effects. Under (2), FDI and domestic investment are short run substitutes, and long run complements, with the implication of positive long run spill-over effects.

Figure 2 illustrates.

To test the robustness of these results to the assumption of a single cointegrating vector, we reestimated both the specification with and without a trend, in the presence of two cointegrating vectors. Given that theory points to a set of determinants of FDI that are at least partially represented in the z-vector included in the estimation of equation (18), we allow for a second cointegrating vector that provides a parsimonious determination of FDI, under inclusion of one risk factor given by an index of political rights or of political instability. Just identification is by:

$$\Pi z_{t-k+1} = \begin{bmatrix} \alpha_{11} & \alpha_{12} \\ \alpha_{21} & \alpha_{22} \\ \alpha_{31} & \alpha_{32} \\ \alpha_{41} & \alpha_{42} \end{bmatrix} \begin{bmatrix} 1 & -\beta_{12} & -\beta_{13} & -\beta_{14} & 0 \\ -\beta_{21} & 0 & -\beta_{23} & 1 & -\beta_{25} \end{bmatrix} \begin{bmatrix} LNRGDP \\ LNTE \\ LNGPSFCS \\ LNRDIY \\ X \end{bmatrix}_{t-k+1} \tag{20}$$

where X denotes $LNINSTAB$ in the first instance. Trace and maximal eigenvalue test statistics

	(1)	(1a)		(1b)		(2)	(2a)		(2b)	
LNRGDP	1.00	1.00	−5.06	1.00	−6.82	1.00	1.00	−5.72	1.00	−1.40
LNGPSFCS	−0.52* {23.34}	−0.48	3.75	−0.58	5.02	−0.80* {14.36}	−0.83	6.05	−0.81	−5.12
LNTE	−0.30* {20.36}	−0.37		−0.19	0.00	−0.22* {4.65}	−0.29		−0.23	0.00
LNRDIY	−0.06* {8.19}	−0.03	1.00	−0.10	1.00	−0.06* {13.55}	−0.04	1.00	−0.06	1.00
LNPOL				0.00	0.32				0.00	0.49
LNINSTAB			0.04					0.07		
Trend						0.01 {2.40}	0.01	−0.07	0.10	0.25
$ecm1_{t-1}$	−0.70* (0.21)	−0.37** (0.20)	−0.82 (0.58)	−0.49∗ (0.20)	−1.89 (2.03)	−0.58* (0.27)	−1.24* (0.53)	−0.64 (0.45)	−1.06* (0.48)	1.75 (1.98)
$ecm2_{t-1}$		0.04 (0.03)	−0.22* (0.10)	$0.31E-4$ ($0.27E-4$)	−0.001* ($0.44E-3$)		−0.01 (0.03)	−0.24* (0.07)	0.004 (0.02)	−0.17* (0.08)
adj-R^2	0.66	0.52	0.33	0.74	0.56	0.70	0.67	0.38	0.67	0.63
Dummy		1980-94					1980-94		1980-94	
* denotes significance at the 5% level; ** denotes significance at the 10% level; Figures in curly and round parentheses										
denote chi-square test statistics and standard errors respectively.										

Table 4: VECM Estimation, Growth Impact of FDI

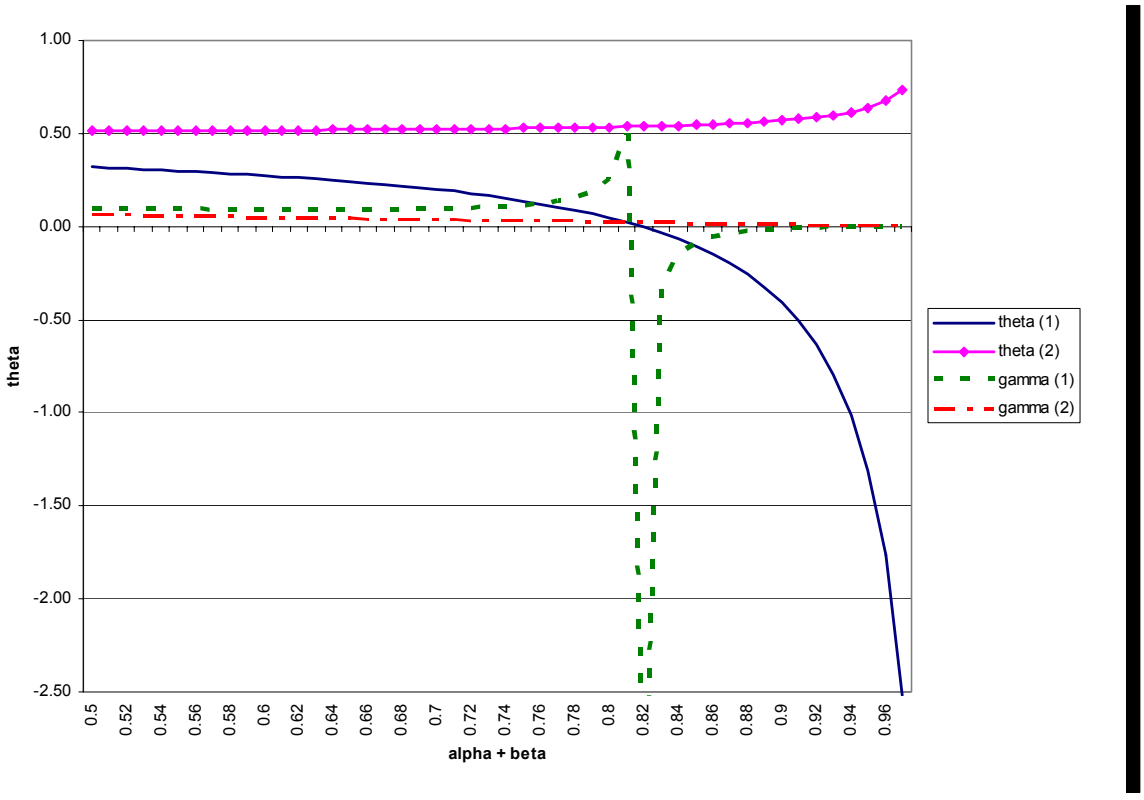

Figure 2: Implied θ, γ, values under estimation in the absence and presence of long run trend.

continue to affirm the possibility of two cointegrating relationships.[34] Columns (1a) and (2a) report the results. While there is some marginal sensitivity of results to the presence of the second cointegrating vector, the core results regarding the complementarity or substitutability of domestic and foreign investment under two alternative specifications remains unaffected. The specification with trend continues to affirm long run complementarity and short run substitutability of domestic and foreign investment, regardless of the value of $\alpha + \beta$. The specification without trend, continues to imply long run substitutability and short run complementarity of domestic and foreign investment as $\alpha + \beta \rightarrow 1$.[35]

As a final robustness check of our findings we replaced $LNINSTAB$ with an alternative institutional measure given by $LNPOL$. While the two variables measure somewhat different dimensions of the South African political institutional structure, from the point of view of foreign investors the distinction may be less important. Changes in political rights as measured by $LNPOL$ represent a source of uncertainty to investors since the direction of future policy may come to be subject to future review. Where such changes favour the possibility of increased populist pressure after periods of long political repression, the uncertainty may be additionally exacerbated. In columns (1b) and (2b) we report results of estimations replacing $LNINSTAB$ with $LNPOL$. Core results regarding the complementarity or substitutability of domestic and foreign capital under the two alternative specifications again remain unaffected. In the presence of a trend, we continue to affirm long run complementarity and short run substitutability of domestic and foreign investment, while removal of the trend again implies long run substitutability and short run complementarity as $\alpha + \beta \rightarrow 1$.

We have provided theoretical and prior empirical findings in support of the inclusion of trends in estimation. These constitute our primary reasons for the specification in the presence of a trend in the long run specification. One concern might be that the trends included in the long run specification of columns (2) of Table 4 prove insignificant. As a final step we therefore test for the appropriateness of trend inclusion in an unrestricted VAR under the specification of equation (18). The chi-square distributed test statistic on the trend zero restriction is 16.7599, rejecting the null of the zero restriction.

Under this evidence, and given the prior theoretical and empirical evidence in favour of the

[34] We suppress these for the sake of brevity of exposition. Full results available from the authors on request.
[35] Indeed, the finding becomes even more binding, with the critical $\alpha + \beta$ value falling to approximately 0.75.

inclusion of the trend in estimation, our preferred results are those under columns (2) of Table 4. The finding is thus of complementarity of foreign and domestic capital in the long run (and short run substitutability), implying a positive technological spill-over from foreign to domestic capital.

Our preferred specification confirms a positive spill-over effect of FDI on capital and labour, and hence on output in the long run for South Africa.

4.4. The Determinants of FDI

Regardless of whether foreign direct investment generates positive or negative spill-overs, it remains vital to isolate the determinants of FDI in South Africa - either to promote or inhibit its positive or negative impacts on output in the long run. It is to this question that the final empirical section of the paper now turns. While the estimation of equation (20) provides an initial parsimonious representation of some potential determinants of FDI, our theoretical sections provide an indication of a fuller set of potential determinants. It is to the fuller structural specification of the FDI equation that we now turn.

We employ time series data for South Africa from 1960 to 1997, again in the context of the Johansen VECM specification. Our starting proposition is given by equation (19), with the implication that $r = 1$. The theoretical priors given by sections 3.2.1. and 3.2.2. suggest the following sign restrictions on the coefficients to be estimated:

$$\beta_{12} > 0; \beta_{13} \gtrless 0; \beta_{14} < 0; \beta_{15} < 0; \beta_{16} > 0; \beta_{17} < 0; \beta_{18} < 0; \beta_{19} > 0 \tag{21}$$

The ambiguity on β_{13} relates to the possibility that either horizontal or vertical FDI may dominate. Provided that the FDI South Africa is attracting is dominated by vertical FDI, the implication is of $\beta_{13} > 0$, given $RATIO \equiv L/K$, while a preponderance of horizontal over vertical investment suggests $\beta_{13} < 0$ instead. The $\beta_{18} < 0$ restriction arises from the expectation that rising imports obviate the need for FDI, since the domestic market can be sufficiently accessed from foreign production bases. Conversely, $\beta_{19} > 0$ arises since increases in the competitiveness of the domestic economy would increase the attraction of the domestic economy as a base for production - including by foreign investors.[36]

[36] See the discussion in Helpman (1984) and Helpman & Krugman (1985).

		VAR=2; Unrestricted Intercept; No Trend		
Null	Alternative	Max Eigen	95% Crit Val	99% Crit Val
$r = 0$	$r = 1$	86.58*	42.68	39.99
$r \leq 1$	$r = 2$	34.58	36.38	33.67
$r \leq 2$	$r = 3$	27.63	29.79	27.05
$r \leq 3$	$r = 4$	12.26	22.19	19.63
Null	Alternative	Trace	95% Crit Val	99% Crit Val
$r = 0$	$r = 1$	161.05*	95.14	89.90
$r \leq 1$	$r = 2$	74.47*	66.94	62.65
$r \leq 2$	$r = 3$	39.89	42.73	39.59
$r \leq 3$	$r = 4$	12.26	22.19	19.63
* indicates rejection of null at 5% level				

Table 5: Maximal Eigenvalue and Trace Statistics

Table 5 reports maximal eigenvalue and trace statistics for equation (20). While the maximal eigenvalue test statistic favours $r = 1$, the trace statistic suggests $r = 2$. Two considerations favour the imposition of $r = 1$. First, theory does not favour a second cointegrating vector. Wages, factor proportions, GDP, trade intensity, as well the institutional variables of equation (20) would all require fuller specifications for full equilibrium relationships plausible on theoretical grounds. Second, the second cointegrating vector is likely a reflection of the partial integration of the $OPENX$ variable included in the specification - as noted in the data section of the paper. For these reasons we estimate under $r = 1$. Reported results investigate the sensitivity of the core findings on FDI determinants under $r > 1$.

Estimation results are reported in Table 6.

Our base estimation is reported in column (1a), which confirms our sign priors and the statistical significance of all regressors. Of significance in the interpretation of the results, is that the coefficient which had an ambiguous prior, β_{13}, is consistently found to be negative in our estimations - since $RATIO \equiv L/K$ it follows that FDI has been capital intensive. The implication is then that FDI has been dominated by horizontal rather than vertical investment. For the remainder, market size ($LNRGDP$) carries a strong positive elasticity (a 1% increase in GDP generates an increase of foreign direct investment liabilities of approximately 20%). Corporate tax (TAX) crowds-out foreign direct investment liabilities, with implied elasticities of 2.70, 3.97, and 5.94 at the minimum, mean and maximum values of the effective corporate tax rate. Wage costs ($LNAVEWAGE$) not

	(1a)	(2a)	(2b)	(2c)	
$LNRDIY$	1.00	1.00	1.00	1.00	−16.74
$LNRGDP$†	−20.13* {57.88}	−13.56* {52.70}	−7.63* {5.13}	−6.57	–
$RATIO$	0.78* {57.92}	0.48* {42.58}	0.39* {5.26}	0.20	1.00
$LNAVEWAGE$	5.62* {58.90}	3.62* {46.76}	2.47* {5.17}	1.61	4.68
TAX	0.09* {66.45}	0.06* {57.61}	0.002 {0.006}	0.05	−0.58
$LNPROP$†	−6.66* {52.38}	−3.81* {42.72}	−2.03** {3.09}	−0.76	−35.46
$LNINSTAB$†	0.03* {54.93}	0.02* {41.15}	0.03* {9.07}	–	0.37
$OPENM$†	21.59 * {52.65}	13.51 * {41.00}	6.11* {4.75}	4.24	74.99
$OPENX$†	−32.75* {58.80}	−19.79* {34.15}	−7.89** {3.16}	−4.50	−165.65
$ecm1_{t-1}$	−0.48* (0.03)	−0.25* (0.05)	−0.31* (0.03)	−0.27* (0.12)	3.84 (3.84)
$ecm2_{t-1}$				0.01 (0.01)	−0.33* (0.08)
$adj - R^2$	0.99	0.98	0.98	0.75	0.67
Dummy		1980-1993	1980-1993	1980-1993	1980-1993
Sample	1962-1996	1962-1996	1962-1990	1962-1996	

* denotes significance at the 5% level; Figures in curly and round parentheses denote chi-square test statistics and standard errors respectively. † denotes exogeneity

Table 6: VECM Estimation: FDI Drivers

only impact negatively on foreign direct investment, but do so with a strong negative elasticity of 5.62. Openness of the economy conforms to our theoretical priors Increased imports ($OPENM$) lower FDI, increased exports ($OPENX$) raise FDI. The implied elasticities are 4.80, 6.76, 8.40 for imports, and 7.92, 10.13, 13.15, at the minimum, mean and maximum import and export ratios respectively. Finally, political institutional structure also matters for foreign investment liabilities. Both improved property rights, as well as improved political stability serve to raise the attractiveness of South Africa as a destination of foreign investors. The impact of property rights (elasticity of 6.66) is strong, while political instability appears to have had a far weaker impact on FDI than in the case of portfolio capital flows,[37] or in the case of domestic private sector investment performance.[38] Given the long term and potentially irreversible nature of FDI, the greater importance of property rights than political instability is not implausible.

We subject our findings to three separate sensitivity tests. In the first, given that FDI flows

[37] See the discussion in Fedderke and Liu (2002).
[38] See the analysis in Fedderke (2004).

are premised on the integration of the domestic economy with the world economy, we test for the impact of the period of maximum closure of the South African economy - from 1980 - 1993. In the estimation reported in column (2a) of Table 6, we include an additional dummy for the 1980-93 period, given the period of extreme closure of the South African economy during the 1980's, until the political transition of 1994. Note that both the signs, and the statistical significance of all our variables remain unaffected, including our finding that FDI has been horizontal rather than vertical. However, the economic significance of the regressors is strongly affected - often approximately halving the estimated impact obtained under column (1a). Thus the market size elasticity falls to 13.56, the wage elasticity to 3.62, the tax elasticity to 2.65 at the mean corporate tax rate, and the import and export elasticities to 4.23 and 6.12 at the mean trade ratios respectively. The institutional variables are similarly affected, with the property rights elasticity falling to 3.81.

In our second sensitivity test we examine the impact of excluding the 1990's from estimation. The 1990's were a period of significant liberalization of the South African economy - particularly in terms of trade liberalization, but in terms of institutional, political, as well as economic policy terms also.[39] An important question is therefore whether the inclusion/exclusion of the 1990's from estimation serves to impact on our results. Column (2b) reports the results of reestimating equation (20) over the 1962-1990 period. We find that while the broad structural features of our results are robust to the change in sample period (signs and statistical significance remain unaffected), the economic significance again declines under the shorter sample period, though in general the decline is less dramatic than under the inclusion of the 1980's dummy. What is particularly notable, however, is that the impact of trade is dramatically weaker prior to the 1990's, than for the full sample period. In particular, the implied import and export elasticities are 1.93 and 2.43 at the the mean trade ratios of 1962-1990 respectively, as compared to the 4.23 and 6.12 full sample elasticities. Given the increase in the trade elasticities, in conjunction with the increase in the elasticities for market size, wages, and the corporate tax rate, the implication is that the reintegration of South Africa into the world economy appears to have raised the responsiveness of FDI to the standard determinants of the net rate of return on foreign investment identified by theory.

As a final sensitivity check we examine the impact of estimating a two equation system in our

[39] Though the liberalization remains partial. See for instance the discussion in Fedderke and Vaze (2001, 2004).

VECM - despite our theoretical priors mitigating against the inclusion of an additional equilibrium relationship. We tested a number of alternative just identifying restrictions - of which column (2c) reports one.[40] Since we consider the second cointegrating vector to be theoretically arbitrary, we focus our discussion on the vector that isolates the determinants of FDI liabilities. We note that estimated coefficients remain consistent with our theoretical priors identified by means of the sign restrictions specified in (21).

Our preferred specification remains that reported in column (2a), since the specification takes fullest account of the closure and institutional peculiarities of the South African economy over the sample period. The implication of the findings is that determinants of FDI in South Africa lie in the determinants of the net rate of return, as well as the risk profile of the FDI liabilities. There is no great mystery here - and the policy handles are both direct, as well as powerful. Reducing political risk, ensuring property rights, bolstering growth in the market size, as well as wage moderation (ideally lowering real wages), lowering corporate tax rates, and above all of ensuring full integration of the South African economy into the world economy all follow as policy prescriptions from our empirical findings. Finally, additional research might address the question of how FDI might come to switch from the predominance of horizontal, to increased vertical FDI.

5. Policy Implications and Conclusions

This paper has generated two sets of results.

We have found that the growth impact of foreign direct investment is indeed positive for South Africa. The finding is of complementarity of foreign and domestic capital in the long run, implying a positive technological spill-over from foreign to domestic capital. While there is a crowd-out of domestic investment from foreign direct investment, this impact is restricted to the short run. Estimation results thus confirm a positive spill-over effect of foreign direct investment on capital and labour, and hence on output in the long run for South Africa.

In identifying the determinants of foreign direct investment, we find that foreign direct investment in South Africa has tended to be capital intensive, suggesting that foreign direct investment has been

[40] Our conclusions are not materially affected by alternative specifications. Full results are available from the authors on request.

horizontal rather than vertical. Market size carries a strong positive elasticity (a 1% increase in GDP generates an increase of foreign direct investment liabilities of approximately 13.56%). Increases in corporate taxation crowds-out foreign direct investment liabilities, with an elasticity of 2.65, at the mean in sample value of the effective corporate tax rate. Wage costs not only impact negatively on foreign direct investment, but do so with a strong negative elasticity of 3.62. Openness of the economy also has a strong impact on foreign direct investment. Increased imports lower, and increased exports raise foreign direct investment. The implied mean elasticities are 4.23, and 6.12 for import and export ratios respectively. Finally, political institutional structure also matters for foreign investment liabilities. Both improved property rights, as well as improved political stability serve to raise the attractiveness of South Africa as a destination of foreign investors. The impact of property rights (elasticity of 3.81) is strong, while political instability appears to have had a far weaker impact on foreign direct investment than in the case of portfolio capital flows, or in the case of domestic private sector investment performance. Given the long term and potentially irreversible nature of foreign direct investment, the greater importance of property rights than political instability is not implausible.

The implication of the findings is that determinants of foreign direct investment in South Africa lie in the determinants of the net rate of return, as well as the risk profile of the foreign direct investment liabilities. There is no great mystery here - and the policy handles are both direct, as well as powerful. Reducing political risk, ensuring property rights, most importantly bolstering growth in the market size, as well as wage moderation (ideally lowering real wages), lowering corporate tax rates, and ensuring full integration of the South African economy into the world economy all follow as policy prescriptions from our empirical findings. Finally, additional research might address the question of how foreign direct investment might come to switch from the predominance of horizontal, to increased vertical foreign direct investment.

References

Balasubramanyam, V.N., Salisu, M., and Sapsford, D., 1996, Foreign Direct Investment and Growth in EP and IS Countries, *Economic Journal*, 106, 92-105.

Barrel,R., and Pain, N., 1997, Foreign Direct Investment, Technological Change and Economic Growth within Europe, *Economic Journal*, 107(1), 1770-85.

Barrell, R., Gottschalk, S.D , and Hall, S.G., 2004, Foreign Direct Investment and Exchange Rate Uncertainty in Imperfectly Competitive Industries, Paper Presented at the Royal Economic Society Annual Conference, 2004, Swansea, United Kingdom.

Basu, P., Chakraborty, C., and Reagle, D., 2003, Liberalization, FDI, and Growth in Developing Countries: A Panel Cointegration Approach, *Economic Inquiry*, 41(3), 510-516.

Blomström, M., 1983, *Foreign Investment and Spillovers*, Routledge: London and New York.

Blomström, M. and Wolf, E., 1994, Multinational Corporations and Productivity Convergence in Mexico , in Baumol,W., Nelson, R. and Wolff, E.N., Editors, *Convergence of Productivity: Cross-National Studies and Historical Evidence*, Oxford: University Press.

Blomström, M., and Kokko, A., 1997, Regional Integration and Foreign Direct Investment, *National Bureau of Economic Research Working Paper 6019.*

Blomström, M., Lipsey, R., and Zejan, M., 1994, What Explains the Growth of Developing Countries? in Baumol, W., Nelson, R., and Wolff, E.N., Editors, *Convergence of Productivity: Cross-National Studies and Historical Evidence*, 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(1), 115-135.

Cassim, R., 2000, Determinants fo Investment in South Africa: a sectoral approach, *Trade and Industry Policy Strategies Report.*

Cushman, D.O., 1985, Real Exchange rate Risk, Expectations, and the Level of Direct Investment, *Review of Economics and Statistics*, 51, 297-308.

De Mello, L., 1997, Foreign Direct Investment in Developing Countries and Growth: A Selective Survey, *Journal of Development Studies*, 34(1), 1-34.

Fedderke, J.W., 2001, Technology, Human Capital and Growth: evidence from a middle income country case study applying dynamic heterogeneous panel analysis, *Econometric Research Southern Africa Working Paper, No.23.*

Fedderke, J.W., 2002a, The Structure of Growth in the South African Economy: Factor Accumulation and Total Factor Productivity Growth 1970-97, *South African Journal of Economics*, 70(4), 611-46.

Fedderke, J.W., 2002b, The Virtuous Imperative: modelling capital flows in the presence of nonlinearity, *Economic Modelling*, 19, 445-61.

Fedderke J.W., 2003, From Chimera to Prospect: Toward an Understanding of the South African Growth Absence, *Report to the World Bank and SA National Treasury.*

Fedderke, J.W., 2004, Investment in Fixed Capital Stock: testing for the impact of sectoral and systemic uncertainty, *Oxford Bulletin of Economics and Statistics*, 66(2), 165-87.

Fedderke, J.W., De Kadt, R., and Luiz, J., 2001, Indicators of Political Liberty, Property Rights and Political Instability in South Africa, *International Review of Law and Economics*, 21(1), 103-34.

Fedderke J.W., Kularatne, C., and Mariotti, M., 2004, Mark-up Pricing in South African Industry, *Research Report, South African National Treasury*; under review.

Fedderke, J.W., and Liu, W., 2002, Modelling the Determinants of Capital flows and Capital Flight: with an application to South African data from 1960-95, *Economic Modelling*, 19, 419-44.

Fedderke, J.W., and Luiz J.M., 2005a, The Political Economy of Institutions, Stability and Investment: a simultaneous equation approach in an emerging economy – the case of South Africa, Mimeo: University of Cape Town.

Fedderke, J.W., and Luiz J.M., 2005b, Does Human Generate Social and Institutional Capital? Exploring Evidence from Time Series Data in a Middle Income Country, Mimeo: University of Cape Town.

Fedderke, J.W., and Vaze, P., 2001, The Nature of South Africa's Trade Patterns, *South African Journal of Economics*, 69(3), 436-73.

Fedderke, J.W., and Vaze, P., 2004, Response to Rangasamy and Harmse: Trade Liberalisation in the 1990's, *South African Journal of Economics*, 72(2), 408-13.

Fielding, D., 1997, Aggregate Investment in South Africa: A Model with Implications for Political Reform, *Oxford Bulletin of Economics and Statistics*, 59(3): 349-69.

Fielding, D., 2000, Manufacturing Investment in South Africa: A Time Series Model, *Journal of Development Economics*, 58, 405-27.

Globerman, S., and Shapiro, D., 1999, The Impact of Government Policies on Foreign Direct Investment: The Canadian Experience, *Journal of International Business Studies*, 30(i3), p513(2).

Golub, S., 2003, Measures of Restrictions on Inward Foreign Direct Investment for OECD Countries, *OECD Economics Department Working Papers, No 357.*

Greenslade, J., Hall, S.G., and Henry, S.G.B., 1999, On the Practical Identification of Cointegrated Systems with an application to UK Wage and Price Setting, Paper presented at the African Econometrics Society Conference 1999.

Helpman, E., 1984, A Simple Theory of International Trade with Multinational Corporations, *Journal of Political Economy*, 92(3).

Helpman, E., and Krugman, P., 1985, *Market Structure and International Trade*, Cambridge MA: MIT Press.

Johansen, S., 1991, Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models, *Econometrica*, 59(6), 1551-80

Johansen, S., and Juselius, K., 1990, Maximum Likelyhood Estimation and Inference on Cointegration - with applications to the demand for money, *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.

Johansen, S., and Juselius, K., 1992, Testing structural hypotheses in a multivariate cointegrating analysis of the PPP and the UIP for UK, *Journal of Econometrics*, 53, 211-44.

Kularatne, C., 2002, An Examination of the Impact of Financial Deepening on Long-Run Economic Growth: An Application of a VECM Structure to a Middle-Income Country Context, *South African Journal of Economics,* 70(4), 647-87.

Lewis, J.D., 2002, Promoting Growth and Employment in South Africa, *South African Journal of Economics*, 70(4), 725-76.

Mariotti, M., 2002, An Examination of the Impact of Economic Policy on Long-Run Economic Growth: An Application of a VECM Structure to a Middle-Income Context, *South African Journal of Economics*, 70(4), 688-725.

Markusen, J.H., 2002, Multinational Firms and the Theory of International Trade, *Cambridge: MIT Press.*

Nicoletti, G., Golub, S., Hajkova, D., Mirza, D., and Yoo, K.Y., 2003, Policies and International Integration: Influences on Trade and Foreign Direct Investment, *OECD Economics Department Working Papers No.359.*

Pesaran, M.H., and Y. Shin, 1995a, Long Run Structural Modelling, Mimeo, University of Cambridge.

Pesaran, M.H., and Y. Shin, 1995b, An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, *DAE Working Paper no 9514*, Department of Applied Economics, University of Cambridge.

Pesaran, M.H., Y. Shin, and R.J. Smith, 1996, Testing for the Existence of a Long Run Relationship, *DAE Working Paper No.9622*, Department of Applied Economics, University of Cambridge.

Ramirez, M, 2000, Foreign Direct Investment in Mexico: A Cointegration Analysis, *Journal of Development Studies*, 37(1), 138-162.

Romer, P.M., 1986, Increasing Returns and Long-Run Growth, *Journal of Political Economy*, 94(5), 1002-37.

Romer, P., 1993, Idea Gaps and Object Gaps in Economic Development, *Journal of Monetary Economics*, 32(3), 543-573.

Romm, A,T., 2005, The Relationship between Saving and Growth in South Africa: A Time Series Analysis, *South African Journal of Economics*, 171-89.

Sethi, D., Guisinger, S.E., Phelan, S.E., and Berg, D.M., 2003, Trends in Foreign Direct Investment flows: A Theoretical and Empirical Analysis, *Journal of International Business Studies*, 34, 315-326.

Smith, P., 2002, Patent Rights and Trade:Analysis of Biological Products, Medicinals and Botanicals, and Pharmaceuticals, *American Journal of Agricultural Economics*, 84(2), 495-512.

Wickens, M.R., 1996, Interpreting cointegrating vectors and common stochastic trends, *Journal of Econometrics*, 74, 255-71.