The Effects of FDI Shocks in South Africa: A Global VAR Approach

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ABSTRACT

This paper uses the global vector autoregressive (global VAR) model to analyze the foreign direct investment linkages between South Africa and the BRIC (Brazil, Russia, India, and China) countries over the period 1995Q1-2009Q4. It specifically evaluates the impact of output and outward FDI shock from the BRIC countries on South African inward and outward FDI. The results shows that the notable performances of the BRIC economies are not transmitted to the South African economy by FDI flows, but transmitted through the exchange rates from some countries and trade from the others.

Keywords: BRICS, Global VAR, Foreign Direct Investment

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Güney Afrika'da Doğrudan Yabancı Yatırım Şoklarının Etkileri: Küresel VAR Yaklaşımı

ÖZET

Bu çalışma küresel vektör otoregresif modeli kullanarak Güney Afrika ile BRIC (Brezilya, Rusya, Hindistan ve Çin) ülkeleri arasında 1995-2009 dönemlerinde gerçekleşen doğrudan yabancı yatırım ilişkilerini incelemeye çalışmaktadır. Çalışma özellikle BRIC ülkelerinden gelen ekonomik (çıktı) ve doğrudan yabancı yatırım şoklarının Güney Afrika ekonomisi üzerine etkilerini incelemektedir. Çalışmada yapılan analiz sonuçlarına göre, BRIC ülkelerinin ekonomik performansları Güney Afrika ekonomisi üzerine etkileri doğrudan yabancı yatırımlar tarafından aktarılmadığı gözlemlenmiştir. Ancak, bazı BRIC ülkelerinin ekonomik performansı ticaret yoluyla ve bazılarının da döviz kurları üzerinden Güney Afrika ekonomisine aktarıldığı tespit edilmiştir.

Anahtar Kelimeler: BRICS, Küresel VAR, Doğruda Yabancı Yatırımlar

Introduction

Foreign direct investment (FDI) is an important and one of the main economic forces that currently drives the integration of developing countries with the world economy. Its role is important in the globalization process and in stimulating economic growth in host countries, especially developing ones (Barro and Sala-i-Martin, 1995; Hermes and Lensink, 2003, and Ndikumana and Verick, 2008). Economic theory has identified a number of channels, such as transferring technology (Dimelis, 2005), productivity gains, and know-how in host countries (Girma, 2005), through which FDI inflows may be beneficial to the host economy. One of the important feature of financial globalization is increased international linkages engendered by FDI flows, which raise significant challenges for policymakers and scholars. Hence, countries should have a better understanding of FDI flows so that they can create avenues to attract it.

This paper aims to explore the FDI linkages between South Africa and the BRIC (Brazil, Russia, India, and China) countries using a global vector autoregressive (global VAR) model. Especially, the impact of real output and outward FDI shocks coming from the BRIC countries on SA FDI inflows, FDI outflows and real output over the period 1995Q1-2009Q4. Firstly, the direct linkages between inward and outward FDI among SA and the BRICs is analyzed via outward FDI shocks. Secondly, as the indirect approaches assume the association between the inward FDI and growth contributes to economic growth, which in turn, contributes to outward FDI, the relationship between outward FDI and growth is also analyzed via output shocks. To the best of my knowledge, this paper is the first application of the global VAR model to study the FDI linkages between SA and the BRIC countries.

The rest of the paper is organized as follows. Section 2 describes the recent FDI trends in SA and with each of the BRIC countries. Section 3 outlines the main features of the global VAR model and discusses its estimation. Section 4 outlines the specification and estimation of the model, the sources of data used and their transformation. This is followed by the analyzing the empirical results, while Section 6 concludes the paper.

South African FDI Linkages with the BRICs

The BRICS[2] countries have increasingly been integrated to the global economy through inward FDI. China ranked the 1st, India the 2nd, Russia the 3rd, Brazil 5th are among the top five recipient countries in the world, an indication of a confidence in these economies. SA ranked the 23rd FDI recipient country in the world showing that it is behind of the other BRICS countries attracting FDI (UNCDAT, 2007).

South African economy, the largest economy in the African continent, received the lowest inward FDI, while it was the second largest investor among the BRICS countries between 1980 and 1993. This low inward FDI is attributed to the SA's economic policies, such as comprehensive intervention in the economy during the apartheid era, economic distortions and political unrests in the 1980s, trade sanctions and investment boycotts through to the 1980s and early 1990s, which had negative influence on foreign investor (Clark and Borgran, 2003).

SA has undertaken important economic reforms in order to attract more FDI following the re-integration with the global economy since 1994. Accordingly, there was large increase of FDI inflows to SA, which increased from US$ 818 million in 1996 to US$ 3.8 billion in 1997. However, the aggregate FDI inflows to SA (US$ 9.2 billion over the period 1994-2000) have remained at low levels compared to other BRICS countries (UNCTAD, 2011). Aggregate FDI outflows from SA also increased to US$ 10.7 billion over the period 1994-2000, only outperformed by China whose FDI outflow stood at US$ 14 billion (UNCTAD, 2011).It can be noticed that, FDI inflows to SA had been volatile historically and were heavily influenced by single large deals, rather than greenfield investments, which tend to involve smaller values.

In terms of sectoral distribution, FDI into SA has been relatively diversified. Table 1 shows that tertiary sector is the main recipient of FDI, followed by secondary and primary sectors respectively. Financial intermediation, insurance, real-estate and business services and community, social and personal services are the major recipient of foreign investment. Both

[2] In 2011, South Africa officially became a member of the BRIC group.

industries have 23% share, followed by transport, storage and communication with 17%, manufacturing with 13%, mining and quarrying with 8%, electricity, gas and water with 7%, and wholesale and retail trade, catering and accommodation with 5%. Agriculture, forestry and fishing (3%) and construction (1%) has have attached very little FDI over the same period.

Table 1: SA's FDI by Sector, 2002-2010 (Rand in millions, else indicated)

Sector/Industry	2004	2005	2006	2007	2008	2009	2010
Primary	332	329	334	346	363	377	404
Agriculture, forestry and fishing	107	106	107	107	109	109	108
Mining and quarrying	225	222	227	239	254	268	297
Secondary	382	389	400	412	425	421	411
Tertiary	2,120	2,192	2,274	2,365	2,488	2,625	2,723
Electricity, gas and water	172	175	181	190	210	251	278
Construction	18	20	22	24	27	31	35
Trade	145	151	159	167	176	184	184
Finance	642	668	697	720	745	764	785
Total	**2,834**	**2,910**	**3,008**	**3,122**	**3,276**	**3,423**	**3,538**

Source: South African Reserve Bank, *Quarterly Bulletin,* various issues.

In terms of regional sources of FDI, European Union (EU) is the largest source of FDI flows to SA, flowed by North and South America, Asia, Africa, and Australia (SARB, 2011). Total inward FDI from EU was 67%, while 7.8% and 7.7% from Asia and America respectively. Only 0.5% and 0.1% of total inward FDI were from Africa and Australia, respectively (SARB, 2011). FDI from UK alone was US$ 63.1 billion in 2009, which accounted for 53.8% of total FDI inflows. Netherlands is also a key investor in SA with 10.5% of total FDI, followed by Germany with 6.7%, the US with 6.4%, and China with 3.9%. FDI into SA from Russia, India, and Brazil accounts for only 0.6%, 0.2% and 0.02%, respectively, of total inflows. It is notable that China is the largest investor in SA among the BRICS, which occupies the fifth position of SA's biggest FDI sources in 2009.

In terms of regional destination of SA's outward FDI, EU is also the largest recipient of SA's FDI, flowed by Asia, Africa, America, and Australia (SARB, 2011). The EU received 41.6% of total outward FDI from SA. It was

followed by Asia with 24% and 21.6% respectively. America and Australia received 8.6% and 4.1% outward FDI (SARB, 2011). The main individual countries recipients of SA outward FDI are China, the UK, Luxemburg, Mauritius, and the US. In 2009, China was the leading recipient of FDI outflows from SA, which accounted for 19%. India, Brazil, and Russia received very little FDI from SA (see Table 2).

Table 2: SA's FDI by Country, end-2009 (US$ in millions, else indicated)

Rank	FDI inflows from:			Rank	FDI outflows to:		
	Country	US$	Percent		Country	US$	Percent
	Total	117,434	100.00		Total	72,583	100.00
1	UK	63,199	53.82	1	China	13,744	18.94
2	Netherlands	12,387	10.55	2	UK	9,052	12.47
3	Germany	7,872	6.70	3	Luxembourg	9,009	12.41
4	US	7,563	6.44	4	Mauritius	6,682	9.21
5	China	4,604	3.92	5	US	4,699	6.47
14	Russia	730	0.62	34	India	126	0.17
19	India	307	0.26	41	Brazil	84	0.12
44	Brazil	27	0.02	49	Russia	22	0.03

Source: *Coordinated Direct Investment Survey*, IMF, 2011.

Methodology

The global VAR model introduced by Pesaran, Schuermann and Weiner (2004) to simplify the analysis of interactions among countries on a global level. They take a slightly different approach by combining several VAR models. In a global VAR model, the country-specific foreign variables are treated as weakly exogenous. The global VAR model has developed through scholars, such as Dees, di Mauro, Pesaran and Smith (2007a) Dees, Holly, Pesaran, Smith (2007b) , Chudik and Pesaran (2009), and Çakır and Kabundi (2013) among others.

Let assume that there are $N+1$ countries in the world and indexed them as $i=0,1,2,...,N$, where 0 replicates the reference country. Denoting each country i VARX* model can be modelled as:

$$\mathrm{x}_{it} = \mathrm{c}_{i0} + \mathrm{c}_{i1}t + \Phi_i \mathrm{x}_{i,t-1} + \Lambda_{i0}\mathrm{x}^{*}_{it} + \Lambda_{i1}\mathrm{x}^{*}_{i,t-1} + \Psi_{i0}\mathrm{d}_t + \Psi_{i1}\mathrm{d}_{t-1} + \varepsilon_{it} \quad (1)$$

where $t=1,2,...,T;$, x_{it} demonstrates a $(k_i \times 1)$ vector of domestic variables which belongs to country i at time t, while x^{*}_{it} indicates is a $(k^{*}_i \times 1)$ vector of

foreign variables specific to country i at time t. $\mathbf{c}_{i0}$ is a $(k_i \times 1)$ vector of fixed intercept coefficients, $\mathbf{c}_{i1}$ is a $(k_i \times 1)$ vector of coefficients of the deterministic time trend, Φ_i is a $(k_i \times k)_i$ matrix of coefficients associated to lagged domestic variables. Λ_{i0} and Λ_{i1} are $(k_i \times k_i^*)$ indicates matrices of coefficients relevant to contemporaneous and lagged foreign variables, $\mathbf{d}_t$ denotes a set of common global variables, such as oil prices and Ψ_{i0} and Ψ_{i1} are the matrices of fixed coefficients. The error term, ε_{it} , is a $(k_i \times 1)$ vector of idiosyncratic country-specific shocks, where $\varepsilon_{it} \sim i.i.d.(0, \sum_{ii})$ and $\sum_{ii}$ is $(k_i \times k_i)$ non-singular for $i = 0,1,....,N$, and $t = 1,2,...,T$.

The fixed trade weights, given by trade shares, are used to build foreign variables, $\mathbf{x}_{it}^*$. For instance, w_{ij} is the share of country j in the total trade of country i, measured in US dollar. Thus:

$$w_{ii} = 0, \quad \forall_i = 0,1,...,N$$

and

$$\sum_{j=0}^{N} w_{ij} = 1, \quad \forall_{i,j} = 0,1,...,N$$

Specially, the set of foreign variables specific to country i defined as:

$$\mathbf{x}_{it}^* = \sum_{j=0}^{N} w_{ij} \mathbf{x}_{jt} \tag{2}$$

where $w_{ij} \geq 0$ is the weights added to the variables. The foreign and global variables are treated as weakly exogenous for considering each country as small when compared to the rest of the world. Therefore, the weights capture the importance of country j for country i. The annual trade averages over the period 1995-2009 is used to capture the weights. Country-specific shocks are serially uncorrelated with the other country shocks through the link between domestic and foreign variables. These shocks are cross-sectionally weakly dependent, such that for each t:

$$\varepsilon_{it}^* = \sum_{j=0}^{N} w_{ij} \varepsilon_{jt} \xrightarrow{q.m.} 0$$

Hence, the idiosyncratic shocks are correlated across countries as;

$$E\left(\varepsilon_{it}\varepsilon'_{jt'}\right)=\begin{cases}\Sigma_{ij} & for\ t=t'\\ 0 & for\ t\neq t'\end{cases}$$

Therefore, the global VAR model allows for interdependence between countries through: (i) the dependence of domestic variables with foreign and their lagged values; (ii) the dependence of the country-specific domestic variables on common global exogenous variables, such as oil prices; (iii) the contemporaneous dependence of the idiosyncratic shock in country i on the shocks in country j.

The country-specific model in equation (1) is considered without the global variables, in order to construct the global VAR model as:

$$\mathrm{x}_{it}=\mathrm{c}_{i0}+\mathrm{c}_{i1}t+\Phi_i\mathrm{x}_{i,t-1}+\Lambda_{i0}\mathrm{x}^{*}_{it}+\Lambda_{i1}\mathrm{x}^{*}_{i,t-1}+\varepsilon_{it} \qquad (3)$$

Then, domestic and foreign variables for each country are grouped together:

$$z_{it}=\begin{pmatrix}\mathrm{x}_{it}\\ \mathrm{x}^{*}_{it}\end{pmatrix}$$

Hence, equation (3) becomes:

$$\mathrm{A}_i z_{it}=\mathrm{c}_{i0}+\mathrm{c}_{i1}t+\mathrm{B}_i z_{i,t-1}+\varepsilon_{it} \qquad (4)$$

where $\mathrm{A}_i=\left(\mathrm{I}_{ki}-\Lambda_{i0}\right)$, $\mathrm{B}_i=\left(\Phi_{i1}-\Lambda_{i1}\right)$. The dimensions of A_i and B_i are $k_i\times\left(k_i+k_i^{*}\right)$ and A_i has a full row rank, that is $rank\left(\mathrm{A}_i\right)=k_i$.

Later, all country -specific domestic variables are collected together to create a global vector, g_t, denoting the total number of endogenous variable in the system: $\mathrm{g}_t=\left(\mathrm{g}'_{0t},\mathrm{g}'_{1t},\ldots,\mathrm{g}'_{Nt}\right)'$. Then, the country-specific variables can be written in terms of the global variable vector to obtain the following identity:

$$\mathrm{z}_{it}=\mathrm{L}_i\mathrm{g}_t \quad \text{for} \quad \forall_i=0,1,2,\ldots,N \qquad (5)$$

where L_i is the $\left(k_i+k_i^{*}\right)\times k$ matrix collecting the trade weights, w_{ij}, $\forall_{i,j}=0,1,\ldots,N$. L_i is defined as the *link* matrices and allows the country-specific models to be written in terms of the global variable vector

Furthermore, using the identity in equation (5) in each country-specific model (4), it follows that:

$$\mathrm{A}_i\mathrm{L}_i\mathrm{g}_t = \mathrm{c}_{i0} + \mathrm{c}_{i1}t + \mathrm{B}_i\mathrm{L}_i\mathrm{g}_{t-1} + \varepsilon_{it} \tag{6}$$

where $\mathrm{A}_i\mathrm{L}_i$ and $\mathrm{B}_i\mathrm{L}_i$ are both has $k_i \times k$ dimensional matrices.

Finally, by stacking each country-specific model in equation (6), the global VAR for all the endogenous variables in the system obtained, g_t,

$$\mathrm{K}\mathrm{g}_t = \mathrm{c}_0 + \mathrm{c}_1 t + \mathrm{M}\mathrm{g}_{t-1} + \varepsilon_t \tag{7}$$

where

$$\mathrm{K} = \begin{pmatrix} \mathrm{A}_0\ \mathrm{L}_0 \\ \mathrm{A}_1\ \mathrm{L}_1 \\ \vdots\ \ \vdots \\ \mathrm{A}_N\ \mathrm{L}_N \end{pmatrix}, \mathrm{M} = \begin{pmatrix} \mathrm{B}_0\ \mathrm{L}_0 \\ \mathrm{B}_1\ \mathrm{L}_1 \\ \vdots\ \ \vdots \\ \mathrm{B}_N\ \mathrm{L}_N \end{pmatrix}, \mathrm{c}_0 = \begin{pmatrix} \mathrm{c}_{00} \\ \mathrm{c}_{10} \\ \vdots \\ \mathrm{c}_{N0} \end{pmatrix}, \mathrm{c}_1 = \begin{pmatrix} \mathrm{c}_{01} \\ \mathrm{c}_{11} \\ \vdots \\ \mathrm{c}_{N1} \end{pmatrix}, \varepsilon_t = \begin{pmatrix} \varepsilon_{0t} \\ \varepsilon_{1t} \\ \vdots \\ \varepsilon_{Nt} \end{pmatrix}$$

The K matrix has $k \times k$ dimensions and if it is non-singular, such as of full rank, then it can be inverted. By inverting the K matrix the global VAR model is obtained in its reduced form:

$$\mathrm{g}_t = \mathrm{b}_0 + \mathrm{b}_1 t + \mathrm{H}\mathrm{g}_{t-1} + \mu_t \tag{8}$$

where

$$\mathrm{b}_0 = \mathrm{K}^{-1}\mathrm{c}_0, \quad \mathrm{b}_1 = \mathrm{K}^{-1}\mathrm{c}_1, \quad \mathrm{H} = \mathrm{K}^{-1}\mathrm{M}, \quad \mu_t = \mathrm{K}^{-1}\varepsilon_t.$$

where g_t is the global $k \times 1$ vector, $k = \sum_{i=0}^{N} k_i$ is the total number of the endogenous variables in the global model. It contains all macroeconomic variables for all the countries. b_0 and b_1 are $k \times 1$ vectors of coefficients, H is a $k \times k$ matrix of coefficients, and μ_{it} is a $k \times 1$ vector of reduced-form.

The model in equation (8) is solved recursively and used to construct generalized impulse response analysis. Following Pesaran et al. (2004) and Dees

et al. (2007a), global VAR model is built in this paper to assess the importance of trade linkages between South Africa and the BRIC countries.

Estimation of the Model

This paper uses the global VAR model[3] to investigate the FDI linkages between SA and the BRIC countries for the period 1995Q1-2009Q4. There are 32 countries[4] in the model, where 8 countries in the euro area are grouped together[5] and the remaining 24 countries are modelled individually. In this paper, the countries in the euro area are treated as a single economy, while the remaining 24 countries are estimated individually.

Table 3: Countries and Regions in the global VAR model

Regions	Countries	Abbreviation	Regions	Countries	Abbreviation
Euro Area	Austria	AUR	Developed Countries	Japan	JPN
	Belgium	BEL		Australia	AUS
	Finland	FIN		Canada	CAN
	France	FRA		New Zealand	NZL
	Germany	GER		England	UK
	Italy	ITL		United States	US
	Netherlands	NTH	Asian Countries	Indonesia	INS
	Spain	SPN		Korea	KOR
Rest of Europe	Norway	NOR		Malaysia	MAL
	Sweden	SWE		Singapore	SIN
	Switzerland	SWT		Thailand	THA
	Turkey	TUR	BRICS	Brazil	BRA
Latin America	Argentina	ARG		Russia	RUS
	Chile	CHL		India	IND
	Mexico	MEX		China	CHN
	Peru	PER		South Africa	SA

A set of potential determinant variables that influence the FDI flows between countries are included in the model. The main variables of interest are: the real output, FDI inflows, and FDI outflows. Firstly, the market size, which is generally measured by gross domestic product (GDP). Trade openness is also included as a determinant of FDI. Following previous empirical studies the ratio

[3] I would like to thank Vanessa Smith and Alessandro Galesi for making their Matlab codes available on the website: *www.cfap.jbs.cam.ac.uk/research/gvartoolbox*.
[4] Countries and regions included in the global VAR model are available on request.
[5] The eight countries originally joined the Euro on 1 January 1999 are grouped into one.

of real imports and exports to GDP are used as a proxy for trade openness. A positive relationship between FDI and trade openness is well established in the literature (Edwards, 1990; Morisset, 2000, and Asiedu, 2002). Moreover, given their typical effect on FDI flows, the real effective exchange rates and inflation are also included. There is an extensive literature indicating that real exchange rate volatility has an adverse effect on FDI inflows (Kiyota and Urata, 2004, and Ruiz, 2005). The inflation is included as it is a proxy of sound macroeconomic policy specifically monetary policy (Burnside and Dollar, 1998, and Salisu, Fidelis, Ogwumike, 2010). Finally, to account for possible common factors, we also the price of oil is included in the model as well. The trade shares for the BRICS economies, with a *Rest* category showing the trade shares with the remaining countries in the model, are presented in Table 4.

Table 4: Trade Weights of the BRICS

Country	Brazil	China	India	Russia	SA
Brazil	0	0.017935	0.01437	0.013141	0.017967
China	0.084299	0	0.117286	0.102787	0.088929
India	0.013288	0.020336	0	0.018037	0.029187
Russia	0.038116	0.056531	0.03728	0	0.006438
SA	0.008556	0.008143	0.017915	0.001094	0
Rest	0.855740	0.897056	0.813149	0.864941	0.857479

Source: *Direction of Trade Statistics*, IMF, 2010.
Note: Trade weights are computed for the period 1995-2009 and displayed in column by country and each column sums to 1, not the row.

The Weighted Symmetric Augmented Dickey-Fuller (WS-ADF) proposed by introduced by Park and Fuller (1995), is used for unit root tests to analyze the integration the integration properties of both the domestic and foreign variables. The lag length is determined by the Akaike Information Criterion (AIC) based on standard ADF regressions. The WS-ADF statistics for the level and first differences of the country specific domestic and foreign variables (the BRICS countries) are reported in Table 5. The results of WS-ADF test statistics generally shows that the variables are integrated of order one. However, the unit root hypothesis for real exchange rate in China, for outward FDI in India, are rejected. The remaining countries and variables treated as I(1).

Table 5: WS-ADF Test Statistics for Variables

Variables			Brazil	China	India	Russia	SA
Domestic variables	Real GDP	y	0.874	1.815	1.126	-0.557	0.211
		Δy	-6.112	-3.708	-6.767	-3.940	-3.570
	Inflation	dp	-1.619	-1.413	-4.276	-1.406	-4.131
		Δdp	-8.116	-5.324	-6.634	-4.782	-6.442
	Exchange rates	ep	-1.242	0.396	0.764	-0.679	-1.666
		Δep	-5.226	-2.437	-4.813	-4.223	-5.110
	Trade openness	open	-0.732	2.400	-1.903	-1.695	-1.774
		Δopen	-5.442	-5.715	-5.779	-5.015	-3.348
	Inward FDI	ifdi	-2.753	-1.195	-0.183	-2.047	-4.742
		Δifdi	-8.034	-4.769	-4.129	-8.207	-8.172
	Outward FDI	ofdi	-4.772	1.369	-0.720	-0.679	-5.832
		Δofdi	-8.126	-3.344	-2.321	-12.001	-10.880
Foreign variables	Real GDP	ys	0.824	0.431	1.055	1.114	1.071
		Δys	-4.461	-4.170	-4.711	-4.577	-4.483
	Inflation	dps	-3.337	-1.760	-2.081	-2.298	-1.658
		Δdps	-5.632	-4.656	-5.022	-6.196	-6.501
	Trade openness	opens	-2.383	-1.618	-2.143	-1.812	-2.147
		Δopens	-4.854	-5.446	-5.202	-4.703	-5.022
Global variables	Oil price	poil	-0.756	-0.756	-0.756	-0.756	-0.756
		Δpoil	-6.292	-6.292	-6.292	-6.292	-6.292

Note: Test statistics are with 5% significant level. The 95% critical value with and without trend is -3.24 and - 2.55, respectively. The first difference level of data are represented with Δ.

For the country specific foreign variables, the lag order firstly set to one for all countries and then the orders are changed from 1 to 2 for Brazil and SA, after finding not smooth responses in initial analysis of the GIRFs. Thereafter a cointegration analysis is performed to identify the rank of the cointegration space (Johansen, 1992), under the assumptions that the foreign variables are weakly exogeneous. The cointegration rank is derived by employing the trace test statistic at the 95% critical values and the *maximum eigenvalue* statistics. The number of cointegration relations for the focus economies is reduced, for instance from 4 to 2 for Brazil, from 5 to 1 for China, from 3 to 2 for India, from 5 to 1 for Russia, and from 3 to 1 for SA to address the issue of possible overestimation of the number of cointegration relationships (Dees et al., 2007a). The number of

cointegration relationships for each domestic and foreign variables are presented in Table 6.

Table 6: Lag Orders of the VARX* Models and Cointegrating Relationship

Lag Order / Country	Domestic Variables	Foreign Variables	Cointegrating Relations
Brazil	1	2	2
China	2	1	1
India	1	1	2
Russia	1	1	1
SA	1	2	1

Note: Johansen's trace statistics at the 95% critical value is used.

The procedure proposed by Johansen (1992) and Harbo, Johansen, Nielsen and Rahbek (1998) is employed to test weak exogeneity of the country specific foreign and global variables. This test assesses the joint significance of the estimated error-correcting terms in the marginal models for the foreign and global variables. The results of weak exogeneity test allow us to estimate each country model separately and show that most of the weak exogeneity assumptions cannot be rejected as reported in Table 7.

Table 7: Weak Exogeneity Tests of Variables

Country	F test	Critical Values	Country-Specific Foreign and Global Variables			
			Real GDP	Inflation	Trade openness	Oil Prices
Brazil	F(1,39)	4.0913	0.0709	0.4971	1.5344	0.0217
China	F(4,36)	2.6335	0.8480	1.6260	1.4070	1.2658
India	F(2,38)	3.2448	0.9393	3.7924	4.4668	0.9232
Russia	F(2,38)	3.2448	0.1164	0.3041	0.3380	0.4935
SA	F(1,39)	4.0913	0.0412	1.2767	1.5600	0.4801

Note: Critical values are at the 5% significance level.

Empirical Findings

This section presents a selection of results for the focus economies that correspond to different applications of the global VAR model. The generalized impulse response functions (GIRF) which has been developed by Pesaran and Shin (1998) consider the historical correlations between variables. The results of

GIRFs are presented first and then the results of the generalized forecast error variance decomposition (GFEVDs) for selected variables are presented.

The Generalized Impulse Response Functions

The rationale is that an increase in outward FDI from one country translates into an increase in inward FDI in another country, which in turn, contributes to economic growth and outward FDI of the other country, and vice-versa. In this study, a positive shock to the real output and outward FDI coming from the BRIC, as a bloc, over a 24-quarter horizon is considered. The time profile of the effects of these shocks to the SA economy is also assessed. Bootstrapped confidence intervals are calculated at the 90% significance level.

Figure 1 presents the empirical results. The first shock that is considered is a positive shock to real output from the BRIC as a bloc. It shows that this shock does not have significant impact on SA FDI inflows. The sign of the effect is positive, but insignificant, which means that a positive performance of the BRIC countries does not translate into FDI flows to SA. Moreover, the results of outward FDI shock from the BRIC also does not have significant effect on SA inward FDI. Likewise, the response of SA inward FDI and output to outward FDI shock is positive and insignificant.

These results are consistent with the data in Table 2, which ranks the Brazil, Russia, India and China at the 44th, 14th, 19th, and the 1st as a source of FDI, respectively. In 2009, the share of these economies' investment in South Africa was only 0.02%, 0.62%, 0.23% and 3.92% of total FDI inflows to the country. Therefore, it is not surprising that Brazil's, Russia's, and India's investments in SA are as small as to have any significant impact on the SA economy. On the other hand, it is surprising that Chinese impressive overall performance does not have noticeable effect in SA economy even though China has become number one destination of SA's FDI and fifth largest investor in SA (Table 2). One would see probably a different picture if bilateral FDI series where available.

The results are also evidenced by the fact that the total BRIC countries' investment in South Africa was only US$ 5.6 billion in 2009, which accounted only for 4.8% of total FDI inflows to SA (Table 2). However, among BRIC

countries, China has the biggest share of FDI inflows, which accounted for 3.9%, while the rest of the BRIC countries share the remaining 0.9%. The effect of outward FDI from the BRIC, as a bloc, on SA has so far been insignificant, relative to the effects of trade.

Generalized Forecast Error Variance Decompositions

This section presents the results for a selected sample of variables that have potential interest for their importance in FDI flows between SA and the BRIC countries. Table 8 shows the GFEVDs for each SA variable explained by the real output and outward FDI shocks from the BRIC countries and the BRIC bloc. The results are averaged over 24 quarter horizon.

Table 8: GFEVDs of SA Variables Explained by the Shocks from the BRICs

Shocks from Country and Variable		**SA Variables**				
		Real GDP	**Exchange rates**	**Trade openness**	**Inward FDI**	**Outward FDI**
Brazil	GDP	0.008	0.009	0.010	0.008	0.007
	Outward FDI	0.023	0.007	0.010	0.006	0.015
Russia	GDP	0.006	0.014	0.006	0.007	0.007
	Outward FDI	0.008	0.010	0.006	0.006	0.006
India	GDP	0.008	0.008	0.014	0.011	0.009
	Outward FDI	0.008	0.008	0.007	0.010	0.009
China	GDP	0.006	0.011	0.006	0.007	0.007
	Outward FDI	0.007	0.006	0.008	0.008	0.006
BRIC	GDP	0.031	0.059	0.033	0.039	0.037
	Outward FDI	0.027	0.035	0.035	0.035	0.032

Note: Forecast horizon is 24 quarters and forecast error variance averaged over 24 quarters.

The portion of the variance decomposition explained by the real output shock from the individual countries and the BRIC bloc seems to be small for SA variables. For instance, the real output shock from Brazil, Russia, India, China and the BRIC bloc only explains 0.08%, 0.06%, 0.08%, 0.06%, and 0.3% of the variation in SA real output, respectively. Though, the fraction of the variance evidenced by the real output shocks from these countries and the BRIC is estimated to be different from different countries. Such as, the output shock from Brazil explains 0.10% of the variation in SA trade openness, while the same shock from Russia explains only 0.06%. Moreover, the output shocks from India, China and the BRIC bloc explains 0.14%, 0.06% and 0.33% of the variation in trade

openness, 0.08%, 0.11%, and 0.59% of the variation in exchange rates, respectively. It is important to note that the channel of transmission of output shocks is exchange rate for some countries, such as Russia and the BRIC bloc, and trade for other countries, such as Brazil and India.

The relative impact of the outward FDI shocks coming from Brazil, Russia, India, China and the BRIC bloc appear to be large for SA real output, while appear to be small for inward FDI, except India and the BRIC bloc. The outward FDI shock from Brazil mainly explains 0.23% and 0.15% of the variation in SA real output and outward FDI, respectively. However, the outward FDI shock from Russia and the BRIC bloc explains 0.10% and 0.35% of variation in SA real exchange rates, respectively. It seems that the real exchange rate is the main channel of transmission of outward FDI shocks, especially between Russia and the BRIC bloc. This is in line with the statement by Friedman (1953) and Mundell (1961) that exchange rate acts as a shock absorber, moderating the economy in face of external shocks (see Figure 1).

Conclusions

This paper applied the global VAR model to assess FDI linkages between SA and the BRIC countries using quarterly data for the period 1995Q1 to 2009Q4. Two types of shocks are considered, namely positive real output and outward FDI shocks to assess the time profile of the effects of these shocks. The rationale is that an increase in outward FDI from one country to another translates into a rise in inward FDI to the latter's economy, which in turn, contributes to the economic growth and outward FDI of the other country, and vice-versa. The results based on GIRFs show that real output shocks from the BRIC bloc does not have positive and significant impact on either SA inward FDI or its outward FDI. In addition, outward FDI shocks from the bloc likewise do not have positive and significant impact on SA inward FDI and output. These results indicate that the impressive performances of the BRIC economies are not transmitted to the SA economy by FDI flows, but transmitted through the exchange rate for some countries and trade for the others. Therefore, it is recommend that the FDI flows between SA and the BRIC countries should increase.

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Figure 1: GIRFs of SA Variables to the Shocks from the BRIC