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FOREIGN DIRECT INVESTMENT AND THE POVERTY REDUCTION NEXUS IN TANZANIA

Mercy T. Magombeyi [1] and Nicholas M. Odhiambo

Abstract

In this study, we investigate the causality between poverty reduction and foreign direct investment (FDI) inflows in Tanzania using time-series data from 1980 to 2014. In order to *capture multidimensional aspects of poverty reduction, we employ three poverty reduction measures, namely, household consumption expenditure (pov1), infant mortality rate (pov2), and life expectancy (pov3). We use the autoregressive distributed lag (ARDL) bounds testing approach to cointegration and ECM-based causality model within a trivariate setting to examine this linkage. Our results show that there is a distinct unidirectional causality from poverty reduction to FDI in the short run and in the long run when poverty reduction is measured by household consumption expenditure and life expectancy. A unidirectional causality is confirmed from FDI to poverty reduction in the short run and no causality is recorded in the long run when infant mortality rate is used as a poverty reduction proxy. Based on these findings, we can conclude that the causal relationship between FDI and poverty reduction in Tanzania is sensitive to the proxy used to measure the level of poverty and to the time span considered.*

Key Words: Tanzania; Household Consumption Expenditure; Life Expectancy; Infant Mortality rate; Granger-causality

JEL Classification: F21; I32.

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1. Introduction

Studies on the causality between foreign direct investment inflows and poverty reduction are still at the nascent stage. The majority of the previous studies have mainly concentrated on the impact of FDI on poverty reduction giving little attention to the causal relationship between the two variables (Jalilian and Weiss, 2002; Zaman *et al*., 2012; Ucal, 2014). Only a few studies have taken the analysis between poverty reduction and FDI further to examine the causal relationship between these two variables. Moreover, some of the studies that have investigated the causality between FDI and poverty reduction used a bivariate causality approach, which has known limitations (see Solarin and Shahzab, 2013). A third intermittent variable can improve the magnitude of the results (see Loizides and Vamvoukas, 2005; Odhiambo, 2009b). In this study, the causal relationship between FDI and poverty reduction is investigated within a trivariate casualty framework, and GDP is included as the intermittent variable.

The objective of this study is to establish the causal relationship between FDI and poverty reduction in Tanzania using the Granger-causality test and time-series data from 1980 to 2014. The study departs from previous studies in numerous ways. First, the study investigates the causality between FDI and poverty reduction using three poverty reduction proxies: household consumption expenditure (Pov1), infant mortality rate (Pov2), and life expectancy (Pov3). The inclusion of three poverty reduction measures gives more informative results on the causality between FDI and poverty reduction, using income and non-income dimensions of poverty. Second, the ARDL-bounds testing approach to cointegration and error correction model (ECM)-based causality test employed in this study has a number of advantages. For example, the ARDL bounds approach to cointegration is robust in small samples (see Odhiambo, 2008; Solarin and Shahbaz, 2013; Nkoro and Uko, 2016). Third, the study analyses the causality between FDI and poverty reduction within a trivariate framework, overcoming the limitations of a bivariate framework (see Odhiambo, 2008; Solarin and Shahzab, 2013).

The rest of the paper is structured as follows: Section 2 provides a review of the literature; Section 3 discusses 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. Literature Review

2.1 FDI and Poverty Dynamics in Tanzania

Tanzania was among the nations that signed the United Nations' Millennium Development Goals (MDGs) declaration in 2000, and was also a signatory to the Sustainable Development Goals 2030 (United Nations, 2000; United Nations, 2017). On the national front, the government of Tanzania enshrined poverty reduction policies in the long-term vision, National Development Vision 2025 and the Zanzibar National Development Vision 2020. To achieve the goals of the National Development Vision 2025, Zanzibar National Development Vision 2020, and the Millennium Development Goals, the government adopted medium-term policies implemented through the National Strategy for Growth and Reduction of Poverty or '*Mkukuta'* (NSGRP) in Tanzania mainland and through the Zanzibar Strategy for Growth and Reduction of Poverty (ZSGRP) or '*Mkuza'* in the isles (Ministry of Finance and Economic Affairs, 2010; Revolutionary Government of Zanzibar, 2010). The NSGRP and the ZSGRP are composed of three clusters: growth for reduction of income poverty, improved standards of living and increasing accountability in resource utilisation and the environment, and good governance and national unity (Ministry of Finance and Economic Affairs, 2010; Revolutionary Government of Zanzibar, 2010). In response to the poverty alleviation policies, poverty headcount as measured by food poverty and basic needs poverty declined from 11.8% and 34.4%, respectively, in 2007 to 9.7% and 28.2%, respectively, in 2011/12 (National Bureau of Statistics, 2014). The same trend was registered in Zanzibar where food poverty declined from 13.2% in 2004/5 to 13% in 2009/10, and basic needs poverty declined from 49.1% to 44.4% (Office of the Chief Government Statistician, 2012). In Tanzania, poverty levels vary depending on settlement type, household size, and educational level (National Bureau of Statistics, 2014; Office of the Chief Government Statistician, 2012).

Besides policies that focus on poverty reduction, government rolled out policy reforms targeting foreign direct investment inflows. A number of reforms have been implemented in Tanzania to increase investment from domestic and foreign companies (OECD, 2013). The reforms can be grouped into two categories: (i) policies that indirectly affect FDI by creating an environment conducive to investment; and (ii) policies that have a direct impact on investment. Among policies that indirectly affect investment are regional integration, export processing zones, free zones, industrial support policies, and privatisation of state-owned enterprises. Direct interventions include the creation of an investment policy, relaxation of exchange control, regulation reforms, bilateral investment treaties, investment incentives, and special economic zones, among other policy initiatives.

In response to the policy reforms implemented, FDI inflows as a proportion of GDP increased in the 1990s, registering an average of 1.6% between 1990 and 2000 (World Bank, 2014). FDI inflows registered an average growth of 4.7% from 2000 to 2014 (World Bank, 2014). There were huge fluctuations in FDI inflows as a proportion of GDP over the period. FDI as a proportion of gross fixed capital formation (GFCF) was modest between 1990 and 1999, recording an average of 8.3% (UNCTAD, 2015). FDI as a proportion of gross fixed capital formation improved significantly from 2000 to 2014, registering an average of 14.4% (UNCTAD, 2015).

2.2 Empirical Literature Review

The literature on the causality between FDI and poverty reduction is still scant. Of the few studies that have analysed the causal relationship between FDI and poverty reduction, the results are inconclusive. While some studies have found unidirectional causality between FDI and poverty reduction, other studies have found either bidirectional causality or no causal relationship between these variables. The results from the causality analyses have varied depending on the poverty reduction proxy used and on the time and sample period, making generalisation of the results inappropriate.

Gohou and Soumare (2012) investigated the causal relationship between FDI and poverty in five regional economic communities and five customs and monetary unions in Africa. They employed the Human Development Index (HDI) as a measure of welfare and found unidirectional causality running from FDI to HDI. In a separate study, Fauzel *et al.* (2015) investigated the causal relationship between FDI and poverty reduction in selected sub-Saharan countries. Using poverty headcount as a proxy for poverty reduction and data from 1990 to 2010, they found unidirectional causality from FDI to poverty reduction. Soumare (2015) analysed the causal relationship between FDI and poverty in North Africa between 1990 and 2011. Using the Granger-causality test, unidirectional causality was found running from FDI to human development index in Egypt, Morocco, Tunisia, and Mauritania.

Despite the above studies, there are other studies that have found evidence of a bidirectional causal relationship between FDI and poverty reduction. In a study on North African countries from 1990 to 2011, Soumare (2015) found a bidirectional causal relationship between FDI and poverty in Algeria when human development index was used as poverty proxy. When another proxy for poverty reduction was used – real per capita GDP – a bidirectional causal relationship was found in all the study countries, with the exception of Libya. In a study on five regional economic communities and five customs and monetary unions in Africa from 1990 to 2007, Gohou and Soumare (2012) found a bidirectional relationship between GDP per capita and FDI in the whole region.

Contrary to the above studies, there are studies that have found no causality between FDI and poverty reduction in either direction. 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, they found no causal relationship between FDI and poverty. Gohou and Soumare (2012) also found no causality between FDI and the Human Development Index in five regional economic groupings and five customs and monetary unions in Africa.

3. Estimation Techniques

This study is based on the ARDL-bounds test to cointegration and ECM-based causality test. The ARDL approach has numerous advantages. Other conventional approaches to cointegration have a restrictive assumption concerning the order of integration of variables, whereas 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; Nkoro and Uko, 2016). The ARDL approach to cointegration is robust in a small sample (see Odhiambo, 2009a; Nkoro and Uko, 2016). Another advantage of the ARDL approach is that it uses a reduced form single equation, while other conventional cointegration methods employ a system of equations (Pesaran and Shin, 1999). The ARDL approach to cointegration also provides unbiased estimates of the long-run model, even in cases where some variables are endogenous (see Odhiambo, 2009a). Given these advantages, the ARDL-bounds testing approach to cointegration was selected. The null hypothesis of no cointegration was tested against the alternative hypothesis of cointegration. The calculated F-statistic was compared to the critical values provided by Pesaran *et al*. (2001). If the calculated F-statistic falls above the critical value, the null hypothesis of no cointegration is rejected. Alternatively, if the F-statistic falls below the lower bound, it is concluded that there is no cointegration. If the F-statistic falls between the upper and the lower bound, the results are inconclusive.

The confirmation of cointegration indicates the presence of both a long-run relationship and causality among the variables in at least one direction (Narayan and Smyth, 2004). To investigate the causal relationship between poverty reduction and FDI, an ECM-based approach was used within a trivariate framework. Gross domestic product was used as the intermittent variable in this study. This provided a trivariate causality approach comprising poverty reduction (proxied by Pov1, Pov2 and Pov3), FDI, and GDP. A trivariate framework overcomes some of the limitations of a bivariate framework, such as omission-of-variable-bias (among others, see Odhiambo, 2008). The use of a trivariate framework can improve the magnitude and inference of the study (see Odhiambo, 2009a).

A number of poverty reduction proxies have been used in the literature. These include – but are not limited to – infant mortality rate, poverty indices, GDP per capita, and household consumption expenditure. 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 selected for this study. Three models – Models 1a-c – were specified to capture the three poverty reduction measures. Model 1a captures poverty reduction proxied by household consumption expenditure, and the model specification is (Pov1|FDI, GDP). Infant mortality rate (Pov2) was used as a poverty reduction proxy in Model 1b, and the model specification is (Pov2|FDI, GDP). Model 1c captures life expectancy (Pov3) as a poverty reduction proxy, and the model is specified as (Pov3| FDI, GDP).

3.1 Cointegration

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

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

$$\Delta Pov1_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov1_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \beta_1 Pov1_{t-1} + \beta_2 FDI_{t-1} + \beta_3 GDP_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots (1)$$

$$\Delta FDI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov1_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \beta_1 Pov1_{t-1} + \beta_2 FDI_{t-1} + \beta_3 GDP_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots (2)$$

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov1_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \beta_1 Pov1_{t-1} + \beta_2 FDI_{t-1} + \beta_3 GDP_{t-1} + \mu_{1t} \ldots\ldots\ldots\ldots (3)$$

ARDL Specification for Model 1b (Pov2, FDI, and GDP)

$$\Delta Pov2_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov2_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 Pov2_{t-1} + \theta_2 FDI_{t-1} + \theta_3 GDP_{t-1} + \mu_{2t} \ldots\ldots\ldots\ldots (4)$$

$$\Delta FDI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov2_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 Pov2_{t-1} + \theta_2 FDI_{t-1} + \theta_3 GDP_{t-1} + \mu_{2t} \ldots\ldots\ldots\ldots (5)$$

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov2_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 Pov2_{t-1} + \theta_2 FDI_{t-1} + \theta_3 GDP_{t-1} + \mu_{2t} \ldots\ldots\ldots\ldots (6)$$

ARDL Specification for Model 1c (Pov3, FDI and GDP)

$$\Delta Pov3_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov3_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 Pov3_{t-1} + \theta_2 FDI_{t-1} + \theta_3 GDP_{t-1} + \mu_3 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \ldots . \ldots \ldots \ldots . \quad (7)$$

$$\Delta FDI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov3_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 Pov3_{t-1} + \theta_2 FDI_{t-1} + \theta_3 GDP_{t-1} + \mu_{3t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \ldots \ldots \ldots . \quad (8)$$

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov3_{t-i} + \sum_{t=0}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=0}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 Pov3_{t-1} + \theta_2 FDI_{t-1} + \theta_3 GDP_{t-1} + \mu_{3t} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \quad (9)$$

Where α_0 is a constant, α_1 - α_3 and $\theta_1 - \theta_3$ are regression coefficients, and μ_{1t} - μ_{3t} is an error term.

3.2 A Granger-Causality Model Specification

The ECM-based Granger-causality models were specified for Model 1a, Model 1b, and Model 1c. The ECM-based causality model enables analysis of causality in the short run and in 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 causality is given by the t-statistic on the lagged error correction term. The introduction of the lagged error correction term reintroduces the long-run relationship that could have been lost with differencing (see Odhiambo, 2009a)

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

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

$$Pov1_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov1_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 ECM_{t-1} + \mu_{1t} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (10)$$

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

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov1_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_3 ECM_{t-1} + \mu_{3t} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (12)$$

Where α_0 is a constant, α_1 - α_3 and $\theta_1 - \theta_3$ are regression coefficients, and $\mu_{1t} - \mu_{3t}$ are the error terms.

ECM-based Granger-causality for Model 1b (Pov2, FDI, GDP)

The ARDL Granger-causality model specification for Model 1b is given in Equations 13-15.

$$\Delta Pov2_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov2_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 ECM_{t-1} + \mu_{1t} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (13)$$

$$\Delta FDI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov2_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_2 ECM_{t-1} + \mu_{2t} \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots \quad (14)$$

$$\Delta GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov2_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_3 ECM_{t-1} + \mu_{3t} \ldots \ldots \ldots \ldots \ldots \ldots (15)$$

Where α_0 is a constant, α_1 - α_3 and $\theta_1 - \theta_3$ are regression coefficients, and $\mu_{1t} - \mu_{3t}$ are the error terms.

ECM-based Granger-causality for Model 1c (Pov3, FDI, GDP)

The ARDL Granger-causality model specification for Model 1c is given in Equations 16-18.

$$\Delta Pov3_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov3_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_1 ECM_{t-1} + \mu_{1t} \ldots \ldots \ldots \ldots \ldots \ldots (16)$$

$$\Delta FDI_t = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \, \Delta Pov3_{t-i} + \sum_{t=1}^{n} \alpha_2 \Delta \, FDI_{t-i} + \sum_{t=1}^{n} \alpha_3 \, \Delta GDP_{t-i} + \theta_2 ECM_{t-1} + \mu_{2t} \ldots \ldots \ldots \ldots \ldots \ldots (17)$$

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

Data Sources

The study employed time-series data from 1980 to 2014 to investigate the dynamic causal relationship between poverty reduction and FDI. The main sources of data are the World Bank development indicators and UNCTAD. Microfit 5.0 was used to analyse the data.

4. Empirical Analysis

Unit Root Tests

In an ARDL approach to cointegration, pretesting of variables for cointegration is not a prerequisite. However, in this study, unit root tests are done on Pov1, Pov2, Pov3, FDI, and GDP to confirm the order of integration of the variables. The ARDL approach is only applicable if variables are integrated of order 0 [I (0)], order 1 [I (1)], or fractionally integrated (Pesaran *et al.*, 2001). The Dickey-Fuller generalised least squares (DF-GLS), Phillip-Perron (PP root) and Perron unit root test (PPU root test) results are presented in Table 1.

Table 1: Unit Root Test Results

DF-GLS Test					PP Test				PPU(root) Test			
Variable	**Stationarity of Variable in Levels**		**Stationarity of Variable in First Difference**		**Stationarity of Variable in Levels**		**Stationarity of Variable in First Difference**		**Stationarity of all Variables in Levels**		**Stationarity of all Variables in First Difference**	
	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend	Without Trend	With Trend
Pov1	-1.2793	-1.8948	-5.9083***	-6.1756***	-1.5927	-1.7032	-5.9083***	-6.1756***	-5.0613*	-5.5126*	-	-
Pov2	-2.5847**	-4.4376**	-	-	3.0267**	-8.4233***	-	-	-5.7978**	-5.4214**	-	-
Pov3	-6.5688***	-4.1466***	-	-	5.1840***	0.5905	-	-3.5913**	-7.0810***	-5.9210**	-	-
FDI	-2.4803**	-5.1055***	-	-	-4.1691***	-9.7404***	-	-	-1.9894	-2.9684	-6.3290***	-6.3292***
GDP	5.2753***	-1.0672	-	-4.0967***	2.5871	4.0179**	2.8988*	-	-1.7443	-0.5549	-5.7987**	-6.1322**

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

The unit root results presented in Table 1 vary from one unit root test to the other; on aggregate, all variables are stationary in levels or in first difference. The results confirm the suitability of the ARDL approach to cointegration and ECM-based causality analysis.

ARDL-Bounds Testing Approach to Cointegration

Cointegration results for Model 1a, Model 1b, and Model 1c are presented in Table 2.

Table 2: ARDL –Bounds Test to Cointegration Results: Model 1a-c

<table>
<tr><th>Dependent variable</th><th colspan="2">Function</th><th colspan="2">F-Statistic</th><th colspan="2">Cointegration Status</th></tr>
<tr><td colspan="7">Panel A: Model 1a</td></tr>
<tr><td>Pov1</td><td colspan="2">F(Pov1|FDI, GDP)</td><td colspan="2">7.987***</td><td colspan="2">Cointegrated</td></tr>
<tr><td>FDI</td><td colspan="2">F(FDI|Pov1,GDP)</td><td colspan="2">4.758***</td><td colspan="2">Cointegrated</td></tr>
<tr><td>GDP</td><td colspan="2">F(GDP|Pov1, FDI)</td><td colspan="2">3.4963</td><td colspan="2">Not Cointegrated</td></tr>
<tr><td colspan="7">Panel B: Model 1b</td></tr>
<tr><td>Pov2</td><td colspan="2">F(Pov2|FDI, GDP)</td><td colspan="2">2.174</td><td colspan="2">Not Cointegrated</td></tr>
<tr><td>FDI</td><td colspan="2">F(FDI|Pov2,GDP)</td><td colspan="2">5.071***</td><td colspan="2">Cointegrated</td></tr>
<tr><td>GDP</td><td colspan="2">F(GDP|Pov2, FDI)</td><td colspan="2">1.724</td><td colspan="2">Not Cointegrated</td></tr>
<tr><td colspan="7">Panel C: Model 1c</td></tr>
<tr><td>Pov3</td><td colspan="2">F(Pov3|FDI, GDP)</td><td colspan="2">7.375***</td><td colspan="2">Cointegrated</td></tr>
<tr><td>FDI</td><td colspan="2">F(FDI|Pov3,GDP)</td><td colspan="2">5.759***</td><td colspan="2">Cointegrated</td></tr>
<tr><td>GDP</td><td colspan="2">F(GDP|Pov3, FDI)</td><td colspan="2">1.940</td><td colspan="2">Not -Cointegrated</td></tr>
<tr><td colspan="7">Asymptotic Critical Values (unrestricted intercept and no trend)</td></tr>
<tr><td rowspan="3">Pesaran et al. (2001:300) critical values (Table CI(iii), Case III)</td><td colspan="2">1%</td><td colspan="2">5%</td><td colspan="2">10%</td></tr>
<tr><td>I(0)</td><td>I(1)</td><td>I(0)</td><td>I(1)</td><td>I(0)</td><td>I(1)</td></tr>
<tr><td>5.15</td><td>6.36</td><td>3.79</td><td>4.85</td><td>3.17</td><td>4.14</td></tr>
</table>

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

The results in Table 2 confirm cointegration between poverty reduction, FDI, and GDP, although the results are sensitive to the poverty reduction proxy used. Cointegration is confirmed in the following functions: Model 1a, F (Pov1|FDI, GDP) and F (FDI|Pov1, GDP); Model 1b, F (FDI|Pov2, GDP); and Model 1c, F (Pov3|FDI, GDP) and F (FDI|Pov3, GDP). The presence of cointegration in these functions indicates the presence of causality in at least one direction (see Granger, 1988; Narayan and Smyth, 2008). A further investigation to establish the direction of causality was done using the ECM-based causality test.

ECM-Based Causality Testing

Following the cointegration tests and the confirmation of cointegration in some of the functions, an ECM was included as an additional variable in the Granger-causality analysis for those functions where cointegration was confirmed. In the equations where no cointegration was confirmed, Granger-causality analysis was performed on the variables without an ECM. Short-run causality was determined by the F-statistics on the explanatory variables given by the variable deletion test; long-run causality was 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 reported in Table 3.

Table 3: ECM-Based Causality Results

Panel A: Model 1a				
Dependent Variable	**F-Statistics**			**ECM**
	ΔPov1	ΔFDI	ΔGDP	**t-statistics**
ΔPov1	-	0.106 [0.900]	5.403*** [0.004]	-0.194* [-1.808]
ΔFDI	3.069* [0.093]	-	0.270 [0.608]	-0.776*** [-2.825]
ΔGDP	0.236 [0.361]	4.671** [0.039]	-	
Panel B: Mode1 1b				
Dependent Variable	**F-Statistics**			**ECM**
	ΔPov2	ΔFDI	ΔGDP	**t-statistics**
ΔPov2	-	5.770** [0.024]	8.551*** [0.007]	-
ΔFDI	0.446 [0.510]	-	6.823** [0.014]	-0.993** [-2.343]
ΔGDP	0.733 [0.399]	4.837** [0.036]	-	-
Panel C : Model 1c				
Dependent Variable	**F-Statistics**			**ECM**
	ΔPov2	ΔFDI	ΔGDP	**t-statistics**
ΔPov2	-	0.129 [0.723]	2.750* [0.054]	-0.032*** [-3.503]
ΔFDI	6.190*** [0.019]	-	0.988 [0.329]	-1.289*** [3.767]
ΔGDP	0.242 [0.996]	4.611** [0.041]	-	-

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

The results presented in Table 3, Panel A for Model 1a confirm a distinct unidirectional causality from poverty reduction to FDI in the short run and in the long run. The results are supported by a statistically significant F-statistic at 10% for ΔPov1 in the ΔFDI function and a statistically significant t-statistic. The results suggest that poverty reduction Granger-causes FDI in the short run in Tanzania when household consumption expenditure (Pov1) is used as a poverty reduction proxy. When infant mortality rate is employed as a poverty reduction proxy, unidirectional causality from FDI to poverty reduction (Pov2) is confirmed in the short run from the results presented in Table 3, Panel B for Model 1b. These results are confirmed by the F-statistic for ΔFDI in the ΔPov2 function, which is significant at the 10% level of significance. These results were expected, and they compare favourably with findings from other studies (see Fauzel *et al*., 2015; Soumare, 2015). However, no long-run causality was confirmed. The results presented in Table 3, Panel C for Model 1c reveal a distinct unidirectional causality from poverty reduction (Pov3) to FDI in the short run and in the long run. The results are supported by a statistically significant F-statistic for ΔPov3 in the FDI function for the short run and a negative and statistically significant error correction term at the 1% level of significance for the long-run causality. The results suggest that poverty reduction Granger-causes FDI in both the long run and the short run in Tanzania. Although the results were not expected, Klein *et al*. (2001) highlighted the importance of preconditions in the FDI receiving country as important in attracting FDI.

Other results show that when household consumption expenditure (Pov1) is used as a poverty reduction proxy there is (i) unidirectional causality from GDP to poverty reduction in the long run and in the short run; and (ii) FDI Granger-causes GDP in the short run. When infant mortality rate (Pov2) is used as a poverty reduction proxy there is (i) bidirectional causality between FDI and GDP in the short run and unidirectional causality from GDP to FDI in the long run; and (ii) unidirectional causality from GDP to poverty reduction in the short run. When poverty reduction is proxied by life expectancy (Pov3) there is (i) unidirectional causality from GDP to poverty reduction (Pov3) in both the short run and the long run; and (ii) unidirectional causality from FDI to GDP in the short run. A summary of the empirical results is reported in Table 4.

Table 4: Summary of Granger-Causality Results

	Causality	
	Short Run	**Long Run**
Model 1a (Pov1)	Pov1→FDI	Pov1→FDI
Model 1b (Pov2)	FDI→Pov2	No causality
Model 1c (Pov3)	Pov3→FDI	Pov3→FDI

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 analysed within a trivariate framework using time-series data for Tanzania from 1980 to 2014. Gross domestic product was included as a third intermittent variable. The intermittent variable was used in order to overcome the limitations of a bivariate causality test. The ECM-based Granger-causality test was employed to analyse the causal relationship between FDI and poverty reduction. In order to capture multidimensional aspects of poverty reduction, the study employed three poverty reduction measures, namely, household consumption expenditure (pov1), infant mortality rate (pov2), and life expectancy (pov3). The findings of this study show that there is unidirectional causality from poverty reduction to FDI when poverty reduction is proxied by household consumption expenditure and life expectancy. This applies – irrespective of whether the causality test is conducted in the short run or in the long run. However, when infant mortality rate is used to measure the level of poverty reduction, unidirectional causality from FDI to poverty reduction was confirmed, but only in the short run. In the long run, there was no causal relationship between FDI and infant mortality (pov3). Based on the findings from this study, it can be concluded that the causality between FDI and poverty reduction is sensitive to the poverty reduction proxy used and time span considered – although the causal flow from poverty reduction to FDI inflows tends to predominate. This implies that in the case of Tanzania, it is poverty reduction that Granger-causes foreign direct investment inflows.

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