

INVESTIGATING THE IMPACT OF FOREIGN DIRECT INVESTMENT ON POVERTY REDUCTION EFFORTS IN AFRICA

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Abstract

The study explored whether the complementarity between foreign direct investment (FDI) and natural resources availability led to poverty reduction in Southern and Western African nations using panel data analysis (fixed effects, random effects, pooled ordinary least squares (OLS) and dynamic generalised methods of moments (GMM) with data spanning from 2002 to 2012. The objective emanates from the theoretical view that if the countries that are receiving FDI have abundance of natural resources, a large number of the unemployed people are likely to get jobs, earn income and get out of poverty zone. Three measures of poverty were used in the current study, namely life expectancy at birth, total (years), household consumption expenditure as a ratio of gross national product and mortality rate and infant (per 1 000 live births). Generally, all the four panel data analysis methods produced similar finding: the interaction between FDI and natural resources reduced poverty levels in African countries studied. Southern and Western African nations are therefore urged to implement FDI enhancement policies which attract foreign investors into the natural resources extraction sector if they want to sustainably reduce poverty. Future studies should investigate other macroeconomic factors that must be available in the host country before FDI reduce poverty in all its forms.

Keywords: FDI; Natural Resources; Poverty; Panel Data Analysis; Africa

1. Introduction

1.1. Background of the study, research gap and problem statement

According to the United Nations Conference on Trade and Development (UNCTAD, 2012) report, FDI has the capacity to reduce poverty in emerging and developing countries due to their ability to steer positive economic development and growth. The majority of theoretical literature supports that FDI has got an indirect positive influence on poverty through its ability to enhance economic growth. Three prominent theories which support this argument include the endogenous (Romer. 1986; Kumar and Pradhan. 2002), neoclassical (Swan. 1956; Solow. 1956) and modernization theories (Calvo and Sanchez-Robles. 2002). Although theoretical literature (Amin's 1974 supported dependency theory) implies that FDI increases poverty levels through its negative impact on economic growth, majority of theoretical and empirical literature supports the FDI-led positive growth or FDI led poverty reduction hypothesis. On the other hand, there exists a theoretical explanation of how natural resources enhances poverty reduction (Dunning. 1973; Kallonga et al. 2003) and how poverty levels can be exacerbated by not only the availability but by the extraction of natural resources (Aubell and Mensah. 2007; Lopez-Feldman et al. 2006).

The theoretical literature contradictions discussed above is a clear evidence that FDI-poverty and natural resources-poverty hypotheses is far from being conclusive. Considering the dominance of the FDI-led poverty reduction and the natural resources

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inspired poverty alleviation views, the theoretical expectation is that the complementarity between FDI and natural resources should enhance poverty reduction. According to the Dunning's (1973) eclectic paradigm hypothesis, natural resources attracts FDI, which then leads to economic growth and consequently poverty alleviation. Despite the existence of such a solid theoretical underpinning, no study that the author is aware of has so far investigated the impact of the interaction or complementarity between FDI and natural resources on poverty alleviation.

Moreover, despite the fact that Africa relies more on FDI inflows to promote economic growth, create jobs and fight poverty, empirical studies that studied the impact of FDI on poverty in Africa as a bloc of countries are quite scant. Few of them were done by Gohou and Soumare (2012) whose study focused on Africa using panel data analysis, Lazreg and Zouari's (2018) study on North African countries using the fully modified ordinary least squares (FMOLS) and Honani's (2017) study on the Middle East and North African nations using the simultaneous equation model. These few empirical studies on FDI led poverty alleviation hypothesis in African countries suffers from several shortcomings. These include (1) failure to capture the complementarity between FDI and natural resources on poverty reduction, (2) ignored the dynamic nature of the poverty data (vicious cycle of poverty), (3) failed to address the endogeneity problem which arises due to possibility of the existence of a feedback relationship between FDI and poverty.

1.2. Contribution of the paper

The current study contributes to literature in the following ways: (1) it investigated the impact of the complementarity between FDI and natural resources on poverty reduction, (2) took into account the dynamic nature of the poverty data and addressed the endogeneity problem (which possibly exists in the FDI-poverty nexus) by using the dynamic GMM approach.

1.3. Organization of the paper

The remaining part of the study is organized as follows: Part 2 discusses both theoretical and empirical literature on the influence of FDI on poverty. Part 3 explains the theoretical rationale behind the impact of natural resources availability on poverty reduction. Part 4 is research methodology whilst Part 5 summarizes the study.

2. The impact of foreign direct investment on poverty – Literature review

There is no theoretical literature which explains the direct influence of FDI on poverty. The closest theories explain how FDI indirectly affects poverty through the economic growth channel and these are endogenous growth, neoclassical, modernisation and the dependency theories.

The endogenous growth theorists (Romer. 1986; Kumar and Pradhan. 2002) argued that FDI brings in technology, skills and human capital development, all of which are necessary ingredients for the achievement of sustainable long term economic growth. On the other hand, neoclassical growth theorists such as Swan (1956), Nath (2005) and Solow (1956) said that FDI contributes towards economic growth through its ability to add to the physical capital stock which is necessary for stimulating investment activities in the economy.

The modernisation theory propounded by Calvo and Sanchez-Robles (2002) argued that FDI enhances economic growth through forcing liberalization of the markets, social

stability and increasing the number of educated people in the host country. Guisan (2014:195) also noted that higher levels of investment enhanced not only economic development but increased income per capita and contributed to a decline in poverty in African countries.

The dependency theory is of the view that FDI has a negative influence on the host country since an economy which is not controlled by local citizens does not organically develop (Amin. 1974). Theoretically, positive economic growth is expected to increase employment levels, spill over effects, low cost of living and investment, all of which consequently reduces poverty.

On the empirical front, several studies have so far attempted to investigate the direct role played by FDI on poverty and these are discussed next. Ogunniyi and Igberi (2014) investigated the effect of FDI on poverty reduction in Nigeria using the OLS approach with annual time series data ranging from 1980 to 2012.

They found out that FDI had a non-significant positive influence on poverty reduction in Nigeria. Using autoregressive distributive lag (ARDL) with time series data (1973-2011), Shamim et al (2014) studied the impact of FDI on poverty in Pakistan. FDI was found to have reduced poverty in Pakistan in the long run. Ucal (2014) also explored the influence of FDI on poverty in developing countries using panel data analysis. The study showed that poverty levels in developing nations were drastically reduced by the inflow of FDI.

Moatari and Gaskari (2016) studied the relationship between FDI and poverty in developing countries using panel data analysis with annual data ranging from 2000 to 2014. FDI was found to have been responsible for poverty alleviation in developing countries. Using ARDL estimation technique with annual time series data ranging from 1980 to 2014, Magombeyi and Odhiambo (2017a) examined the causal linkage between FDI and poverty reduction in South Africa.

They found out that a unidirectional causality relationship running from poverty reduction towards FDI was detected both in the short and long run. Moreover, Agarwal et al (2017) empirically tested the influence of FDI on poverty in (1) India using ARDL with times series data (1981-2011) and (2) South Asian Association for Regional Cooperation (SAARC countries) using panel data ranging from 1981 to 2011. FDI was found to have had a deleterious effect on poverty in India. As for the SAARC countries, FDI reduced poverty in Sri Lanka and Nepal and increased poverty levels in Pakistan and Bangladesh.

Table 1 summarizes the empirical literature on the influence of FDI on poverty reduction.

The findings from empirical studies discussed in section 2 shows divergent and conflicting conclusions. It is clear from the empirical research on the impact of FDI on poverty reduction that the subject matter is inconclusive, not yet a settled matter and is far from being over. It is against this backdrop that the current study intends to contribute to literature by investigating the impact the impact of FDI on poverty alleviation in African countries.

Table 1: Summary of the empirical literature on the impact of FDI on poverty reduction			
Author	Country/Countries of study, Period	Methodology	Results
Jalilian and Weiss (2002)	Association of Southeast Asian Nations (ASEAN countries) 1991-1997	Panel data analysis	FDI inflows into the ASEAN countries increased economic growth thereby lowering poverty levels among the people.
Uttama (2015)	Southeast Asia 1995-2011	Panel data analysis	The study noted that FDI contributed to the poverty reduction in the Southeast Asian countries.
Trinh (2017)	63 provinces of Vietnam 2002-2012	Panel data analysis	FDI was found to have reduced poverty levels in Vietnam
Ukamaka et al (2016)	Nigeria 1970-2001	Ordinary Least Squares (OLS)	FDI was found to have had a statistically significant negative impact on poverty.
Gohou and Soumare (2012)	Africa 1990-2007	Panel data analysis	FDI was found to have reduced poverty levels by a wider margin in poorer Africa countries as compared to richer African countries.
Okpe and Abu (2009)	Nigeria 1975-2003	Multiple regression analysis	Poverty levels were significantly lowered by the inflow of FDI into the Nigerian economy.
Fauzel et al (2016)	Mauritius 1980-2013	Dynamic vector autoregressive (VAR) and the vector error correction models	FDI more significantly reduced poverty levels in the long run in comparison to in the short run.
Durowah (2018)	91 developing countries 2000-2014	Panel data analysis	FDI was found to be an effective agent for poverty reduction in developing countries.
Adu (2018)	Ghana 2002-2009	Trend analysis	Foreign direct investment into the mining sector was found to have had a deleterious effect on poverty in the rural areas of Ghana.
Magombeyi and Odhiambo (2018a)	Botswana 1980-2014	ARDL	When life expectancy was used as a proxy of poverty reduction, FDI reduced poverty levels in the short run and increased poverty in the long run. An insignificant impact of FDI on poverty reduction was detected when infant mortality rate was used as a measure of poverty reduction both in the short and long run. Their study also observed that FDI reduced poverty in the short run when household

			consumption expenditure was used as a poverty proxy.
Magombeyi and Odhiambo (2018b)	South Africa 1980-2014	ARDL	FDI reduced poverty in the long run when infant mortality rate was used as a proxy of poverty whilst poverty was increased by FDI in the short run when the same proxy of poverty was used. A negligible impact of FDI on poverty reduction was detected when household consumption expenditure and life expectancy were used as measures of poverty.
Mirza and Giroud (2003)	ASEAN countries 1989-2002	Descriptive statistics and trend analysis	FDI was found to have contributed to poverty alleviation in the ASEAN countries.
Lazreg and Zouari (2018)	North Africa 1985-2005	Fully modified ordinary least squares (FMOLS)	FDI increased poverty when the GINI index was used as a measure of poverty.
Magombeyi and Odhiambo (2017b)	Tanzania 1980-2014	ARDL	Using infant mortality rate as a proxy of poverty, poverty levels were found to have been reduced by FDI in the short run. FDI had no effect on poverty reduction when household consumption expenditure and life expectancy were used as measures of poverty.
Hmani (2017)	Middle East and North African (MENA) region 1990-2014	Simultaneous Equations Model	FDI had a reduction effect on poverty in the MENA region.
Yohanna (2013)	Nigeria 1981-2010	OLS	FDI was found to have reduced the prevalence of poverty in Nigeria during the period under study.
Arabyat (2017)	Developing countries 1980-2012	Unbalanced panel data analysis	A negligible positive impact of FDI on poverty reduction was detected in the developing countries.

Source: Author compilation

3. The influence of natural resources on poverty alleviation

Following Dunning's (1973) eclectic paradigm hypothesis, natural resources availability reduce poverty through attracting FDI and boosting economic growth. Kallonga et al (2003) found out that the management of natural resources management in a democratic manner to a larger extent played a significant positive role in improving the livelihoods of the poor people in Tanzania. Extraction of natural resources is normally associated with disastrous regional and local effects such as toxic contamination of the soil, air pollution, surface and ground water and also causes critical loss of the inhabitants of the ecosystem (Aubell and Mensah (2007: 14). Consistent with Lopez-Feldman et al (2006), the

availability of natural resources helps in the eradication of poverty but overreliance on natural resources may perpetuate poverty. It was also noted that most people in resources rich developing countries are living in poor conditions (Lopez-Feldman et al. 2006:1), clear evidence that the natural resources and poverty nexus is still inconclusive. The current study is based on the expectation that the combination of FDI inflows and natural resources availability should enhance poverty reduction efforts in the African continent in line with Dunning's (1973) theoretical implications.

4. Research methodology

4.1 Data, description and collection

The study used panel data (2002-2012) for 16 Southern and Western African countries, namely Ghana, Madagascar, Nigeria, Senegal, Sierra Leone Botswana, Ivory Coast, Togo, Mozambique, Tanzania, Guinea-Bissau, Liberia, Niger, Namibia, South Africa and Burkina Faso. Secondary data used in this study was extracted from credible international sources such as the World Development Indicators, African Development Bank, International Financial Statistics and United Nations Development Programme databases. Pre-estimation diagnostics (descriptive statistics and correlation analysis) were done before main data analysis –results of which are presented in the appendix section. Table 2, 3 and 4 show correlations of the three poverty indicators with the main explanatory variables whilst Table 5 presents descriptive statistics (see Appendix section).

4.2 Foreign direct investment and poverty trends in Southern and Western Africa

FDI and poverty trends in Southern and Western African countries during the period spanning from 2002 to 2012 are presented in Table 6.

Madagascar, Mozambique, Liberia and Sierra Leone are the four African countries which recorded the highest mean net FDI ratio (net FDI as a ratio of GDP) above the overall mean net FDI ratio of 6.20% of GDP. Liberia is an outlier because its mean FDI ratio (32.56% of GDP) is far higher than the overall mean net FDI ratio. Botswana, Namibia, South Africa, Madagascar, Tanzania, Ghana, Senegal and Togo are characterised by mean infant mortality rates (per 1 000 births) which are lower than the overall mean infant mortality rate (per 1 000 births) of 68.21. The remaining African countries (Mozambique, Burkina Faso, Ivory Coast, Guinea-Bissau, Liberia, Niger, Nigeria, and Sierra Leone) had their mean infant mortality rates (per 1 000 births) above the overall mean. Sierra Leone is an outlier because its mean infant mortality rate (per 1 000 births) is well above the overall mean.

In terms of the household consumption expenditure, only Madagascar, Ghana, Guinea-Bissau, Liberia, Sierra Leone and Togo had their mean household consumption expenditure ratios above the overall mean of 79.03% of GDP. Liberia is an outlier because its mean household expenditure ratio (154.83% of GDP) is far much higher than the overall mean household expenditure ratio. Botswana is also an outlier because its mean household expenditure ratio (42.95% of GDP) is far much lower than the overall mean household expenditure ratio of 79.03% of GDP.

The mean total life expectancy at birth (years) of South Africa, Mozambique, Burkina Faso, Ivory Coast, Guinea-Bissau, Niger, Nigeria, and Sierra Leone are below the overall mean total life expectancy at birth (years) during the period spanning from 2002 to 2012.

The mean total life expectancy at birth (years) of the remaining African nations were higher than the overall mean total life expectancy at birth (years) – refer to Table 6. The mean total life expectancy at birth (years) statistics does not show any presence of abnormal data values. In other words, the mean total life expectancy at birth (years) of all the African countries studied is around the overall mean of the total life expectancy at birth (years).

	Net FDI (% of GDP)	Mean mortality rate, infant (per 1 000 births)	Mean household consumption expenditure (% of GDP)	Mean life expectancy at birth, total (years)
Southern Africa				
Botswana	4.72	43.78	42.95	55.43
Namibia	5.96	43.03	62.47	55.88
South Africa	1.47	43.95	60.69	54.45
Madagascar	6.59	50.07	83.76	62.06
Mozambique	10.79	81.99	78.87	52.70
Tanzania	3.88	55.61	65.86	58.04
Western Africa				
Burkina Faso	0.86	75.10	68.11	54.85
Ivory Coast	1.65	84.49	67.91	48.85
Ghana	5.18	54.32	86.19	59.57
Guinea-Bissau	1.67	82.70	90.87	54.08
Liberia	32.56	79.97	154.83	56.92
Niger	6.03	72.84	74.05	54.63
Nigeria	3.09	90.41	70.79	49.30
Senegal	2.27	50.35	78.57	62.02
Sierra Leone	7.80	118.97	90.22	45.41
Togo	4.67	63.71	88.32	55.85
Overall mean	6.20	68.21	79.03	55.00

Source: Author's compilation

4.3 Research Methodology, Results Description and Interpretation

The econometric model used for the current study is represented by equation 1.

$$POVERTY_{i,t} = \beta_0 + \beta_1 FDI_{i,t} + \beta_2 NATURAL_{i,t} + \beta_3 (FDI_{i,t} \cdot NATURAL_{i,t}) + \beta_4 X_{i,t} + \mu + \varepsilon \quad [1]$$

Where β_3 is the coefficient of the interaction term (interaction between FDI and natural resources). X_{it} represents the control variables such as economic growth (GROWTH), greenhouse gas emissions (GGE), population growth (POPUL), trade openness (OPEN), unemployment (UNEMPL) and infrastructural development (INFR). Pooled OLS, fixed and random effects panel data analysis approaches were used to estimate equation 1. The

main advantage of these methods is that they take into account both time series and cross sectional data.

In order to capture the poverty cycle hypothesis which says that poverty exacerbates poverty in line with Tsaurai (2018), the dynamic nature of the poverty data was taken into consideration by incorporating the lag of poverty into equation 2.

$$POVERTY_{i,t} = \beta_0 + \beta_1 POVERTY_{i,t-1} + \beta_2 FDI_{i,t} + \beta_3 NATURAL_{i,t} + \beta_4 (FDI_{i,t} \cdot NATURAL_{i,t}) + \beta_5 X_{i,t} + \mu + \varepsilon \quad [2]$$

The author used the dynamic GMM approach by Arellano and Bond's (1991) which captures the dynamic nature of the poverty data (the impact of the lag of poverty on poverty).

Mortality rate, infant (per 1 000 live births), household consumption expenditure (% of GDP) and life expectancy at birth, total (years) are the proxies of poverty that were used in model 1, 2 and 3 respectively, consistent with Magombeyi and Odhiambo (2018).

While infant mortality is, usually, negatively correlated with development, life expectancy is, generally, positively related with economic development. This study therefore expects infant mortality to have a positive influence on poverty and also life expectancy to have a negative effect on poverty. Higher levels of household consumption expenditure in an economy is inflationary and it means that less funds are going towards developmental projects (Aslam. 2017). It is against this background that the current study expects household consumption expenditure to have a positive effect on poverty.

Net FDI (% of GDP), total natural resources rents (% of GDP), GDP per capita, total greenhouse gas emissions (kt of CO2 equivalent), population growth (% annual), trade (% of GDP), total unemployment (% of total labour force) and fixed telephone subscriptions were used as proxies for FDI, natural resources, economic growth, greenhouse emissions, population growth, unemployment and infrastructural development respectively. There are two main considerations that were taken into account in choosing the proxies for all the variables used in the current study. Firstly, the choice of the proxies follows other empirical studies on similar subject matter.

In the selection of the variables it is usually important to avoid problems of inadequate mixing of mean values (per capita, per cent or per thousand people) with shares or with rates of growth consistent with Guisan (2015).

4.4 Main Data Analysis

Before main data analysis, the study found out that all the data was stationary at first difference (see Table 7- Appendix section) and that the variables are co-integrated (see Table 8 –Appendix section).

Under fixed effects in model 1, both FDI and natural resources had a non-significant negative impact on mortality rate (see Table 9). The interpretation is that FDI and natural resources reduced poverty levels, when mortality rate is used as a measure of poverty. The interaction between FDI and natural resources also had a non-significant negative effect on mortality rate. In line with theoretical expectation (Dunning. 1973), the finding

means that the combination between FDI and natural resources non-significantly reduced poverty in the Southern and Western African countries studied.

	Model 1	Model 2	Model 3
LFDI	-0.0293	-0.0997***	-0.0072
LNATURAL	-0.0344	-0.1128***	0.0134*
INTERACTION TERM	-0.00003	0.0382***	0.0044
LGROWTH	-0.2469***	-0.0287	0.0829***
LGGE	-0.0124	0.0743**	0.0248***
LPOPUL	-0.1014**	0.2255***	0.0304*
LOPEN	-0.0902***	0.3585***	0.0405***
LUNEMPL	0.0383**	-0.0002	-0.0016
LINFR	0.0175*	-0.0202	0.0005
Adjusted R-squared	0.9628	0.8782	0.9254
F-statistic	189.95	53.58	91.40
Prob (F-statistic)	0.00	0.00	0.00

***, ** and * denote 1%, 5% and 10% levels of significance, respectively.

Source: Author's compilation from E-Views

FDI and natural resources had a significant negative influence on household consumption expenditure (refer to model 2). This means that both FDI and natural resources availability separately increased the poverty levels. The finding resonates with the dependency theory of FDI propagated by Amin (1974) which argued that overreliance on FDI has got a negative influence on economic growth and poverty fighting efforts. The finding also confirms Aubell and Mensah (2007)'s argument that the extraction of natural resources perpetuates poverty as the extraction of natural resources is associated with disastrous regional and local effects such as toxic contamination of the soil, air pollution, surface and ground water. When FDI and natural resources were interacted, the interaction term had a significant positive impact on household consumption expenditure. In other words, the complementarity between FDI and natural resources availability lowered down the poverty levels in the African countries studied in line with Dunning 's (1973) theoretical implications.

FDI had a non-significant negative influence on life expectancy whilst natural resources availability was found to have had a significant positive impact on life expectancy. This means that FDI reduced the life expectancy (increased poverty levels) in line with Amin (1994)'s dependency theory whereas natural resources availability increased life expectancy (lowered down poverty levels). The latter supported Kallonga et al's (2003) finding that the management of natural resources management in a democratic manner to a larger extent played a significant positive role in improving the livelihoods of the poor people in Tanzania. The interaction term was found to have had a non-significant positive effect on life expectancy. The finding means that the complementarity between FDI and natural resources reduced poverty levels. As expected, the fixed effects approach indicates that FDI and natural resources availability complemented each other in reducing poverty levels in the Southern and Western African countries.

Under the random effects model (see Table 10), the adjusted R-squared is 43.14%, a percentage which is too low to be able to meaningfully estimate the impact of FDI on

poverty reduction. The same applies to model 3 under the pooled OLS approach, whose adjusted R-squared is 13.06%. Under random effects, model 1 shows that FDI had a non-significant negative influence on mortality rate whereas natural resources were found to have had a significant negative effect on mortality rate. This means that both FDI and natural resources separately reduced the mortality rate or put differently, they reduced the poverty levels in the Southern and Western African nations studied. The result supports the modernization theory by Calvo and Sanchez-Robles (2002), the endogenous theory by Romer (1986) and Kumar and Pradhan (2002) and neoclassical growth theory founded by Solow (1956) and Swan (1956) whose arguments were that FDI contributes positively towards economic growth and poverty alleviation.

	Model 1	Model 2	Model 3
LFDI	-0.0285	-0.0955***	-0.0060
LNATURAL	-0.0308*	-0.0813***	0.0156**
INTERACTION TERM	-0.0002*	0.0379***	0.0042
LGROWTH	-0.2492***	-0.0600***	0.0781
LGGE	-0.0158	0.0141	0.0186**
LPOPUL	-0.0991**	0.2590***	0.0387**
LOPEN	-0.0928***	0.3338***	0.0384***
LUNEMPL	0.0368**	-0.0171	-0.0051
LINFR	0.0162*	-0.0330**	-0.0009
Adjusted R-squared	0.7704	0.4314	0.6663
F-statistic	66.23	15.76	39.82
Prob (F-statistic)	0.00	0.00	0.00

***, ** and * denote 1%, 5% and 10% levels of significance, respectively.

Source: Author's compilation from E-Views

The results are also consistent with Guisan and Exposito (2010) and Guisan and Exposito (2012) whose study observed that foreign investment into the host country boosted economic development and consequently reduced poverty levels. Moreover, the interaction between FDI and natural resources was found to have had a significant negative influence on mortality rate. Put differently, FDI and natural resources were found to have complemented each other in reducing poverty levels when mortality rates were used as a measure of poverty. The finding is in line with theoretical predictions (Dunning's 1973 theoretical implications).

In model 3 under the random effects, FDI had a non-significant negative influence on life expectancy whilst natural resources had a significant positive effect on life expectancy. The finding means that FDI reduced life expectancy/increased poverty levels consistent with the dependency theory of FDI. Natural resources increased life expectancy/reduced poverty levels in the African countries studied, in support of Lopez-Feldman et al's (2006) argument that the availability of natural resources helps in the eradication of poverty. Moreover, the interaction between FDI and natural resources was found to have had a non-significant positive effect on life expectancy (see Table 10). The finding means that the combination of high levels of FDI and natural resources in the Southern and Western African nations complemented each other in reducing poverty when life expectancy was used as a proxy of poverty levels in line with majority theoretical and empirical literature.

	Model 1	Model 2	Model 3
LFDI	0.0128	-0.1339***	-0.0198
LNATURAL	0.1401***	-0.0130	-0.0338**
INTERACTION TERM	-0.0188	0.0522***	0.0107
LGROWTH	-0.1934***	-0.1085***	0.0320
LGGE	-0.0331**	-0.0084	0.0320**
LPOPUL	-0.1663*	0.0561	0.1195***
LOPEN	-0.1708***	0.2517***	0.0635***
LUNEMPL	0.0560**	0.0194	-0.0106
LINFR	-0.0140	-0.0402**	0.0002
Adjusted R-squared	0.5583	0.6684	0.1306
F-statistic	22.05	40.19	3.91
Prob (F-statistic)	0.00	0.00	0.00

***, ** and * denote 1%, 5% and 10% levels of significance, respectively. Source: Author's compilation from E-Views

	Model 1	Model 2	Model 3
<i>POVERTY</i> _{<i>i,t-1</i>}	0.1274***	0.7193***	0.9777***
LFDI	-0.0003	-0.0383*	0.0031*
LNATURAL	-0.0002	-0.0061	0.0026**
INTERACTION TERM	-0.0010	0.0149*	0.0008*
LGROWTH	0.0074***	-0.0620***	0.0051***
LGGE	0.00006	0.00009	-0.0015***
LPOPUL	0.0004	-0.0862**	0.0210***
LOPEN	0.0037	0.1108***	-0.0012
LUNEMPL	-0.0055***	0.0083	0.0025***
LINFR	0.0045**	-0.0146	0.0008
Adjusted R-squared	0.9975	0.8825	0.9939
J-statistic	165.00	165.00	165.00
Prob (J-statistic)	0.00	0.00	0.00

***, ** and * denote 1%, 5% and 10% levels of significance, respectively.

Source: Author's compilation from E-Views

Under pooled OLS and dynamic GMM, the interaction between FDI and natural resources was also found to have reduced the mortality rate in model 1 whilst the interaction between the two variables increased the household consumption (see Table 11 and 12). The results mean that the interaction between FDI and natural resources had a poverty reduction effect in the Southern and Western African nations. The finding is not only backed by theoretical and empirical literature but is congruent to the conclusions made under the fixed and random effects. Table 12 shows the Dynamic GMM results for the paper.

Under the dynamic GMM, the lag of life expectancy had a significant positive effect on life expectancy in all the three models, consistent with the vicious cycle of poverty hypothesis propagated by Azher (1995). Under model 3, both FDI and natural resources

separately had a significant positive influence on life expectancy, findings which resonate with existing theoretical views. The interaction between FDI and natural resources was also found to have had a significant positive impact on life expectancy. The result shows that the complementarity between FDI and natural resources not only reduced poverty levels but also increased life expectancy in the Southern and Western African nations studied.

5. Summary of the study

The study explored whether the complementarity between FDI and natural resources availability led to poverty reduction in Southern and Western African nations using panel data analysis (fixed effects, random effects, pooled OLS and dynamic GMM) with data spanning from 2002 to 2012. The objective emanates from the theoretical view that if the countries that are receiving FDI are also characterised by natural resources abundance, a large number of the unemployed people are likely to get jobs, earn income and get out of poverty zone. Three measures of poverty were used in the current study, namely life expectancy at birth, total (years), household consumption expenditure (% of GDP) and mortality rate and infant (per 1 000 live births). Generally, all the four panel data analysis methods produced similar finding: the interaction between FDI and natural resources reduced poverty levels in the African countries studied. Southern and Western African nations are therefore urged to implement FDI enhancement policies which attract foreign investors into the natural resources extraction sector if they want to sustainably reduce poverty. Future studies should investigate other macroeconomic factors that must be available in the host country before FDI reduce poverty in all its forms.

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Appendix. Correlations of Poverty indicators with other variables

Table 2: Correlation results: Poverty 1 = MORT: Mortality rate, infant (per 1000 live births)

	MORT	FDI	NATURAL	GROWTH	GGE	POPUL	OPEN	UNEMPL	INFR
MORT	1.0000								
FDI	0.02	1.0000							
NATURAL	0.34***	0.58***	1.0000						
GROWTH	-0.54***	-0.13*	-0.31***	1.0000					
GGE	-0.16**	-0.11	-0.09	0.35***	1.0000				
POPUL	0.40***	0.09	0.25***	-0.71***	-	1.0000			
OPEN	-0.12	0.33***	0.40***	0.06	-	-0.07	1.0000		
UNEMPL	-0.38***	-0.05	-0.34***	0.71***	0.50***	-0.63***	0.09	1.0000	
INFR	-0.56***	-0.16**	-0.38***	0.91***	0.34***	-0.77***	0.05	0.78***	1.0000

Note: ***/**/* denotes statistical significance at the 1%/5%/10% level respectively.

Source: Author compilation from E-Views

Table 3: Correlation results: Poverty 2 = HCE : Household Consumption Expenditure (%GDP)

	HCE	FDI	NATURAL	GROWTH	GGE	POPUL	OPEN	UNEMPL	INFR
HCE	1.0000								
FDI	0.35***	1.0000							
NATURAL	0.58***	0.58***	1.0000						
GROWTH	-0.44***	-0.13*	-0.31***	1.0000					
GGE	-0.25***	-0.11	-0.09	0.35***	1.0000				
POPUL	0.39***	0.09	0.25***	-0.71***	-0.25***	1.0000			
OPEN	0.68***	0.33***	0.40***	0.06	-0.21***	-0.07	1.0000		
UNEMPL	-0.33***	-0.05	-0.34***	0.71***	0.50***	-0.63***	0.09	1.0000	
INFR	-0.44***	-0.16**	-0.38***	0.91***	0.34***	-0.77***	0.05	0.78***	1.0000

Note: ***/**/* denotes statistical significance at the 1%/5%/10% level respectively.

Source: Author compilation from E-Views .

Table 4: Correlation results: Poverty 3=LE: Life Expectancy at birth, total (years)

	LE	FDI	NATURAL	GROWTH	GGE	POPUL	OPEN	UNEMPL	INFR
LE	1.0000								
FDI	0.13*	1.0000							
NATURAL	-0.06	0.58***	1.0000						
GROWTH	0.08	-0.13*	-0.31***	1.0000					
GGE	-0.06	-0.11	-0.09	0.35***	1.0000				
POPUL	0.03	0.09	0.25***	-0.71***	-0.25***	1.0000			
OPEN	0.16**	0.33***	0.40***	0.06	-0.21***	-0.07	1.0000		
UNEMPL	-0.01	-0.05	-0.34***	0.71***	0.50***	-0.63***	0.09	1.0000	
INFR	0.06	-0.16**	-0.38***	0.91***	0.34***	-0.77***	0.05	0.78***	1.0000

Note: ***/**/* denotes statistical significance at the 1%/5%/10% level respectively.

Source: Author compilation from E-Views

	MORT	FDI	NATURAL	GROWTH	GGE	POPUL	OPEN	UNEMPL	INFR
Mean	68.21	6.20	11.80	1 434	115 377	2.57	75.89	8.59	2.16
Median	63.8	3.1	8.98	545.5	43 479	2.66	70.89	4.46	0.84
Maximum	137	89.48	61.51	7 976	509 634	4.77	311.4	27.18	10.46
Minimum	37.1	0.08	0.55	133.5	2 047	1.05	30.73	0.31	0.01
Standard. deviation	22.6	11.1	9.85	1 896	142 520	0.75	40.05	7.91	2.92
Skewness	0.76	5.12	2.13	1.88	1.43	-0.03	3.44	1.07	1.62
Kurtosis	3.10	35.02	8.35	5.29	3.86	3.14	18.93	2.47	4.13
Jarque-Bera	17.23	8 288	342.5	141.8	65.3	0.17	2 208	35.78	86.56
Probability	0.00	0.00	0.00	0.00	0.00	0.92	0.00	0.00	0.00
Observations	176	176	176	176	176	176	176	176	176

Source: Author compilation from E-Views

	Level				First difference			
	LLC	IPS	ADF	PP	LLC	IPS	ADF	PP
LMORT	-1.59*	3.44	21.73	52.34	-2.46***	-1.31*	41.27*	85.36***
LHCE	-2.97***	-0.60	40.86	46.12*	-4.99***	-2.44***	56.06***	117.56***
LLE	-2.74***	2.67	13.60	33.71	-4.51***	-3.45***	59.75***	88.11***
LFDI	-4.45***	-1.50*	45.32*	60.05***	-4.28***	-3.82***	75.85***	147.26***
LNATURAL	-1.01	0.59	30.25	48.81	-5.29***	-2.98***	63.06***	128.03***
LGROWTH	-1.92**	1.78	13.59	79.01***	-7.75***	-4.06***	77.31***	143.34***
LGGE	-2.36***	-0.99	39.99	115.80***	-5.05***	-5.81***	99.83***	274.40***
LPOPUL	-8.52***	-3.39***	74.29***	44.04*	-6.41***	-2.72***	63.20***	84.78***
LOPEN	-5.72***	-1.46*	49.30**	35.12	-8.69***	-3.37***	75.06***	85.93***
LUNEMPL	1.02	2.08	21.34	19.65	-1.90**	-0.71*	43.90**	59.29***
LINFR	-0.17	0.45	29.33	60.74***	-4.86***	-2.29**	55.81***	144.84***

Note: LLC, IPS, ADF and PP stands for Levin, Lin and Chu; Im, Pesaran and Shin; ADF Fisher Chi Square and PP Fisher Chi Square tests respectively. *, ** and *** denote 1%, 5% and 10% levels of significance, respectively.

Source: Author's compilation from E-Views

Series	ADF t-statistic
MORT FDI NATURAL GROWTH GGE POPUL OPEN UNEMPL INFR	-3.0839***
HCE FDI NATURAL GROWTH GGE POPUL OPEN UNEMPL INFR	-6.8416***
LE FDI NATURAL GROWTH GGE POPUL OPEN UNEMPL INFR	-2.7911***

Source: Author's compilation from E-Views