CAUSAL RELATIONSHIP BETWEEN FDI AND POVERTY REDUCTION IN SOUTH AFRICA

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Abstract

This study investigates the causal relationship between poverty reduction and foreign direct investment (FDI) inflows in South Africa using time-series data from 1980 to 2014. A trivariate framework is used in this analysis, with the addition of real gross domestic product (GDP) as an intermittent variable. Employing the autoregressive distributed lag (ARDL)-bounds testing approach to cointegration and ECM-based causality tests, the results from this study found a distinct unidirectional causality from poverty reduction to FDI in both the short run and the long run when poverty reduction is measured by life expectancy and infant mortality rate. However, the results failed to find any causality, irrespective of the time considered, when poverty reduction is measured by household consumption expenditure. Based on the results from this study, it can be concluded that the causal relationship between FDI and poverty reduction is sensitive to the proxy used to measure the level of poverty reduction.

Key Words: South Africa; Household consumption expenditure; Life expectancy; infant mortality rate; Granger-causality

JEL Classification: F21; I32.

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1. **Introduction**

The causal relationship between poverty reduction and foreign direct investment (FDI) has received little coverage in the literature with only a few studies having analysed the causal relationship between the two variables. The majority of the studies on poverty reduction and FDI have focused on the impact of FDI on poverty. Yet, it is equally important to establish the causal relationship between FDI and poverty for policy making that effectively assists in poverty reduction. Thus, the direction of causality indicates which of these two variables can be influenced first in order to achieve a change in the other variable as desired. Moreover, of the few studies that have attempted to establish the causal relationship between FDI and poverty, most have employed a bivariate causality framework, which is now known to have some limitations (see Odhiambo, 2008; Solarin and Shahzab, 2013). The inclusion of a third intermittent variable can alter the direction of causality or the magnitude of variables (Loizides and Vamvoukas, 2005; Odhiambo, 2009b). In this study, gross domestic product is included as an intermittent variable. The results from the few studies that have analysed causality between FDI and poverty are inconclusive. Some studies have found unidirectional causality between the two variables (see Gohou and Soumare, 2012). A bidirectional causal relationship has also been found (see, for example, Soumare, 2015). Other studies have found no causal relationship between FDI and poverty (see Ogunniyi and Igberi, 2014). The results of these studies have varied depending on the poverty measure used, the sample period, and the methodology employed. This makes generalisation of the findings across all countries inappropriate.

The current study, therefore, aims to establish the causal relationship between FDI and poverty reduction in South Africa between 1980 and 2014 using the Granger-causality test. The study
differs fundamentally from previous studies in a number of ways. First, the study analyses the causal relationship between FDI and poverty reduction within a trivariate framework. This overcomes the limitations of a bivariate framework that has been employed in other studies with the omission of variable bias (see Solarin and Shahzab, 2013). Second, the study investigates the causal relationship between FDI and poverty reduction using three poverty reduction proxies, which are household consumption expenditure (Pov1), infant mortality rate (Pov2), and life expectancy (Pov3). Unlike previous studies that have relied on one poverty reduction proxy, the inclusion of three poverty reduction measures gives another angle on causality in the study country. Third, the ARDL bounds testing approach to cointegration employed in this study has a number of advantages. For instance, the ARDL bounds approach to cointegration is robust in small samples (see also Odhiambo, 2008; Solarin and Shahbaz, 2013).

South Africa has been selected for investigation mainly because it is one of the largest economies as measured by GDP in Africa, while the country also receives fairly high FDI inflows (World Bank, 2016). An investigation of South Africa will shed more light on the causal relationship between FDI inflows and poverty reduction. This will provide more information to policy makers regarding policy directions in relation to poverty reduction and FDI.

South Africa was among the nations that signed the United Nations’ Millennium Development Goals (MDGs) declaration in 2000, indicating the government’s effort to reduce poverty (United Nations, 2000). South Africa is also a signatory to the Sustainable Development Goals 2030, which was signed in 2015 after the expiry of the MDGs (United Nations, 2017). The country is actively involved in programmes that involve the eradication of poverty. Beside international collaboration,
the country’s development plans also support poverty reduction, starting with the Reconstruction and Development White paper to the National Development Plan 2030 (Government Gazette, 1994; The National Planning Commission, 2011). Apart from poverty reduction initiatives, the government has rolled out policies that have opened the South African economy to the global economy (Government Gazette, 1994; The National Planning Commission, 2011). The policies that the government adopted aimed, among other objectives, to increase foreign direct investment (FDI). For instance, government implemented polices that focused on increasing FDI inflows to augment domestic capital and spur economic growth, which is associated with an increase in standards of living. The policies implemented by the government include sound industrial policies, bilateral and multilateral investment agreements aimed at increasing market access for South African goods, regional integration initiatives, trade liberalisation, regulatory reforms, and capital account liberalisation, among other policies. In response to policies advanced by the government on poverty reduction and attracting FDI, South Africa has realised a gradual increase in FDI inflows and also a reduction in poverty (World Bank, 2016; Statistics South Africa, 2015).

The various policy reforms have resulted in a gradual increase in FDI flows into South Africa. Although FDI inflows as a percentage of GDP were depressed between 1980 and 1994, inflows took an upward trend from 1994 (World Bank, 2016). The average share of FDI to GDP between 1994 and 2014 was 0.9% (World Bank, 2016). On the poverty front, the incidence of poverty, as measured by the poverty headcount at $1.90/day, declined from 31.9% in 1993 to 16.6% in 2011 (World Bank, 2016). There has been a general decrease in poverty in South Africa as evidenced by other poverty measures like the human development index and poverty gap (World Bank, 2016). It is interesting to note, though, that there is a wide difference in poverty levels across
provinces, according to sex, age, and settlement type in South Africa (Statistics South Africa, 2014). What remains uncertain is if FDI has had a role to play in the reduction in poverty experienced.

The rest of the paper is set out as follows: Section 2 provides a brief review of literature; Section 3 outlines estimation techniques covering variable definition, specification of the models, and data sources; Section 4 discusses the results of the study; and Section 5 concludes the study.

2. Empirical Literature Review

The literature on the causal relationship between FDI and poverty reduction is still at the nascent stage. Of the few studies that have attempted to analyse causality between FDI and poverty reduction, the results are mixed. Some studies have found unidirectional causality between FDI and poverty reduction, while others have found bidirectional causality between these variables. A further set of studies have found no causal relationship between FDI and poverty reduction.

Fauzel et al. (2015) investigated the causal relationship between foreign direct investment inflows on poverty reduction in selected Sub-Saharan countries from 1990 to 2010. Using poverty headcount as a poverty reduction measure, they found FDI to Granger-cause poverty reduction. Gohou and Soumare (2012), investigated the causality between FDI and poverty in 5 regional economic communities and 5 customs and monetary unions in Africa. Using Human Development Index (HDI) as a measure of welfare, a unidirectional causality was found running from FDI to HDI. In a separate study, Soumare (2015) studied causal relationship between FDI and poverty in
North Africa between 1990 and 2011. Using Granger–causality test a unidirectional causality was found running from FDI to HDI in Egypt, Morocco, Tunisia and Mauritania.

While some studies have found unidirectional causality between FDI and poverty, others have found bidirectional causality between these variables. Gohou and Soumare (2012) examined the causal relationship between FDI and poverty in five regional economic communities and five customs and monetary unions in Africa from 1990 to 2007. In this study, GDP per capita was used as a poverty proxy and the Granger-causality test was employed. They found a bidirectional relationship between GDP per capita and FDI in the whole region. In a study on North African countries from 1990 to 2011, Soumare (2015) employed the Granger-causality test and found bidirectional causality between FDI and HDI in Algeria. In the same study, when real per capita GDP was used as poverty proxy, a bidirectional causal relationship was found in all the countries, except for Libya.

A further set of studies have found no causality between FDI and poverty. For example, Ogunniyi and Igberi (2014) investigated the causal relationship between FDI and standard of living in Nigeria between 1980 and 2012. Using per capita income as a standard of living proxy and employing the Granger-causality test, they found no causality between FDI and poverty. Thus, the empirical findings with respect to the causal relationship between FDI and poverty are inconclusive.
3. Estimation Techniques

This study is based on the ARDL-bounds test and the ECM-based causality test. The ARDL test has been selected because of a number of advantages. The ARDL approach to cointegration is robust in a small sample (see also Odhiambo, 2009a, Solarin and Shahbaz, 2013). While other conventional approaches to cointegration have a restrictive assumption concerning the order of integration of variables, the ARDL bounds test can be used even when series have a different order of integration (Pesaran et al., 2001: 290; Solarin and Shahbaz, 2013). Another advantage of using the ARDL approach to cointegration is that it provides unbiased estimates of the long-run model, even in cases where some variables are endogenous (Odhiambo, 2009a). The ARDL approach also uses a reduced form single equation, while other conventional cointegration methods employ a system of equations (Pesaran and Shin, 1999). Given these advantages, the study used the ARDL bounds testing approach to cointegration. To determine cointegration, the null hypothesis of no cointegration is tested against the alternative hypothesis of cointegration. The calculated F-statistic is compared to the critical values provided by Pesaran et al. (2001). If the calculated F-statistic falls above the critical value, we reject the null hypothesis of no cointegration. Alternatively, if the F-statistic falls below the lower bound, we conclude there is no cointegration. However, if the F-statistic falls between the upper and the lower bound, the results are inconclusive.

After confirming the existence of a long-run relation, the next step is establishing the direction of causality. The presence of cointegration only indicates the presence of a long-run relationship and the existence of causality in at least in one direction (Narayan and Smyth, 2004). The causal relationship between poverty reduction and FDI is investigated using the ECM-based approach within a trivariate framework. The gross domestic product is added as an intermittent variable to
give a trivariate causality framework consisting of poverty reduction – Pov1, Pov2, Pov3, FDI, and GDP. This is in response to a weakness of a bivariate framework that the results may suffer from omission of variable bias (among others, see Odhiambo, 2008). The use of a trivariate framework can improve the magnitude of the results (see also Odhiambo, 2009a).

In the literature, a number of poverty reduction proxies have been used, including GDP per capita, infant mortality rate, household consumption expenditure, and certain poverty indices, among other poverty proxies. Due to limited time-series data on other proxies and the need to capture income and non-income poverty, household consumption expenditure (Pov1), infant mortality rate (Pov2), and life expectancy (Pov3) were used. Three models – Model 1-3 – were specified to capture the three poverty reduction proxies. In Model 1, poverty reduction is proxied by household consumption expenditure, and the model specification is Pov1|FDI, GDP. Infant mortality rate (Pov2) is used as a poverty reduction proxy in Model 2, and the model specification is Pov2|FDI, GDP. In Model 3, life expectancy (Pov3) is used as a poverty reduction proxy, and the model is specified as Pov3|FDI, GDP. The definition of variables included in the study are given in Table 1.

Table 1: Variables Definition

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pov1</td>
<td>Household consumption expenditure per capita</td>
</tr>
<tr>
<td>Pov2</td>
<td>Infant mortality rate</td>
</tr>
<tr>
<td>Pov3</td>
<td>Life expectancy</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------</td>
</tr>
<tr>
<td>FDI</td>
<td>foreign direct investment inflows as a proportion of GDP</td>
</tr>
<tr>
<td>GDP</td>
<td>Real Gross Domestic Product</td>
</tr>
</tbody>
</table>

### 3.1 Cointegration

Following Odhiambo (2008) and Narayan and Smyth (2008), the ARDL-bounds specification for Models 1-3 are given Equations 1-9.

**ARDL Specification for Model 1 (Pov1, FDI and GDP)**

\[
\Delta Pov_{1t} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{1t-i} + \sum_{i=0}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{i=0}^{n} \alpha_3 \Delta GDP_{t-i} + \beta_1 Pov_{1t-1} + \beta_2 FDI_{t-1} + \beta_3 GDP_{t-1} + \mu_{1t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (1)
\]

\[
\Delta FDI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{1t-i} + \sum_{i=0}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{i=0}^{n} \alpha_3 \Delta GDP_{t-i} + \beta_1 Pov_{1t-1} + \beta_2 FDI_{t-1} + \beta_3 GDP_{t-1} + \mu_{1t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (2)
\]

\[
\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{1t-i} + \sum_{i=0}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{i=0}^{n} \alpha_3 \Delta GDP_{t-i} + \beta_1 Pov_{1t-1} + \beta_2 FDI_{t-1} + \beta_3 GDP_{t-1} + \mu_{1t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3)
\]

**ARDL Specification for Model 2 (Pov2, FDI and GDP)**
\[ \Delta \text{Pov}_2 = a_0 + \sum_{i=1}^{n} a_1 \Delta \text{Pov}_{2-i} + \sum_{t=0}^{n} a_2 \Delta \text{FDI}_{t-i} + \sum_{t=0}^{n} a_3 \Delta \text{GDP}_{t-i} + \theta_1 \text{Pov}_{2-t-1} + \theta_2 \text{FDI}_{t-1} + \theta_3 \text{GDP}_{t-1} + \mu_1 t \]  
\[ (4) \]

\[ \Delta \text{FDI}_t = a_0 + \sum_{i=1}^{n} a_1 \Delta \text{Pov}_{2-i} + \sum_{t=0}^{n} a_2 \Delta \text{FDI}_{t-i} + \sum_{t=0}^{n} a_3 \Delta \text{GDP}_{t-i} + \theta_1 \text{Pov}_{2-t-1} + \theta_2 \text{FDI}_{t-1} + \theta_3 \text{GDP}_{t-1} + \mu_1 t \]  
\[ (5) \]

\[ \Delta \text{GDP}_t = a_0 + \sum_{i=1}^{n} a_1 \Delta \text{Pov}_{2-i} + \sum_{t=0}^{n} a_2 \Delta \text{FDI}_{t-i} + \sum_{t=0}^{n} a_3 \Delta \text{GDP}_{t-i} + \theta_1 \text{Pov}_{2-t-1} + \theta_2 \text{FDI}_{t-1} + \theta_3 \text{GDP}_{t-1} + \mu_1 t \]  
\[ (6) \]

**ARDL Specification for Model 3 (Pov3, FDI and GDP)**

\[ \Delta \text{Pov}_3 = a_0 + \sum_{i=1}^{n} a_1 \Delta \text{Pov}_{3-i} + \sum_{t=0}^{n} a_2 \Delta \text{FDI}_{t-i} + \sum_{t=0}^{n} a_3 \Delta \text{GDP}_{t-i} + \theta_1 \text{Pov}_{3-t-1} + \theta_2 \text{FDI}_{t-1} + \mu_1 t \]  
\[ (7) \]

\[ \Delta \text{FDI}_t = a_0 + \sum_{i=1}^{n} a_1 \Delta \text{Pov}_{3-i} + \sum_{t=0}^{n} a_2 \Delta \text{FDI}_{t-i} + \sum_{t=0}^{n} a_3 \Delta \text{GDP}_{t-i} + \theta_1 \text{Pov}_{3-t-1} + \theta_2 \text{FDI}_{t-1} + \theta_3 \text{GDP}_{t-1} + \mu_1 t \]  
\[ (8) \]

\[ \Delta \text{GDP}_t = a_0 + \sum_{i=1}^{n} a_1 \Delta \text{Pov}_{3-i} + \sum_{t=0}^{n} a_2 \Delta \text{FDI}_{t-i} + \sum_{t=0}^{n} a_3 \Delta \text{GDP}_{t-i} + \theta_1 \text{Pov}_{3-t-1} + \theta_2 \text{FDI}_{t-1} + \theta_3 \text{GDP}_{t-1} + \mu_1 t \]  
\[ (9) \]
Where $\alpha_0$ is a constant, $\alpha_1 - \alpha_3$ and $\theta_1 - \theta_3$ are regression coefficients, and $\mu_{1t}$ is an error term.

3.2 A Granger-Causality Model Specification

The ECM-based Granger-causality models are specified for Model 1, Model 2, and Model 3. The introduction of the lagged error correction term reintroduces the long-run relationship that could have been lost with differencing (see Odhiambo, 2009a) The ECM-based causality test also enables analysis of causality in both the short run and the long run. The F-statistics obtained from the variable deletion test or the Wald test gives the short-run causality, while the long-run relationship is given by the t-statistic on the lagged error correction term. The ECM-based Granger-causality model used in this study can be expressed as follows:

**ECM-based Granger-causality for Model 1 (Pov1, FDI, GDP)**

The ARDL Granger-causality model specification for Model 1 is given in Equations 10-12.

\[
Pov1_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov1_{t-i} + \sum_{i=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{i=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_1 ECM_{t-1} + \mu_{1t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (10)\]

\[
\Delta FDI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov1_{t-i} + \sum_{i=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{i=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_2 ECM_{t-1} + \mu_{2t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (11)\]

\[
\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov1_{t-i} + \sum_{i=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{i=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_3 ECM_{t-1} + \mu_{3t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (12)\]
Where $\alpha_0$ is a constant, $\alpha_1 - \alpha_3$ and $\theta_1 - \theta_3$ are regression coefficients, and $\mu_{1t} - \mu_{3t}$ are the error terms.

**ECM-based Granger-causality for Model 2 (Pov2, FDI, GDP)**

The ARDL Granger-causality model specification for Model 2 is given in Equations 13-15.

\[
\Delta Pov_{2t} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{2t-i} + \sum_{t=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_1 ECM_{t-1} \\
+ \mu_{1t} \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots (13)
\]

\[
\Delta FDI_{t} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{2t-i} + \sum_{t=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_2 ECM_{t-1} \\
+ \mu_{2t} \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots (14)
\]

\[
\Delta GDP_{t} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{2t-i} + \sum_{t=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_3 ECM_{t-1} \\
+ \mu_{3t} \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots (15)
\]

Where $\alpha_0$ is a constant, $\alpha_1 - \alpha_3$ and $\theta_1 - \theta_3$ are regression coefficients, and $\mu_{1t} - \mu_{3t}$ are the error terms.

**ECM-based Granger-causality for Model 3 (Pov3, FDI, GDP)**

The ARDL Granger-causality model specification for Model 3 is given in Equations 16-18.

\[
\Delta Pov_{3t} = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov_{3t-i} + \sum_{t=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_1 ECM_{t-1} \\
+ \mu_{1t} \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots \cdots (16)
\]
\[ \Delta FDI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov3_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_2 ECM_{t-1} + \mu_{2t} \quad (17) \]

\[ \Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta Pov3_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \Delta GDP_{t-i} + \theta_3 ECM_{t-1} + \mu_{3t} \quad (18) \]

**Data Sources**

The study used time-series data from 1980 to 2014 to investigate the dynamic causal relationship between poverty reduction and FDI. The data employed in this study was obtained from the World Bank development indicators. Microfit 5.0 was used to analyse the data in this study.

### 4. Empirical Analysis

#### 4.1 Unit Root Test

The ARDL approach to cointegration does not require pretesting of variables for stationarity. In this study unit root test are done on Pov1, Pov2, Pov3, FDI and GDP to confirm if the variables are integrated of at most order 1 \([I(1)]\). The ARDL approach is only applicable if variables are integrated of order 0 \([I(0)]\), order \([I(1)]\) or fractionally integrated (Pesaran *et al.*, 2001). The results of Dickey Fuller Generalised Least Square (DF-GLS), Phillip-Perron (PP root) and Perron unit root test (PPU root test) and presented in Table 2.
### Table 2: Unit Root Test Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>DF-GLS Test</th>
<th></th>
<th></th>
<th>PP Test</th>
<th></th>
<th></th>
<th>PPU(root) Test</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stationarity of</td>
<td>Stationarity of</td>
<td>Stationarity of</td>
<td>Stationarity of</td>
<td>Stationarity of</td>
<td>Stationarity of</td>
<td>Stationarity of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variable in Levels</td>
<td>variable in First</td>
<td>Variable in Levels</td>
<td>variable in First</td>
<td>Variable in Levels</td>
<td>variable in First</td>
<td>Variable in Levels</td>
<td>variables in First</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Without Trend</td>
<td>With Trend</td>
<td>Without Trend</td>
<td>With Trend</td>
<td>Without Trend</td>
<td>With Trend</td>
<td>Without Trend</td>
<td>Difference</td>
<td></td>
</tr>
<tr>
<td>Pov1</td>
<td>0.0553</td>
<td>-1.9904</td>
<td>-3.4348***</td>
<td>-3.8536***</td>
<td>0.6090</td>
<td>-1.0017</td>
<td>-3.5089**</td>
<td>-4.2448**</td>
<td></td>
</tr>
<tr>
<td>Pov2</td>
<td>-0.6196</td>
<td>-2.4142</td>
<td>-1.7115</td>
<td>-3.4807**</td>
<td>-1.5984</td>
<td>-1.8477</td>
<td>-2.7283</td>
<td>-6.0645***</td>
<td></td>
</tr>
<tr>
<td>Pov3</td>
<td>-3.7138***</td>
<td>5.0544***</td>
<td>-</td>
<td>-</td>
<td>-3.2334***</td>
<td>-3.7126**</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>FDI</td>
<td>-4.1328***</td>
<td>5.8740***</td>
<td>-</td>
<td>-</td>
<td>-4.2533***</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>GDP</td>
<td>0.9090</td>
<td>-1.4383</td>
<td>-3.4211***</td>
<td>-4.1374***</td>
<td>2.1948</td>
<td>-0.9724</td>
<td>-3.5341***</td>
<td>-4.4367***</td>
<td></td>
</tr>
</tbody>
</table>

Note: *, ** and *** denote stationarity at 10%, 5% and 1% significance levels respectively.
Although the results of the unit root tests vary from one test to the other and from poverty reduction proxy to the other, overall the variables are stationary in first difference. Only FDI is consistently stationary in levels across all three tests of unit root. The results confirm the suitability of the ARDL-bounds test approach to cointegration and causality analysis.

**ARDL-Bounds Testing Approach to Cointegration**

Cointegration results for Model 1, Model 2 and Model 3 are presented in Table 3.

**Table 3: Bound F-test for Cointegration: Model 1, Model 2 and Model 3**

<table>
<thead>
<tr>
<th>Country</th>
<th>Dependent variable</th>
<th>Function</th>
<th>F-Statistic</th>
<th>Cointegration Status</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td><strong>Panel A: Model 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>Pov1</td>
<td>F(Pov1</td>
<td>FDI, GDP)</td>
<td>5.820**</td>
</tr>
<tr>
<td></td>
<td>FDI</td>
<td>F(FDI</td>
<td>Pov1,GDP)</td>
<td>5.605**</td>
</tr>
<tr>
<td></td>
<td>GDP</td>
<td>F(GDP</td>
<td>Pov1, FDI)</td>
<td>2.268</td>
</tr>
<tr>
<td><strong>Panel B: Model 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>Pov2</td>
<td>F(Pov2</td>
<td>FDI, GDP)</td>
<td>1.808</td>
</tr>
<tr>
<td></td>
<td>FDI</td>
<td>F(FDI</td>
<td>Pov2,GDP)</td>
<td>7.400***</td>
</tr>
<tr>
<td></td>
<td>GDP</td>
<td>F(GDP</td>
<td>Pov2, FDI)</td>
<td>1.087</td>
</tr>
<tr>
<td><strong>Panel C: Model 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Africa</td>
<td>Pov3</td>
<td>F(Pov3</td>
<td>FDI, GDP)</td>
<td>9.096***</td>
</tr>
<tr>
<td></td>
<td>FDI</td>
<td>F(FDI</td>
<td>Pov3,GDP)</td>
<td>6.539***</td>
</tr>
<tr>
<td></td>
<td>GDP</td>
<td>F(GDP</td>
<td>Pov3, FDI)</td>
<td>2.865</td>
</tr>
</tbody>
</table>

**Asymptotic Critical values (unrestricted intercept and no trend)**

<table>
<thead>
<tr>
<th>Pesaran et al.(2001:300) critical values(Table CI(iii) Case III)</th>
<th>1%</th>
<th>5%</th>
<th>10%</th>
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<tbody>
<tr>
<td>I(0)</td>
<td>5.15</td>
<td>6.36</td>
<td>3.79</td>
</tr>
</tbody>
</table>

Note:*, ** and *** denote stationarity at 10%, 5% and 1% significance levels respectively
The results in Table 3 confirm cointegration between poverty reduction, FDI and GDP, although the results are sensitive to the poverty reduction proxy used. The F-statistics confirm existence of cointegration between Pov1, Pov2, Pov3, FDI and GDP. Cointegration is confirmed in the following functions; Model 1, \( F (Pov1 | FDI, GDP) \) and \( F (FDI | Pov1, GDP) \); Model 2, \( F (FDI | Pov2, GDP) \); and Model 3 \( F (Pov3 | FDI, GDP) \) and \( F (FDI | Pov3, GDP) \). The presence of cointegration in these functions indicate presence of causality in at least one direction (see Granger, 1988; Narayan and Smyth, 2008). The direction of causality is obtained by running an ECM-based causality test. A further investigation is done to determine direction of causality using the ECM based causality test.

**ECM Based Causality Testing**

After establishing existence of cointegration between poverty reduction – Pov1, Pov2, Pov3, FDI and GDP, to proceed with Granger-causality analysis, for those equations that cointegration was confirmed, an ECM is included as an additional variable in the causality analysis. Those equation where no cointegration was confirm, Granger-causality is performed on the variables without an ECM. Short-run causality is determined by F-statistics on the explanatory variables given by the Variables Deletion Test and the long run causality is determined by the significance of the lagged error correction term using the t-statistic (see Narayan and Smyth, 2008; Odhiambo, 2009a). The results of the ECM-based causality test are shown in Table 4.
Table 4: ECM Based Causality Results

<table>
<thead>
<tr>
<th>Panel A: Model 1</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable</strong></td>
<td><strong>F-Statistics</strong></td>
<td><strong>ECM t-statistics</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ΔPov1</td>
<td>ΔFDI</td>
<td>ΔGDP</td>
</tr>
<tr>
<td>ΔPov1</td>
<td>-</td>
<td>1.095 [0.350]</td>
<td>5.946*** [0.008]</td>
</tr>
<tr>
<td>ΔFDI</td>
<td>0.183 [0.673]</td>
<td>-</td>
<td>4.038* [0.056]</td>
</tr>
<tr>
<td>ΔGDP</td>
<td>3.240* [0.082]</td>
<td>0.390 [0.537]</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Panel B: Model 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dependent Variable</strong></td>
<td><strong>F-Statistics</strong></td>
<td><strong>ECM t-statistics</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ΔPov2</td>
<td>ΔFDI</td>
<td>ΔGDP</td>
</tr>
<tr>
<td>ΔPov2</td>
<td>-</td>
<td>0.439 [0.513]</td>
<td>3.144* [0.087]</td>
</tr>
<tr>
<td>ΔFDI</td>
<td>6.231** [0.016]</td>
<td>-</td>
<td>0.007 [0.934]</td>
</tr>
<tr>
<td>ΔGDP</td>
<td>3.661* [0.067]</td>
<td>3.309* [0.081]</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Panel C: Model 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dependent Variable</strong></td>
<td><strong>F-Statistics</strong></td>
<td><strong>ECM t-statistics</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ΔPov2</td>
<td>ΔFDI</td>
<td>ΔGDP</td>
</tr>
<tr>
<td>ΔPov2</td>
<td>-</td>
<td>0.488 [0.492]</td>
<td>3.790* [0.064]</td>
</tr>
<tr>
<td>ΔFDI</td>
<td>4.757** [0.038]</td>
<td>-</td>
<td>3.696* [0.065]</td>
</tr>
<tr>
<td>ΔGDP</td>
<td>4.761** [0.040]</td>
<td>4.103** [0.030]</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: *, ** and *** denote stationarity at 10%, 5% and 1% significance levels respectively.

The empirical results reported in Table 4, Panel A for Model 1, where Pov1, FDI and gross domestic product (GDP) are variables, reveal that in South Africa, no short-run or long-run causality exist between FDI and poverty reduction (Pov1). The results suggest that there is no
Granger-causality between FDI and poverty reduction in South Africa irrespective of the time considered, when household consumption expenditure is used as a poverty reduction measure. The findings from this study, although not expected, compare favourably with some studies (see Ogunniyi and Igberi, 2014).

Other results presented in Table 4, Panel A confirm that in South Africa there is: (i) a bidirectional causality between GDP and poverty reduction (Pov1) in the short run; (ii) a unidirectional causality in the long run from GDP to poverty reduction (Pov1); (ii) a unidirectional causality from GDP to FDI in the short run and in the long run.

Empirical results reported in Table 4, Panel B, for Model 2 where poverty reduction is captured by infant mortality rate (Pov2) show that in South Africa there is a unidirectional causality from poverty reduction (Pov2) to FDI. These results apply irrespective of whether the estimation was done in the short run or in the long run. The short-run causality is confirmed by significant F-statistic for $\Delta$Pov2 in the $\Delta$FDI function that is statistically significant at 5% significance level; while the long-run causality is shown by the error correction term (ECM) in the $\Delta$FDI function that is negative and statistically significant at 1% significance level. Thus, in South Africa, it is poverty reduction that Granger-cause FDI, both in the long run and the short run, when poverty reduction is measured by infant mortality rate.
Other results reported in Table 4, Panel B reveal that there is; (i) a bidirectional causality between poverty reduction and GDP in the short run; (ii) a unidirectional causality from FDI to GDP in the short run.

The empirical results in Table 4, Panel C for Model 3 show that there is a distinct unidirectional causality from Pov3 to FDI in the short run and in the long run in South Africa. The significant short-run causality is supported by a significant F-statistics for ΔPov3 in the FDI function, while the long run causality is supported by a negative error correction term that is statistically significant at 1% level of significance. The results suggest poverty reduction Granger-cause FDI in South Africa irrespective of the time considered. The results are consistent with findings from other studies where absorption capacity was found to be important in increasing the capacity to benefit from FDI (see, for example, Klein et al., 2001:5).

Other results reported in Table 4, Panel C show that: in South Africa there is; (i) a bidirectional causality between poverty reduction to GDP in the short run and a unidirectional causality from GDP to poverty reduction in the long run; and (ii) a bidirectional causality between FDI and GDP in the short run and a unidirectional causality from GDP to FDI in the long run. A summary of Granger-causality results is given in Table 5.
Table 5: Summary of Granger-causality Results

<table>
<thead>
<tr>
<th>Model</th>
<th>Causality</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short run</td>
<td>Long run</td>
</tr>
<tr>
<td>Model 1 (Pov1)</td>
<td>No causality</td>
<td>No causality</td>
</tr>
<tr>
<td>Model 2 (Pov2)</td>
<td>Pov2→FDI</td>
<td>Pov2→FDI</td>
</tr>
<tr>
<td>Model 3 (Pov3)</td>
<td>Pov3→FDI</td>
<td>Pov3→FDI</td>
</tr>
</tbody>
</table>

Notes: Pov1 = household consumption expenditure; Pov2 = infant mortality rate; Pov3 = life expectancy

5. Conclusion
In this study, the causal relationship between poverty reduction and FDI was investigated using time series data for South Africa from 1980 to 2014. Gross Domestic Product was included as a third variable in the analysis to form a tri-variate Granger-causality test. The intermittent variable was used to overcome the limitation of bivariate causality test, where the results can be improved or altered due to the inclusion of the intermittent variable. The study employs the ECM-based causality test to investigate the Granger-causality relationship between FDI and poverty reduction. Three poverty reduction measures were used in this study to minimise reliance on one variable. To this end, three models were used, Model 1 with household consumption expenditure as a measure of poverty reduction, and Model 2 with infant mortality rate as the second poverty reduction measure and Model 3 with life expectancy as a proxy for poverty reduction. The findings from this study reveal that the causality between FDI and poverty reduction is sensitive to the poverty reduction proxy used and time considered. No causality was confirmed when household consumption expenditure was used as a poverty reduction measure. However, when infant mortality rate and life expectancy were used as a poverty reduction proxy a unidirectional causality was recorded from poverty reduction to FDI. The results, therefore point to the need for a careful
selection of a poverty reduction measure to target and a perfect timing if FDI-based policies are used to positively influence poverty reduction.

References


