The Effects of Foreign Direct Investment (FDI) on Sectoral Growth and Poverty in Africa

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The Effects of Foreign Direct Investment (FDI) on Sectoral Growth and Poverty in Africa

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Abstract

Background: This study examines the effects of foreign direct investment (FDI) on sectoral growth and poverty reduction in Africa. The transfer of technology into different sectors of economy through FDI has enabled many developing and emerging economies to achieve sustained economic growth and development. However, this is not the case with Africa's growth architecture and poverty levels. A look at the region's growth and welfare structure revealed that the FDI-growth-welfare relationship is weak when compared with those of other developing continents such as Asia and Latin America.

Methods: The study adopted recent causality method and simultaneous equation as well as dynamic threshold models to analyze the effect of FDI on sectoral growth and poverty. We accounted for sectoral spillover effect, heterogeneity, simultaneity and cross section dependence in our modeling.

Results: Main findings from our results suggest that FDI promotes outputs of manufacturing and service sectors, but hinders that of agricultural sector, while it fosters human development. Also, the results showed that, while human development promotes output of the agricultural sector, it deters output of manufacturing and service sectors. Further results revealed that only agricultural output improves human development and welfare among countries. The dynamic threshold regression analysis showed that FDI promotes output growth in all sectors with larger effect at levels beyond the optimal HDI.

Conclusions: Africa's growth architecture is weak to stimulate poverty reduction. For the region to improve its sectoral output growth and welfare using the FDI as a catalyst, a policy framework towards attracting more FDI into the three key productive sectors (especially in the manufacturing and services) is desirable for increased output and poverty reduction. However, to achieve the desired level of poverty reduction, policies should be targeted to sectors with inter-sectoral linkages especially between agricultural and manufacturing sectors along the local and international value chain.

JEL Classification: O1; O41; I31; O55
Keywords: FDI; Sectoral Growth; Poverty Reduction; Africa, Simultaneous equation model (SEM)

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1.0 Background

One of the facilitators of economic growth and development is the rapid and efficient transfer and adoption of 'modern technology' by economic agents. According to economic development literature, FDI plays key role in the transfer of this modern technology. Wang and Wong (2012) posit that technological transfer from one country to another is possible through the instrument of FDI. The transfer of technology into different sectors of economy through FDI has enabled some developing and emerging economies to achieve sustained economic growth and development in the recent time (see Nunnenkamp, 2004; Gohou, and Soumare, 2012; Anyanwu, 2017; and Magombeyi and Odhiambo, 2017).

However, a cursory look at Sub-Saharan Africa's growth architecture and poverty levels showed that the FDI-growth-welfare relationship is weak when compared with those of other developing continents such as Asia and Latin America (see UNCTAD, 2016 and Alley, 2017). Statistical evidence shows that while aggregate FDI inflows into Africa decreased by 7 percent to $54 billion in 2015, those of Asia increased by 16 percent to $541 billion. Similarly, the recent World Bank report (World Bank, 2019) shows that the population of the poor that lives below $1.9 per day[2]in Sub-Saharan Africa (SSA) stands at 45 percent whereas, those of other regions such as South Asia, Europe and Central Asia, and Latin America and the Caribbean, stands at 22, 2 and 6 percent respectively (see appendix 1).

The significant reduction in the level of the poorer population in some countries of the Asian, Latin America, and Caribbean were made possible mainly through attracting investments into some specific economic sectors. Dupasquier and Osakwe (2006) posit that the substantial FDI investment into the secondary sector contributed to the East Asia export diversification and aggregate growth. Dutta (2005) submits that through the approach of targeting the industrial sector, China grew total output to above two-thirds of the total aggregate growth in 2000. In the case of sectoral growth and welfare improvement, although views on the impact of sectoral investment on economic growth and welfare may differ across regions, Loayza and Raddatz (2010) and Gohou and Soumare (2012), state that adequate investments into labour-intensive sectors improve growth and welfare faster among countries.

Conversely, this cannot be said to be true for the African continent as investments into the sectors have provided little economic and social benefits to the region. Despite the fact that the African region is faced with many structural and institutional challenges which has hindered growth and development,

[2]Poverty definition is based on the multidimensional approach which includes: those deprived of education, health, and standard of living. See appendix 1 for African Countries data (2005 – 2015) and appendix 2 for regional economies'

policymakers within the region still find it challenging implementing policies capable of attracting external funding into the real sectors of the economy for growth and development. An appropriate policy structure towards improving resource inflows into the re1al sectors for the purpose of welfare improvement is considered necessary for developing economies who would wish to improve their growth and welfare architectures.

This study identifies four gaps in the literature in which it contributes to fill. First, previous studies have centred mainly on either **FDI- economic growth link** (Akinlo, 2004; Alfaro, 2003 & Alfaro, et al 2004; Durham, 2004; Viu and Noy, 2009; Azman-Saini, et al 2010; Choong et al 2010; Balloumi 2014; Iamsiraroj, 2016), or **FDI-poverty** link (Jalilian and Weisis, 2002; Basu and Guariglia, 2007; Loayza and Raddata, 2010; Gohou and Soumane, 2012; Wu and Hsu, 2012; Magombeyi and Odhiambo, 2017) or **growth-poverty link** (Schneider and Gugarthy (2011). However, little or no study has explored the three links simultaneously despite the need for a comprehensive analysis (taking account of the direct and indirect impacts of FDI on output growth and welfare)[3] for evidence-based policy making. It is against this background that this study used the most recent causality methods and developed a simultaneous equation model derived from the endogenous growth theory to conduct a comprehensive sectoral analysis of FDI-growth-poverty link.

Second, there is dearth of studies on Africa in some parts of the three links (especially FDI-poverty and Growth-poverty links), which is another gap in the literature that this study fills. Third, the few studies that examined any of the parts of the FDI-growth-welfare relationship did so without taken into consideration the sectoral interdependence. Economic activities in one sector tend to spill over to others (inter-sectoral linkages). Consequently, this confounds the estimates of the real impact of FDI on sectors and welfare. This study therefore first filters out the ‘spillover effect’ of one sector from another sector prior to formal empirical analysis. The filtering out of sectoral spillover effect provides the actual sectoral share of GDP. Fourth, earlier studies on cross-country analysis did not consider the problem of cross-section dependence which emanates from common global factors inherent in economic variables across sample countries. The existence of cross-section dependence may render model results imprecise. This problem is dealt with in this study using recently developed econometric techniques[4]. Another novelty of this study is the use of the dynamic threshold regression approach to track the FDI –output - poverty

[3] The direct and indirect impact of FDI on growth and welfare is fully discussed at the theoretic framework section.
[4] The ‘filtering’ system approach is discussed at the data section.

impact. The rest of the paper is structured as follows: Section 2 reviews relevant literature on impact of FDI on sectoral growth and welfare. Section 3 presents the theoretical framework and econometric methodology. Section 4 presents the empirical results, and section 5 concludes the study.

2.0 Literature Review

Although a huge body of literature exists on FDI and economic growth (as identified earlier), studies relating to the impact of FDI on sectoral growth and welfare are taking the center stage in recent development literature. Received literature shows that many of these studies on FDI-Sectoral-welfare relationship relies on the endogenous growth theory of 'technological diffusion to demonstrate how (i) through FDI, technology can move from the secondary to tertiary sectors rather than the primary sector; and (ii) welfare conditions of a country can be improved. The seminal paper by Findlay (1978) shows that through technological diffusion and growth in total factor productivity (TFP), a relatively backward economy can catch up faster with those of the technologically advanced economy provided the sectors have strong linkages.

However, research has shown that not all the sectors have the capacity to absorb these foreign technologies and improve welfare because of weak industrial linkages. Theoretically, it has been proven that linkages are weak in agriculture and mining sectors unlike in the manufacturing and services sectors. An investment report by UNCTAD (2001:138) states that "in the primary sector, the scope for linkages between foreign affiliates and local suppliers is often limited. The manufacturing sector has a broad variation of linkage intensive activities. In the tertiary sector, the scope for dividing production into discrete stages and sub-contracting out large parts to independent domestic firms is also limited. The effect of weak industrial linkage therefore means that certain sectors may not be able to attract the needed foreign investment that can drive economic growth and welfare improvement.

Although there had been an on-going debate on which sectors have the higher capacity to absorb foreign technology, improve economic growth and welfare, received empirical studies have shown that the impact of FDI on sectoral growth is ambiguous. While the impact of FDI on sectoral growth is positive among developed economies, it presents negative relationship among developing countries; and in some cases, mixed. Perhaps some of the reasons behind the weak performance of FDI among developing economies are weak human development and lower absorptive capacity of the sectors, where resource inflows are often channelled to.

Research has shown that African economies are mostly dependent on primary sector resources; and this sector is noted for its lower industrial linkage and absorptive capacity. Examining how foreign direct investment affects economic growth in 69 developing countries, Borensztein et al. (1998), reports that FDI only drives economic growth in economies with sufficient absorptive capability in advanced technologies and higher productivity level. Adams (2009) reports that increase in absorptive capacity of local firms and institutional collaboration are necessary for FDI, and domestic investment (DI) to promote economic growth. The contribution of the agricultural sector to economic growth has been noted to be lesser than those of the industrial and services sectors.

Alfaro (2003) examines the effect of FDI on growth in the agricultural, manufacturing, and services sectors in Asia and the Pacific, Africa, Latin America, and the Caribbean. The study finds that, while the effect of FDI is negative on the agricultural sector, it is positive on the manufacturing sector, and diverse in the case of the service sector. Contrary to the findings of Alfaro (2004), Msuya (2007) posits that agricultural productivity is considered essential in achieving sustainable growth. Examining the performance of FDI in promoting economic growth in Africa, Dupasquier and Osakwe (2006) submit that the sustained FDI growth in the secondary sector in East Asia contributes to the higher aggregate growth experienced within the economy. Similar study by Bwalya (2006) demonstrates that, FDI inflows in the secondary sector were much higher than those of the primary and tertiary sectors in Zambian between 1990 and 1998.

While FDI in the manufacturing sector in Africa is dominated by non-traditional sources (UNCTAD, 2014), studies have shown that FDI promotes economic growth in the manufacturing sector. Akinlo (2004), reports that in Nigeria, the impact of FDI in the manufacturing sector on aggregate economic growth outweighs those of the extractive industry. Nonetheless, while Basu and Guariglia (2007) noted that FDI promotes inequality and industrial growth, it reduces the share of agriculture to GDP among 119 developing countries. Studies have shown that the positive impact of FDI on the secondary and tertiary sectors is contingent upon the political structure; environmental challenges; macroeconomic and industrial policies frameworks of the country. The issue of strong macroeconomic and industrial policy has been highlighted in development literature as key factors to robust economic growth and development (Collier and Gunning, 1999, Eichengreen, 2007, and Rodrik, 2008).

Although the macroeconomic environment of a country is apt for economic growth, the productive sectors benefit more when FDI is allowed to be the catalyst for economic growth (see Baharumshah, Yusop and Habibullah, 2010). Countries of East Asia were able to apply clear-cuts macroeconomic and industrial policy frameworks and robust financial markets to diversify their economies, thus, boosting economic growth. According to Dutta (2005) through trade and industrial policy reforms, China was able to diversify its economy from agricultural to industrial sector with share of GDP rising above two-thirds of the total aggregate growth in 2000. The successful 'growth miracle' in the South-South is not peculiar to China alone but to some other Asian countries like Singapore, Japan, Malaysia, and Indonesia. It is therefore evident that the growth of the 'Asian Tigers' and the improvement in the levels of welfare did not just arise from comprehensive industrial policy and robust institution but also through sound macroeconomic framework which created the enabling environment for economic growth. Growth that can lead to welfare improvement among economic agents coupled with sound macroeconomic environment must interact at optimum to produce the desired goals of an economy.

2.1 Trend of FDI (Inflows) in Developing Economies

A recent investment statistic of the United Nations Conference on Trade and Development (UNCTAD, 2018) shows that in 2017, FDI inward stock for developing economies increased by 10.8 percent to $10353.48 billion from 2016. Within this same period, Africa's share of the total inflows increased by over 6 percent to $867 billion (See Table 1). However, a cursory look at the Asia and Latin America and the Caribbean continents indicates that FDI inward within the two regions is much higher than those of the African region. Although FDI average percentage share in the Asia continent rose by a merger 0.02 percentage points from 2016 to 23.04 in 2017, the total share of FDI inflow for the region within the period, supersedes those of the rest of the entire developing continents, accounting for nearly 23 percent of the global inflows. The case with the African continent calls for greater concern as the region has never been a major recipient of FDI inflows.

[Insert Table 1 here]

Although there was a percentage increase in FDI inflows between 2013 and 2016, the increase is negligible when compare to those of Asia, Latin America, the Caribbean and Oceania. The improvement in FDI inflows in the Asian region and other regions is a reflection of the level of economic freedom and the absorptive capacity which many experts have noted as the main catalyst of Asian growth. As observed by Durham (2004), the impact of FDI on growth is dependent on the 'absorptive capacity' of economies. Where the absorptive capacity is low, the impact on aggregate growth becomes negligible. And where it is appreciable, it enhances aggregate growth. Similarly, Azman-Saini et al. (2010) noted that although

FDI by itself has no direct (positive) effect on output growth, its effect is contingent on the level of economic freedom in the host countries. It therefore means that the countries that promotes greater freedom of economic activities gain significantly from the presence of foreign investors.

2.2 FDI and Welfare Relationship

Analysis of the impact of FDI on poverty reduction has received little discussions in the development literature despite its importance to evidence-based policy making on welfare improvement. The few empirical studies in this regard, seem to have divergent views. OECD Global Forum on International Investment report (2002:4) states that "FDI has been recognized as a powerful engine and a major catalyst for achieving development, poverty-reducing growth and global integration process". Similarly, Aaron and Hadjimichael (2001) argue that FDI in social services such as water and energy is the most effective way to fight against poverty in developing countries. Wu and Hsu (2012) analyse the effects of FDI on income inequality in 54 countries over the period 1980–2005 and found that FDI affects the income of countries with limited absorptive capacity negatively rather than those with strong absorptive capacity. However, Mold (2004) posits that contrary to conventional view, there exits little evidence that FDI inflow causes poverty reduction.

The channels through which FDI impacts welfare have been identified to include stock of human capital (Borenszteinaet al., 1998); technological, innovation and knowledge spillover effects among sectors (Klein et al., 2001 and Tambunan, 2004); income (Jalilian and Weiss, 2002); and productivity growth (Djankov and Hoekman, 2000). Klein et al (2001) submits that since growth is the single-most important factor affecting poverty reduction, FDI is central to achieving that goal. Borenszteina et al (1998) argued that minimum threshold stock of human capital leads to higher productivity of FDI in host countries. The study by Tambunan (2004) suggests that the channel by which FDI can lead to welfare improvement is through labour intensive economic growth with export growth as the most important engine.

Although the study identified other channels such as development of human capacity programs or projects financed by government tax revenue, and improving access to productive employment, it did not find any evidence in support of these three other channels. However, the study by Li and Liu (2005) showed that FDI inflow promotes economic growth directly and indirectly through its interaction with human capital. Jalilian and Weiss (2002) examined the impact of FDI on poverty reduction in the ASEAN region and fond that at a very minimum analysis, there is no evidence in support that FDI either weakens growth or reduces the incomes of the poor. However, a more rigorous estimation shows that FDI inflows are associated with higher economic growth and income of the poor. In Djankov and Hoekman, (2000), the study observed that the magnitude of productivity growth increased more with firms that have foreign partnership.

However, the extent of knowledge diffusion between the local and foreign firms was not determined. Conversely, in spite of the importance of FDI towards improving growth and welfare, Africa is yet to take advantage of the huge opportunity which it presents to host countries probably due to their weak financial market institution and level of education. Nunnenkamp (2002) discloses that the growth-enhancing and poverty alleviating effects of FDI are greatly suppressed by weak markets and institutions that characterised poor countries. This finding is similar to those of Balasubramanyam, Salisu, and Sapsford (1999) and Alfaro, Chanda, Kalemli-Ozcan and Sayek (2004). While the former study shows that FDI promotes economic growth through the development of human capital, the latter reports that the level of development of the financial markets is crucial for FDI to drive economic growth. It is therefore worthy of note that strengthening the market and repositioning the necessary institutions through appropriate framework could be the needed catalyst the African continent requires to promote economic growth and development.

2.3 FDI Inflows by Sectors

FDI trends by sectors differ significantly across various regions of world economies. This indicates that most countries are faced with one challenge or the other in attracting sufficient amount of FDI into various sectors. However, despite these challenges, a substantial amount of the inflows goes into the service sector with the greater percentage going into the Asian and African regions (see Table 2). Concerning the other two sectors, although all the regions recorded significant inflows in these two sectors, Africa's share is much lower than the rest of the other regions.

[Insert Table 2 Here]

However, the region performed better in manufacture than in agriculture when compared to those of the Latin America and Caribbean and Transition economies. The performance of the African region in the manufacturing sector is linked to the region's recent efforts in accessing domestic and regional markets, which act as the major factor that influences investment decisions and the adaptation of formal industrial development strategies in the last five years. The implementation of a well-designed industrial development policies (in particular FDI policies) is key to industrial growth and development. According to the World Investment Report, (UNCTAD, 2018: xiv), "modern industrial policies are thus a key driver of investment policy trends. In fact, more than 80 per cent of investment policy measures recorded since 2010 are directed at the industrial system (manufacturing, complementary services and industrial infrastructure), and about half of these clearly serve an industrial policy purpose".

2.4 Aggregate FDI Inflows to Africa (by Regions)

The volume of aggregate FDI inflow in Africa varies by region and period (see Table 3). Although between 1980 and 1989, East Africa's average FDI/GDP ratio was the lowest when compared with other regions, the region recorded significant growth between 1990 and 2017. A Similar result is also observed for, FDI/Export ratio and FDI per capita for the region within the same period.

[Insert Table 3 Here]

However, even though East Africa's performance in the three measures were very significant, West Africa's performance outweighs those of the entire region for FDI/GDP and FDI/Export measures. Disaggregating the regions into countries, statistics show that apart from Ghana in the West African region, the magnitude of FDI/GDP inflows into Tanzania and Uganda (Eastern Africa) forms the highest bulk of inflows in the African continent, especially during the period 2002-2013 (see Table 4). During 2014-2016, FDI/GDP is highest in Mozambique, while FDI per export is highest in South Africa.

[Insert Table 4 Here]

Conversely, in 2015, the magnitude of inflows shifted to the Northern and Southern regions of the continent owing to massive inflows of FDI to Egypt and Angola respectively. According to UNTCAD (2016) Angola recorded over $8 billion inflows owing to intra-company loans. The World Investment Report (UNCTAD, 2016) further reported that FDI to North Africa rose by 9 per cent to $12.6 billion in 2015, while that of Southern Africa, increased by 2 per cent to $17.9 billion owing to low commodity prices and higher electricity. However, among other regions such as West and Central Africa, FDI inflow decreased significantly with West Africa having the highest of 18 percent decrease. The cause of the weak performance by the West African region might not be unconnected with the slump in Nigeria's FDI inflow from an average of 2.5 per cent between 2006 and 2009 to 1.61 per cent in 2013.

3.0 THEORETICAL FRAMEWORK AND METHODOLOGY

3.1 Theoretical Framework

This study relies on the endogenous growth theory of 'technological diffusion' initially developed by Arrow (1962). Technological diffusion usually refers to a form of "conditional convergence" where lagging countries (and sectors) catch up with technological leaders. Technology often flow from industrialized economies to developing ones in the form of foreign direct investment (FDI), helping these economies to fill the technology gap existing across sectors and promotes both sectoral and national output growth. Recent advancements on the endogenous growth theory championed by Romer (1986, 1990; 1994), Lucas (1988), Barro (1991) and Easterly, King, Levine and Rebelo (1994) strongly demonstrate the role of technology and human capital in economic development. According to Gohou and Soumare (2012), FDI can generate both direct and indirect effect on an economy. The direct effect ensues via human welfare impact in form of creation of new jobs, improved skills through technical and managerial skills spillover and better environmental management practices that improve health status (first round effect of FDI itself).

The indirect effect manifests at sectoral and macroeconomic level in terms of firm or sectoral level technological transfer which foster backward and forward inter-sectoral linkages among firms and industries that lead to increase in sectoral output. Increase in firms' output across sectors implies increase in the quantity of labour required in production processes. This eventually reduces unemployment and hence reduces poverty in the economy (second round indirect effect of FDI on welfare via sectoral output growth). Hence, the diffusion of technology from advanced economies to developing countries allows the later to grow faster provided the sectors in these economies have strong linkages with other sectors. Where linkages are weak, diffusion of technology may be hindered, sector growth retarded while unemployment and poverty may become worse. In essence, there are both direct (human welfare effect) and indirect (sectoral growth effect) of FDI. Thus, the first and second rounds effects of FDI on poverty (POV) or human development (HDI)[5] is expressed in equation 1, where HDI (POV) is a function of both FDI inflow and the sectoral output performance (measured as sectoral output share- SOs)

$$\text{POV (HDI)} = f\ (\text{FDI, SOs}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Following Barro (1991) and Easterly *et al (*1994), we capture the role of technology and human capital in economic development by exploring the indirect effect of FDI on sectoral output growth (via

[5] The justification for adopting human development index (HDI) in place of poverty index (POV) is stated at the data section.

technological and skill transfers and addition to existing inputs) and the impact of human capital development on same. Thus, the relation can be written as:

$$SOs = f\ (POV, FDI) \ldots\ldots(2)$$

It therefore implies that a system of relationship exists between poverty and sectoral growth where FDI plays a critical role. Thus, output of sector *i* in country *j* depends on the country-wide poverty level (or human capital development) and FDI, while poverty (or human capital development) is a function of sectoral output, corrected for inter-sectoral linkages, and FDI. The corrected sectoral output (Z_{ij}) is defined as the product of sectoral share in GDP and annual rate of change of sectoral share in GDP for sector *i* and country *j* (y_j). Both sectoral growth rate and poverty level are also affected by the level of capital formation (INV), population growth (POPG), sectoral output prices (prices)[6] and trade openness (OPEN) of the economy (Basu and Guariglia, 2007) while governance institution – proxied by rule of law (RLAW) is critical to poverty outcomes (Gohou and soumare, 2012; Wu and Hsu, 2012). Thus, a system of simultaneous relationship can be established as follows;

$$HDI_j = f(Z_j, FDI_j, INV_j, POPG_j, Price_j, OPEN_j, RLAW_j \ldots\ldots(3)$$

$$Z_{ij} = f(HDI_j, FDI_j, INV_j, POPG_j, Price_j, OPEN_j, RLAW_j) \ldots\ldots(4)$$

Where Z is later defined for agricultural, services and manufacturing sectors as AGR, SER and MAN, respectively.

3.2. Methodology

3.2.1 Model Specification and Estimation Technique

3.2.1.1 Heterogeneous Panel Granger Causality Test

In line with the theoretical framework in the previous section, causality between the main variables (FDI, sectoral output –Z and HDI) is first examined. Causality looks at whether the past values of one variable (for example FDI) can improve the prediction of another variable (for example Z) apart from the one given by its own past values. Causality captures the antecedence and information content of FDI in respect of Z and vice versa. Recent development in panel data econometric modelling has led to the development of panel causality test which accounts for potential heterogeneity in the data by permitting all coefficients to vary across cross-sections and also recognises cross-section dependence using critical values obtained from block bootstrap procedure. Thus, we adopt the approach by Dumitrescu and Hurlin

[6] Sector specific prices are used, except in the case of service sector that we did not use any commodity price due to data unavailability. Specifically, World Agricultural commodity prices was used in Agricultural sector, while Beverages commodity prices (By definition this captured manufactured Cocoa and Tea) was used as proxy for Manufacturing sector price.

(2012) to conduct heterogeneous panel causality in this study using the estimation method developed by Lopez and Weber (2017).

Assuming two stationary variables, *x (FDI)* and *y (sectoral out-Z)*, the Granger non-causality between these variables for individual country i in period *t* is tested in a panel data framework using the following VAR model:

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \beta_{ik} y_{i,t-k} + \sum_{k=1}^{K} \gamma_{ik} x_{i,t-k} + \varepsilon_{i,t} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots 5$$

In this case, coefficients differ across individuals but they are time invariant while *K* (lag order) is identical for all individuals with balanced panel. In line with Granger (1969), determining the existence of causality involve testing for significant effects of past values of *x* on the present value of *y*. The null hypothesis is defined as:

H_o: $\theta_{i1} \ldots = \gamma_{iK} = 0$ $\quad\quad$ $\pi i = 1 \ldots N$ $\quad$ ……………………………………………………………….....6

This represents a situation where there is no causality for all individuals in the panel. However, the test allows existence of causality for some individuals in which case the alternative hypothesis is written as:

H_1: $\theta_{i1} \ldots = \Upsilon_{iK} = 0$ $\quad\quad$ $\pi_i = 1 \ldots N_1$

$\theta_{i1} \neq 0$ *or ... or ...* $= \Upsilon_{iK} \neq 0$ $\quad$ $\pi_i = N_1 + 1 \ldots N$

Where N_1 *[0, N – 1]* is unknown. In the event where $N_1 = 0$, causality exist for all individuals in the panel. In the case where N_1 is strictly smaller than *N,* otherwise there is no causality for all individuals and H_1 reduces to H_0.

According to Dumitrescu and Hurlin (2012), the procedure starts by running the *N* individual regressions in equation 5. Then, perform F-tests of the K linear hypotheses $\Upsilon_{i1} = \ldots = \Upsilon_{iK} = 0$ to retrieve W_i, before computing $\overline{W}$ as the average of the *N* individual Wald statistics as follows:

$$\overline{W} = \frac{1}{N}\sum_{i=1}^{N} W \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 7$$

W represents the standard adjusted Wald statistics for individual i observed during *t* periods. Since Monte Carlo simulations of Dumitrescu and Hurlin (2012) show that $\overline{W}$ is asymptotically well-behaved, it can genuinely be used to for panel causality analysis.

Moreover, giver the assumption that Wald Statistics, W_i, are independently and identically distributed across individuals, then the standardized statistic $\overline{Z}$ when T $\rightarrow\infty$and N $\rightarrow\infty$follows a standard normal distribution:

$$\bar{Z} = \sqrt{\frac{N}{2K}} \cdot (\bar{W} - K) \quad \xrightarrow[\overline{N \to \infty}]{d} \quad N(0, 1) \qquad \ldots\ldots 8$$

For a fixed T dimension where T > 5 + 3K, the approximated standardized statistic $\tilde{Z}$ follows a standard normal distribution:

$$\tilde{Z} = \sqrt{\frac{N}{2K} \cdot \frac{T-3K-5}{T-2K-3}} \cdot \left[\frac{T-3K-3}{T-3K-1} \cdot \bar{W} - K\right] \xrightarrow[\overline{N \to \infty}]{d} N(0, 1) \qquad \ldots\ldots 9$$

The procedure for testing the null hypothesis in equation 6 is based on $\overline{Z}$ and $\tilde{Z}$ in equations 8 and 9 respectively. If these statistics are larger than the corresponding normal critical values, then H_0 should be rejected and there is Granger causality. Where *N* and *T* are large panel datasets, $\overline{Z}$ can be reasonably considered. Where *N* is large, but *T* is relatively small, $\tilde{Z}$ will be appropriate. In addition, Dumitrescu and Hurlin (2012) showed, in Monte Carlo simulations, that the test exhibits very good finite sample properties, even with both *T* and *N* small.

3.2.1.2 Panel Multivariate Linear and Non-Linear Granger Causality Test

Given that economic relationships are complex and not bivariate as assumed in the previous causality method, we also used a multivariate approach. Thus, the directions of causality among the main variables in this study (FDI, HDI and Z) are examined in a multivariate panel framework. According to Engle and Granger (1987), if two non-stationary variables are co integrated, then a VAR in first differences will be mis-specified. When long-run equilibrium relationships established among foreign direct investment (FDI), sectoral output (Z) and poverty indicator (HDI), a model is specified with a dynamic error-correction representation. Following Bai, Li, Wong and Zhang (2011), a panel multivariate linear granger causality test can be articulated to test the linear relationship between two vectors of different stationary series – for instance X_{jt} (such as FDI)and Y_{jt}(HDI).

VAR Framework

$$\begin{pmatrix} x_{it} \\ y_{it} \end{pmatrix} = \begin{pmatrix} A_{x,it[n_1\times 1]} \\ A_{y,it[n_2\times 1]} \end{pmatrix} + \begin{pmatrix} A_{xx,jt}(L)[n_1\times n_1] & A_{xy,jt}(L)[n_1\times n_2] \\ A_{yx,jt}(L)[n_2\times n_1] & A_{yy,jt}(L)[n_2\times n_2] \end{pmatrix} + \begin{pmatrix} x_{j,t-1} \\ y_{j,t-1} \end{pmatrix} + \begin{pmatrix} e_{x,jt} \\ e_{y,jt} \end{pmatrix}$$

………10

Where $A_{x,jt[n_1\times 1]}$ and $A_{y,jt[n_2\times 1]}$ are two vectors of intercept terms, $A_{xx,jt}(L)[n_1\times n_2]$, $A_{xy,jt}(L)[n_1\times n_2]$, $A_{yx,jt}(L)[n_2\times n_1]$ and $A_{yy,jt}(L)[n_2\times n_2]$ are matrices of lag polynomials and $e_{x,jt}$ and $e_{y,jt}$ are corresponding residual terms.

To test the multivariate causal relationship between vectors X_{jt} and Y_{jt}, two null hypotheses are tested as follows;

H_0^1 :$A_{xy,\ jt}(L) = 0$

H_0^2: $A_{yx,\ jt}(L) = 0$

There are four different situations for these causality relationships;

1) There is unidirectional causality from Y_{jt} to X_{jt} if H_0^1 is rejected but H_0^2 is not rejected.
2) There is unidirectional causality from X_{jt} to Y_{jt} if H_0^2 is rejected but H_0^1 is not rejected.
3) There is feedback relation when both H_0^1 and H_0^2 are rejected.
4) X_{jt} and Yjt are not being rejected to be independent when both H_0^1 and H_0^2 are not rejected.

A restricted VAR (ECM-VAR) is employed to test the causality relationship between two vectors of non-stationary time series, where the time series are co-integrated.

ECM-VAR Framework

$$\begin{pmatrix} x_{it} \\ y_{it} \end{pmatrix} = \begin{pmatrix} A_{x,it[n_1\times 1]} \\ A_{y,it[n_2\times 1]} \end{pmatrix} + \begin{pmatrix} A_{xx,it}(L)[n_1\times n_1] & A_{xy,jt}(L)[n_1\times n_2] \\ A_{yx,it}(L)[n_2\times n_1] & A_{yy,jt}(L)[n_2\times n_2] \end{pmatrix} + \begin{pmatrix} x_{j,t-1} \\ y_{j,t-1} \end{pmatrix} + \begin{pmatrix} \alpha_x[n_1\times 1] \\ \alpha_y[n_2\times 1] \end{pmatrix} ecm_{j,t-1} + \begin{pmatrix} e_{x,jt} \\ e_{y,jt} \end{pmatrix}$$

…………………………………………………………………………………………………..…11

Where $ecm_{i,t-1}$ is the lag 1 case error correction model parameter, $\alpha_{x,jt}[n_1\times 1]$ and $\alpha_{y,jt}[n_2\times 1]$ are vector of coefficients of $ecmj_{,t-1}$ term. Thus, the null hypotheses of H_0^1: $A_{xy,\ jt}(L) = 0$ and/or H_0^2: $A_{yx,\ jt}(L) = 0$ can be tested to identify the causality relationship.

In principle, the multivariate non-linear causality is similar to the bivariate non-linear causality test developed by Hiemstra and Jones (1994). In order to identify any non-linear granger causality relationship between two vectors of the time series say X_{jt} and Y_{jt} in the multivariate setting, the residuals from either the VAR or ECM-VAR model above are obtained, before applying a non-linear granger causality test to the residual series.

3.2.1.2 Simultaneous Equation Framework

Following the theoretical framework and the possibility of bidirectional causality among the variables, the simultaneous equations (3 and 4) are re-specified in sector specific and log-linear terms[7]. Based on data availability for the variables, the simultaneous equations estimated are given as follows (see next sub-section for variables definitions);

$$IN(AGR_{jt}) = \beta_0 + \beta_{1i}IN(FDI_{jt}) + \beta_{2i}IN(INV_{jt}) + \beta_{3i}(POPG_{jt}) + \beta_{4i}IN(OPEN_{jt}) + \beta_{5i}(HDI_{jt}) + \beta_{6i}IN(AGPrice_{jt}) + \beta_{7i}(RLAW_{jt}) + \mu_{it} \quad \text{(12a)}$$

$$(\mathrm{HDI_{jt}}) = \beta_0 + \beta_{1i}\mathrm{IN}(\mathrm{AGR_{jt}}) + \beta_{2i}\mathrm{IN}(\mathrm{FDI_{jt}}) + \beta_{3i}\mathrm{IN}(\mathrm{INV_{jt}}) + \beta_{4i}(\mathrm{POPG_{jt}}) + \beta_{5i}\mathrm{IN}(\mathrm{OPEN_{jt}}) + \beta_{6i}\mathrm{IN}(\mathrm{AGPrice_{jt}}) + \beta_{7i}(\mathrm{RLAW_{jt}}) + \mu_{jt} \quad \text{(12b)}$$

$$\mathrm{IN}(\mathrm{SER_{jt}}) = \beta_0 + \beta_{1i}\mathrm{IN}(\mathrm{FDI_{jt}}) + \beta_{2i}\mathrm{IN}(\mathrm{INV_{jt}}) + \beta_{3i}(\mathrm{POPG_{jt}}) + \beta_{4i}\mathrm{IN}(\mathrm{OPEN_{jt}}) + \beta_{5i}(\mathrm{HDI_{jt}}) + \beta_{6i}(\mathrm{RLAW_{jt}}) + \mu_{jt} \quad \text{(13a)}$$

$$(\mathrm{HDI_{jt}}) = \beta_0 + \beta_{1i}\mathrm{IN}(\mathrm{SER_{jt}}) + \beta_{2i}\mathrm{IN}(\mathrm{FDI_{jt}}) + \beta_{3i}\mathrm{IN}(\mathrm{INV_{jt}}) + \beta_{4i}(\mathrm{POPG_{jt}}) + \beta_{5i}\mathrm{IN}(\mathrm{OPEN_{jt}}) + \beta_{6i}(\mathrm{RLAW_{jt}}) + \mu_{jt} \quad \text{(13b)}$$

$$IN(MAN_{jt}) = \beta_0 + \beta_{1i}IN(FDI_{jt}) + \beta_{2i}IN(INV_{jt}) + \beta_{3i}(POPG_{jt}) + \beta_{4i}IN(OPEN_{jt}) + \beta_{5i}(HDI_{jt}) + \beta_{6i}IN(MANPrice_{jt}) + \beta_{7i}(RLAW_{jt}) + \mu_{jt} \quad \text{(14a)}$$

$$(\mathrm{HDI_{jt}}) = \beta_0 + \beta_{1i}\mathrm{IN}(\mathrm{MAN_{jt}}) + \beta_{2i}\mathrm{IN}(\mathrm{FDI_{jt}}) + \beta_{3i}\mathrm{IN}(\mathrm{INV_{jt}}) + \beta_{4i}(\mathrm{POPG_{jt}}) + \beta_{5i}\mathrm{IN}(\mathrm{OPEN_{jt}}) + \beta_{6i}\mathrm{IN}(\mathrm{MANPrice_{jt}}) + \beta_{7i}(\mathrm{RLAW_{jt}}) + \mu_{jt} \quad \text{(14b)}$$

Equations (12a) through (14b) are re-specified to correct for cross-sectional correlated errors, following Pesaran (2004,), Binder and Offermanns, (2007) and Adewuyi, (2016) as follows:

$$IN(AGR_{jt}) = \beta_0 + \beta_{1i}IN(FDI_{jt}) + \beta_{2i}IN(INV_{jt}) + \beta_{3i}(POPG_{jt}) + \beta_{4i}IN(OPEN_{jt}) + \beta_{5i}(HDI_{jt}) + \beta_{6i}IN(AGPrice_{jt}) + \beta_{7i}(RLAW_{jt}) + \sum_{p=1}^{n}\theta\overline{AGR}_{ij,p} + \sum_{p=1}^{n}\theta\overline{FDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{INV}_{ij,p} + \sum_{p=1}^{n}\theta\overline{POPG}_{ij,p} + \sum_{p=1}^{n}\theta\overline{OPEN}_{ij,p} + \sum_{p=1}^{n}\theta\overline{HDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{AGPrice}_{ij,p} + \sum_{p=1}^{n}\theta\overline{RLAW}_{ij,p} + \mu_{it} \quad \text{(12a}^1\text{)}$$

[7]All variables are expressed in logs except Rule of Law, population growth rate and Human development Index

$$(HDI_{it}) = \beta_0 + \beta_{1i}IN(AGR_{it}) + \beta_{2i}IN(FDI_{it}) + \beta_{3i}IN(INV_{it}) + \beta_{4i}(POPG_{it}) + \beta_{5i}IN(OPEN_{it}) + \beta_{6i}IN(AGPrice_{it}) + \beta_{7i}(RLAW_{it}) + \sum_{p=1}^{n}\theta\overline{HDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{AGR}_{ij,p} + \sum_{p=1}^{n}\theta\overline{FDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{INV}_{ij,p} + \sum_{p=1}^{n}\theta\overline{POPG}_{ij,p} + \sum_{p=1}^{n}\theta\overline{OPEN}_{ij,p} + \sum_{p=1}^{n}\theta\overline{AGPrice}_{ij,p} + \sum_{p=1}^{n}\theta\overline{RLAW}_{ij,p} + \mu_{it} \quad \ldots\ldots (12b^1)$$

$$IN(SER_{it}) = \beta_0 + \beta_{1i}IN(FDI_{it}) + \beta_{2i}IN(INV_{it}) + \beta_{3i}(POPG_{it}) + \beta_{4i}IN(OPEN_{it}) + \beta_{5i}(HDI_{it}) + \beta_{6i}(RLAW_{jt}) + \sum_{p=1}^{n}\theta\overline{SER}_{ij,p} + \sum_{p=1}^{n}\theta\overline{FDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{INV}_{ij,p} + \sum_{p=1}^{n}\theta\overline{POPG}_{ij,p} + + \sum_{p=1}^{n}\theta\overline{OPEN}_{ij,p} + \sum_{p=1}^{n}\theta\overline{HDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{RLAW}_{ij,p} + \mu_{it} \quad \ldots\ldots (13a^1)$$

$$(HDI_{it}) = \beta_0 + \beta_{1i}IN(SER_{it}) + \beta_{2i}IN(FDI_{it}) + \beta_{3i}IN(INV_{it}) + \beta_{4i}(POPG_{it}) + \beta_{5i}IN(OPEN_{it}) + \beta_{6i}(RLAW_{it}) + \sum_{p=1}^{n}\theta\overline{HDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{SER}_{ij,p} + \sum_{p=1}^{n}\theta\overline{FDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{INV}_{ij,p} + \sum_{p=1}^{n}\theta\overline{POPG}_{ij,p} + \sum_{p=1}^{n}\theta\overline{OPEN}_{ij,p} + \sum_{p=1}^{n}\theta\overline{RLAW}_{ij,p} + \mu_{it} \quad \ldots\ldots (13b^1)$$

$$IN(MAN_{it}) = \beta_0 + \beta_{1i}IN(FDI_{it}) + \beta_{2i}IN(INV_{it}) + \beta_{3i}(POPG_{it}) + \beta_{4i}IN(OPEN_{it}) + \beta_{5i}(HDI_{it}) + \beta_{6i}IN(MANPrice_{it}) + \beta_{7i}(RLAW_{jt}) + \sum_{p=1}^{n}\theta\overline{MAN}_{ij,p} + \sum_{p=1}^{n}\theta\overline{FDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{INV}_{ij,p} + \sum_{p=1}^{n}\theta\overline{POPG}_{ij,p} + \sum_{p=1}^{n}\theta\overline{OPEN}_{ij,p} + \sum_{p=1}^{n}\theta\overline{HDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{MANPrice}_{ij,p} + \sum_{p=1}^{n}\theta\overline{RLAW}_{ij,p} + \mu_{it} \quad \ldots\ldots (14a^1)$$

$$(HDI_{it}) = \beta_0 + \beta_{1i}IN(MAN_{it}) + \beta_{2i}IN(FDI_{it}) + \beta_{3i}IN(INV_{it}) + \beta_{4i}(POPG_{it}) + \beta_{5i}IN(OPEN_{it}) + \beta_{6i}IN(MANPrice_{it}) + \beta_{7i}(RLAW_{it}) + \sum_{p=1}^{n}\theta\overline{HDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{MAN}_{ij,p} + \sum_{p=1}^{n}\theta\overline{FDI}_{ij,p} + \sum_{p=1}^{n}\theta\overline{INV}_{ij,p} + \sum_{p=1}^{n}\theta\overline{POPG}_{ij,p} + \sum_{p=1}^{n}\theta\overline{OPEN}_{ij,p} + \sum_{p=1}^{n}\theta\overline{MANPrice}_{ij,p} + \sum_{p=1}^{n}\theta\overline{RLAW}_{ij,p} + \mu_{it} \quad \ldots\ldots (14b^1)$$

Where $\overline{AGR_{ij}}$, $\overline{FDI_{ij}}$, $\overline{INV_{ij}}$, $\overline{POPG_{ij}}$, $\overline{OPEN_{ij}}$, $\overline{HDI_{ij}}$, $\overline{RLAW_{ij}}$, $\overline{MAN_{ij}MANPrice_{ij}}$, $\overline{AGPrice_{ij}}$,and $\overline{SER_{ij}}$ are cross-sectional mean of agricultural, Services and Manufacturing output shares (AGR), SER and MAN respectively),foreign direct investment (FDI), Investment (INV), population growth rate (POPG), trade openness (OPEN), human development index (HDI), world manufacturing price (MANPrice), world agricultural price(AGPrice) and rule of law (RLAW) governance index across countries.

Since the existence of cross section dependence and non-stationarity could make the econometrics results imprecise, the estimation started with testing for cross-section dependence (CD), and stationarity using Pesaran (2004 and 2015), CD tests, and Hadri (2000), Pesaran (2003; CADF and 2007; CIPS) tests respectively. Therefore, the simultaneous equations for 5a to 7b are estimated using two stage least square (2SLS) and three stage least (3SLS) techniques correcting for cross section dependence since there are relatively large cross-section and time period and as confirmed by the CD tests (Lee and Robinson, 2016).

3.2.1.2 Threshold Regression

In order to examine the precise threshold level of FDI at which sectoral output (AGR, MAN, SER) will positively impact poverty (proxy by Human Development index-HDI), this study adopts the dynamic threshold panel model developed by Kremer et al. (2013). The dynamic threshold panel model not only endogenously determines the threshold values based on the characteristics of the constraint variables; it also addresses the problem of endogeneity that may occur in the nexus. This approach is an advanced procedure over the static threshold panel model suggested by Hansen (1999) and that proposed by Dang et al. (2012). Following Kremer et al. (2013) therefore, we set the following equations to underscore the threshold level of FDI required to raise outputs and reduce poverty levels in Africa. A higher or lower level of FDI presents different implications for both poverty index and sectoral output growth.

Impact of FDI on Sectoral output given the level of Poverty (HDI)

All variables are as defined before except that the threshold parameter in the model isHDI_{it} which represents the regime-switching variable that is assumed to be stationary and exogenous. x_{jt} refers to other control variables in our model. The model is as specified:

$$AGR_{jt} = \beta_0 + \beta_1 AGR_{j,t-1} + \beta_2 FDI_{jt} * I(HDI_{it} < C) + \beta_3 FDI_{jt} * I(HDI_{it} \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt} \ldots \ldots \quad (15a)$$

$$MAN_{jt} = \beta_0 + \beta_1 MAN_{j,t-1} + \beta_2 FDI_{jt} * I(HDI_{it} < C) + \beta_3 FDI_{jt} * I(HDI_{it} \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt}. \ldots \quad (15b)$$

$$SER_{jt} = \beta_0 + \beta_1 SER_{j,t-1} + \beta_2 FDI_{jt} * I(HDI_{it} < C) + \beta_3 FDI_{jt} * I(HDI_{it} \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt}. \ldots \quad (15c)$$

Impact of FDI on HDI given the level of Sectoral Output

All variables are as defined before except that the threshold parameter in the model is now sectoral output defined as: AGR_{it}, MAN_{it}, and SER_{it}respectively. They represent the regime-switching variables that are assumed to be stationary and exogenous. x_{jt} refers to other control variables in our model. The model is as specified:

$$HDI_{jt} = \beta_0 + \beta_1 HDI_{j,t-1} + \beta_2 FDI_{jt} * I(AGR_{it} < C) + \beta_3 FDI_{jt} * I(AGR_{it} \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt}$$

……… (16a)

$$HDI = \beta_0 + \beta_1 HDI_{j,t-1} + \beta_2 FDI_{jt} * I(MAN_{it} < C) + \beta_3 FDI * I(MAN_{it} \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt}. \quad (16b)$$

$$HDI = \beta_0 + \beta_1 HDI_{j,t-1} + \beta_2 FDI_{jt} * I(SER_{it} < C) + \beta_3 FDI * I(SER \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt}. \quad (16c)$$

Impact of HDI on Sectoral output given the level of FDI

All variables are as earlier defined, however μ_j and $V_t$designate country and time effects, while ε_{jt} refers to the model error term. Further, $I(.)$refers to the indicator function, and C is the threshold parameter while FDI_{it} indicates the regime-switching variable that is assumed to be stationary and exogenous. x_{jt} refers to other control variables in our model. The Wald statistic is used to determine whether the threshold effect is significant. The smaller the estimated probability, the more significant the threshold effect.

$$AGR_{jt} = \beta_0 + \beta_1 AGR_{j,t-1} + \beta_2 HDI_{jt} * I(FDI_{it} < C) + \beta_3 HDI_{jt} * I(FDI_{it} \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt} \quad (17a)$$

$$MAN_{jt} = \beta_0 + \beta_1 MAN_{j,t-1} + \beta_2 HDI_{jt} * I(FDI_{it} < C) + \beta_3 HDI_{jt} * I(FDI_{it} \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt}. \quad (17b)$$

$$SER_{jt} = \beta_0 + \beta_1 SER_{j,t-1} + \beta_2 HDI_{jt} * I(FDI_{it} < C) + \beta_3 HDI_{jt} * I(FDI_{it} \geq C) + \beta_n x_{jt} + \mu_j + V_t + \varepsilon_{jt}.. \quad (17c)$$

3.2.2 Data Sources and Description of Variables

Some of the major challenges faced by this study are the collection of data for the African countries. In trying to overcome these difficulties, data were collected from different sources for 34 countries[8] from 1990-2018. This period captures the period where virtually all the regions witnessed a positive aggregate FDI inflows (see Table 4). FDI data defined as net inflows of FDI as a percentage of GDP data was sourced from Word Development Indicators (WDI) (World Bank, 2017), while both agricultural and manufacturing world prices (AGPrice and MANPrice respectively) were obtained from World Bank's Global Economic Monitor database. In the case of the poverty data, the study adopted the Human Development Index (HDI) following Gohou and Soumare (2012)[9]. In the past, development literature

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[8]See appendix 3 for the list of countries

[9]We also employed the Households and NPISHs Final consumption expenditure per capita (constant 2010 US$) as a measure of poverty status to check for robustness of results. This data was obtained from the World Bank data base online (WDI, 2019).

has used measures such as GDP per capita or private (household) consumption expenditure per capita or poverty incidence to assess welfare levels among countries.

However, according to Gohou and Soumare (2012), these measures come with some levels of limitations. For instance, while GDP per capita only captures the economic dimension of welfare, it deemphasised the importance of other factors such as education, health care and sanitation. Similarly, while poverty incidence measures the levels of well-being in all-inclusiveness, it is difficult to be aggregated across countries. Secondly, it is not recorded annually and this has posed serious challenges for empirical studies. Therefore, in order to overcome these challenges, this study adopts the Human Development Index (HDI) which is an aggregate composite of measures of well-being. Data for sectoral output share (share of agriculture--AGR, manufacturing--MAN and services--SER in GDP) and population growth rate (POPG) were sourced from the UNCTAD and World Development Indicator (WDI) (World Bank database, 2017).

Data for Openness to trade (OPEN) defined as the average of the sum of exports plus imports to total output (GDP) was sourced from (WDI, 2017). The per capita growth rate of output is measured as the growth of real per capita GDP in constant dollars using data from the (WDI, 2017). Investment– GDP ratio (INV) was proxied by gross capital formation as a percentage of GDP (WDI, 2017). This is defined as outlays on fixed assets of the economy plus net changes in the level of inventories. The study adopts the partial regression approach using Ordinary Least Square (OLS) econometric procedure to 'filter out' the influence of one sector from another following Chukwu and Malikane (2017). This approach entails the setting of each of the sectors as the dependent variables, while the rest of the sectors are set as the independent variables at different times. At each stage, the *residual* values for each of the equations are obtained and then adopted as the 'real' values of the sectors' share to GDP for various years. The equation for obtaining each sector's residual value is stated as follows: $\hat{y}_{jt} = \beta_j + \beta_i x_{jt} + \varepsilon_{jt}$. Where, y_{jt} represents each of the three sectors (dependent variables) for country j at time t; β_j, represents the equation intercept; β_i represents the coefficient of the parameters; x_{jt} represents other sectors (independent variables);ε_{jt} is the error term.

4.0 RESULTS AND DISCUSSIONS

4.1Descriptive Statistics and Correlation Analysis

The descriptive statistics and correlation analysis of the variables used in the regression analysis are presented in Table 5. Rule of law (RLAW) recorded the highest mean and maximum while share of service in GDP (SER) has the highest minimum value among the series. Conversely, human development index (HDI) has the least average values, while foreign direct investment (FDI % of GDP) has the least minimum value among the variables**.** It is also observed that variability is highest for rule of law (RLAW), while HDI appears to be the least volatile among the variables. There exists weak to moderate correlation among all pairs of variables, except between the share of manufacturing and service in GDP and between private consumption expenditure per capita (PCPC) and HDI where correlation is high. Also, correlation analysis shows that population growth (POPG) has negative relationship with all other variables except share of agricultural output in total GDP (AGR). FDI and HDI have positive relationship with all other variables except population growth (POPG). Similarly, service output and manufacturing shares in GDP have positive correlation with all variables except trade openness (OPEN) and population growth (POPG) where correlation is negative. Agricultural output share in GDP maintained negative association with investment (INV), trade openness (OPEN), rule of law (RLAW) and private consumption per capita (PCPC).

[Insert Table 5 Here]

4.2 Test for Cross Sectional Dependence (CD) and Stationarity

This study conducts the Pasaran (2004) and Pasaran (2015) CD tests to discover the existence of global common shocks or spillover effect that may result in imprecise model estimates. The tests have the null hypothesis of no cross-sectional dependence which is robust in the presence of multi-breaks in slope coefficients and in the error variance. The results of the two tests presented in Table 6 clearly rejects the null hypothesis of no cross-sectional dependence among panel groups, except in the case of rule of law where only Pesaran (2015) shows evidence of cross- sectional independence. Stationarity property of the series is established, using Hadri (2000) LM, Pesaran (2003)'s CADF and Pesaran (2007)'s CIPS tests. The results presented in Table 7 show that the series are stationary either at level or at first difference.

[Insert Table 6 Here]

Following the results of the above tests, we proceeded to estimate our simultaneous equation models which were corrected for cross section dependence and stationarity status of the variables. It should be noted that although OLS was used along with the simultaneous equation techniques (2SLS and 3SLS), the latter was interpreted and analysed. In particular, in the next sub-section, we have focused on the interpretation and analysis of the estimates obtained from 3SLS method because of its ability to account for both endogeneity and contemporaneous correlation of the error terms in the estimated equations.

[Insert Table 7 Here]

4.3 Granger Causality among FDI, Sectoral output and Poverty level

Results of Heterogeneous Panel Granger causality analysis reported in Table 8 reveals significant positive bidirectional causality between FDI and each of agricultural, manufacturing and service output. Similar bidirectional causality is also found between HDI, as well as private consumption per capita (PCPC), and each of the sectoral output

[Insert Table 8 Here]

The Vector Auto-regression (VAR) or ECM-VAR models are also employed to examine whether there are any multivariate linear Granger causality relationships among foreign direct investment (FDI), sectoral output and human development index (HDI). As presented in Table 9a, there is unidirectional linear Granger causality from agricultural output and HDI to FDI. Unidirectional linear Granger causality from manufacturing output and HDI to FDI is also discovered. For the service sector, no linear Granger causality exists from the output of the sector and HDI to FDI or vice versa. Moreover, multivariate nonlinear Granger causality test is applied to the error terms from the estimated VAR or ECM-VAR models to investigate whether there is any remaining undetected multivariate nonlinear relationship among the variables.

The results show evidence of unidirectional nonlinear causality from FDI to agricultural output and HDI and from FDI to manufacturing output and HD as well as from FDI to service output. Therefore, combining the results of both the linear and non-linear multivariate granger causality tests, it could be concluded that the bidirectional (feedback) causality exists among the variables.

This is because, while linear method discovers one part of the causality, the non-linear technique finds the other part. Thus, further analysis can be conducted using simultaneous equation model that can provide not only the causality among the variables but also the direction and precise estimates of the effect of one variable on the others.

[Insert Table 9a Here]

In order to account for robustness, the linear and non-linear causality tests based on VECM and VAR framework are repeated taking personal consumption per capital (PCPC) as the proxy for poverty with results presented in Table 9b.

The results reveal bidirectional linear Granger causality from agricultural output and PCPC to FDI and vice-versa (reverse from FDI to agricultural output and PCPC). Furthermore, unidirectional linear Granger causality exists from FDI to service output and PCPC while bidirectional linear granger causality is observed to move from FDI to manufacturing output and PCPC and vice versa. On the other hand, the results of the nonlinear multivariate causality show only unidirectional nonlinear Granger causality from FDI to agricultural output and PCPC. The possibility of feedback relationship among FDI, sectoral output and poverty level as suggested by the results of the multivariate Granger causality tests therefore informs the conduct of further analysis using simultaneous equation model to avoid simultaneity bias in the results.

[Insert Table 9b Here]

4.4 Simultaneous Equation Results

In the estimations for all the sectors, 3SLS estimates are preferred since it solves the problems of endogeneity and contemporaneous correlations among the models' residuals.

4.4.1 The Effect of FDI on Agricultural Output Growth and Poverty

Results of OLS, 2SLS and 3SLS methods for the effect of FDI on agricultural sector output and poverty are reported in Table 10. The results reveal that FDI exerts insignificant positive impact on both agricultural output and HDI. This implies that inflow of FDI has little complementary effect on domestic investment in the sector in terms of reducing the application of crude implements in farming activities as FDI produces little technology spillover to replace manual activities and raise productivity as well as human development (reduce poverty). This finding is inconsistent with Basu and Guariglia (2007) who noted that FDI reduces the share of agriculture to GDP among selected 119 developing countries.

Furthermore, domestic investment had significant positive effect on agriculture output but significant negative effect on HDI, where 1.0 percent increase in domestic capital formation promotes agricultural output growth but reduce human development (increase poverty) by about 3.97 percent and 0.22 percent respectively. This suggests that while domestic capital formation in most African countries enhances productivity in the sectors (with investment in the accumulation of inputs), it does not necessarily translate to poverty reduction. Similarly, rule of law enforcement exerts significant negative and positive effects on agricultural output and HDI respectively, as 1.0 percent improvement in the enforcement of the rule of law generated 0.19 percent fall and 0.01 percent rise in agricultural output and HDI respectively. This reflects the positive influence of improvement in the institutional quality on the implementation and execution of human development and poverty reduction programmes in African States. However, enforcement of rule of law may hinder agricultural productivity particularly when such law prohibits child and female labour among agricultural or rural populace. The results also indicate that, while openness of the economy harm agricultural productivity, it enhances human development (reduces poverty). The first part of the results may be a reflection of lack of competitiveness of the African agricultural sector (output) in the international market, while the second part may exhibit the role of trade in enhancing welfare by broadening production and consumption baskets, and providing commodities at competitive affordable prices.

The results of the feedback effect between HDI and agricultural output show that HDI had significant positive impact on agricultural output, while the latter also exerts significant positive effect on HDI. Hence, 1.0 percent increase in HDI led to 17.93 percent increase in agricultural output growth while a similar increase in the latter raised the former by about 0.05%. This may imply that, as the human development improves (level of poverty declines), there will be increase in agricultural output as improved education, health and income enable people to raise their productivity levels Also, the results suggest that, as the agricultural output rises, food becomes affordable, nutritional status improves and linkage with other sectors progresses while poverty eventually declines (improvement in HDI). This result is consistent with the findings of Msuya (2007) where agricultural productivity was considered essential in achieving sustainable growth.

[Insert Table 10 Here]

4.4.2 The Effect of FDI on Service Output Growth and Poverty

The results presented in Table 11 reveal that FDI has significant positive effect on both service sector output and HDI, as 1.0 percent increase in FDI inflow resulted in 1.19 percent and 0.09 percent increase in service sector output and HDI respectively. This may reflect the significant spillover effect of FDI in the service sector in African countries, which translates to significant poverty reduction as employment and service delivery in this sector (particularly telecommunication and transportation) rises in most African economies due to complementarity and competition between domestic and foreign investments. Moreover, rule of law exerts significant positive effect on both service output and HDI underscoring the positive impact of improvement in the enforcement of rule of law on economic activities, as well as better access to basic education and health facilities (under compulsory universal basic education and health insurance programmes) which leads to poverty reduction in Africa. Thus, improvement in the enforcement of rule of law is important for the effectiveness of poverty reduction programmes.

Domestic investment has significant negative impact on both HDI and service sectors GDP, while the influences of both trade openness and population growth on them are insignificant. The estimates show that 1.0% increase in domestic investment hurts service sector output and HDI by 5.41 percent or 0.39 percent respectively, thereby aggravating poverty. It may also portray diminishing marginal productivity of labour in the sector. Further results show that the influence of HDI on service sector output is significantly negative while the effect of the later on HDI is negligible. Thus, 1.0 percent improvement in HDI (reduction in poverty) cripples service output by about 13.96 percent as the required high skills and energy are produced via improved education and health to engage in more rewarding and specialised or real sector activities than providing services. Thus, improvement in education (skill) and health status of labour may not significantly raise the level of service output. Hence, improvement in service sector output may not enhance human development (may not produce the desired reduction in poverty level) following lack of trickle-down effect on the society in terms of increased employment and income as well as social responsibility.

[Insert Table 11 Here]

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4.4.3 The Effect of FDI on Manufacturing Output Growth and Poverty

According to the results in Table 12, FDI had significant positive effect on both manufacturing output and human development, implying that 1.0 percent rise in FDI raises manufacturing output and human development by about 1.95 percent and 0.04 percent respectively. These results reflect the spillover effect of FDI on the sector in terms of inflow of better technology, skills and managerial capabilities which promote efficiency and productivity growth. FDI when properly harnessed could lead to transfer of technology and skills to host country and this in turns promote human development. These findings are in line with Akinlo (2004) where the impact of FDI on manufacturing sector output was reported to outweigh those of the extractive industry and Basu and Guariglia (2007) where FDI promotes industrial growth. The results also show that the effect of trade openness and population growth on manufacturing output and HDI is insignificant. These results point to the lack of international competitiveness of this sector. It also reflects the inability of the sector to absorb the growing labour force (majority of which are unskilled), which leads to marginal rise in labour productivity in the sector.

Further, enforcement of rule of law is found to have positive effect on both manufacturing output growth and HDI. Effective enforcement of contract and property rights as well as absence of crimes foster manufacturing productivity and human development. Similar to the results obtained for service output, HDI has significant negative effect on manufacturing sector output, while there is no feedback effect as the impact of manufacturing output on HDI is insignificant. In this case, 1.0 percent increase in HDI is capable of retarding this sector output by about 43 percent as diversion to human development (poverty reduction) programmes may cause increased investment in sectors such as the services (education and health) and agricultural sectors at the expenses of the manufacturing sector. However, improvement in manufacturing sector output may not promote human development (may not reduce poverty level). This may be the case in the absence of trickle-down effect of the sectoral growth on the society (in terms of increased employment and income as well as social responsibility) particularly if there is poor linkage of the sector with the agricultural sector, which employs the large share of the labour force and produces food and raw materials.

[Insert Table 12 Here]

4.4.4 Robustness Check

For robustness purpose, per capita private consumption expenditure (PCPC) is used as a proxy for poverty level as high private spending may suggest low poverty level, while low spending is an indication of high poverty level in an economy. Robustness results for the agricultural, service and manufacturing sectors are presented in Table 13.The results for the agricultural sector are largely consistent with earlier results in terms of sign and significance. For instance, FDI does not exert significant influence on both agricultural output and per capita private consumption, reinforcing earlier findings that FDI inflow has negligible impact on agricultural output and HDI.

Similarly, robustness estimates confirm the significant positive feedback effect between agricultural sector output and per capita private consumption (or HDI in the earlier results), with elasticities of 2.0 and 0.45 respectively. This implies that high agricultural output has positive influence on private consumption, hence reduces poverty. In the same vein, human development or poverty alleviation is important for high agricultural output as improved education, health and nutritional status raise labour productivity and income in the sector, and hence enhance output of the sector. For service sector, FDI has significant positive impact on per capita private consumption with elasticity of 0.19, while its positive effect on the output of this sector is insignificant. This partly corroborates earlier results where FDI is found to exert significant positive impact on agricultural sector output.

Also, while the effect of per capita private consumption expenditure on service output is insignificant, the impact of the later on the former is significant positive with elasticity of 0.01. This indicates that while service output growth may not be important for improving HDI, it is critical for raising per capita private consumption. In the case of the manufacturing sector, FDI has similar significant positive effect on per capita private consumption as HDI (though with higher elasticity of 0.22). However, its impact on the output of the sector is negligible. Moreover, while per capita private consumption does not influence manufacturing output significantly, the effect of the latter on per capita private consumption is significantly negative. This shows that manufacturing output growth influences private consumption and HDI differently in most African countries. Hence, the relationship among FDI, manufacturing output and poverty level largely depends on the proxy used for measuring poverty level.

[Insert Table 13 Here]

4.5 Threshold Analysis

First, the dynamic threshold results presented in Table 14 is used to test the null hypothesis of no threshold effects, where the transition variable is HDI. Thus, we examine the level of HDI that is optimal, below (regime $1(\alpha_{it} < \gamma)$) or above (regime $2(\alpha_{it} \geq \gamma)$) which further increase could increase or reduce sectoral growth among African countries. The results reported in Table 14 show significant presence of dynamic threshold effect in all the sectors. Thus, in all the sectors, the influence of FDI on sectoral output is significantly positive with higher response of output when HDI rises above the threshold. This indicates that, increase in FDI tends to promote output in all sectors with larger effect even at beyond the optimal HDI levels.

[Insert Table 14 Here]

Second, we analyse the optimal level of each of the sectoral output for which FDI is capable of increasing or reducing the level of poverty. According to Table 15, FDI has a significant positive impact on poverty (as measured by HDI) only when outputs of the agricultural and service sectors are at their threshold levels. This implies that FDI inflow reduces poverty to the extent that agricultural and service output do not exceed their optimal levels, otherwise the impact wanes and become negligible. For the manufacturing sector, FDI has no significant impact on human development (poverty reduction) either below or above the optimal level of manufacturing output. The implication of this is that FDI plays no significant role in reducing poverty given the output of the manufacturing sector.

[Insert Table 15 Here]

Third, the dynamic threshold results presented in Table 16 is employed to test the null hypothesis of no threshold effects, where the transition variable is FDI. Thus, we examine the level of FDI inflow that is optimal, below or above which further increase could increase or reduce the impact of poverty on sectoral growth among the selected African countries. HDI (poverty reduction) has significant positive effect on output of the agricultural sector in regime 1, but its impact becomes insignificant in the regime 2. This indicates that poverty reduction raised agricultural output only when foreign direct investment is kept below its optimal level, otherwise poverty reduction activities may be jeopardised by continuous inflow of FDI especially to the agricultural sector. For manufacturing and service sectors, HDI has significant positive effect on outputs in both regimes, though coefficients are higher in regime 1 than in regime 2. Thus, poverty reduction significantly enhances output growth in both manufacturing and service sectors especially when FDI is above the threshold (optimal) level. However, the positive impact of poverty reduction on the output of these sectors is lower with higher FDI inflow beyond its optimal value.

[Insert Table 16 Here]

These results are largely consistent with those obtained when personal consumption per capita is used as a measure of poverty, especially in the agricultural and manufacturing sectors. In the service sector, results are similar in both regimes, suggesting that impact of personal consumption (poverty reduction) on service output is identical at any level of FDI inflow.

5.0 Conclusion and Policy Recommendations

This study examined the effects of FDI on sectoral growth and poverty in a cross-sectional panel of 34 countries, spanning 1990-2018. It adopted recent causality methods and simultaneous equation as well as threshold models. The paper accounted for sectoral spillover effect, heterogeneity, simultaneity and cross section dependence in the modeling. Results of the bivariate causality tests reveal significant positive bidirectional causality between FDI and each of agricultural, manufacturing and service output. Similar bidirectional causality is also found between HDI, as well as private consumption per capita (PCPC), and each of the sectoral outputs. Combining the results of both the linear and non-linear multivariate granger causality tests, bidirectional (feedback) causality exists among the variables. This is because, while linear method discovers one part of the causality, the non-linear technique finds the other part.

Results of the simultaneous equation models show that FDI promotes outputs of manufacturing and service sectors, but hinders that of agricultural sector, while it fosters human development. Also, the results show that, while human development promotes output of the agricultural sector, it deters output of manufacturing and service sectors. Further results show that only agricultural output improves human development and welfare among countries. The above results are complemented with those of the dynamic threshold regression analysis which reveals the following. First, FDI tends to promote output growth in all sectors with larger effect at levels beyond the optimal HDI. Second, FDI has a significant positive impact on poverty reduction (HDI) only when growth of outputs of agriculture and services are at their threshold levels. Third, poverty reduction significantly enhances output growth in both manufacturing and service sectors especially when FDI is above the threshold (optimal) level.

This study therefore recommends that for the African countries to improve sectoral output growth and welfare using the FDI as a catalyst, a policy framework towards attracting more FDI into the three key sectors (especially in the manufacturing and services) is desirable for increased output and poverty reduction (human development). Also, such policies should target intersectoral linkages especially between agricultural and manufacturing sectors along the local and international value chain. The international competitiveness of the economies should be improved so as to be able to reap the benefits of openness of the economies. One way to do this is to reduce the cost of doing business in African countries and improve products quality. Moreover, there is need for continuous human development via improved quality of education and health so as to complement FDI to produce high sectoral outputs. Thus, African countries need to learn from the experience of the major Asian economies (China and India) which have shown that population growth can be used to stimulate economic growth if there is a clear and effective framework for human capital development. This therefore calls for compliance with the stipulated minimum budget shares for education and health by the WHO and UNESCO.

Declarations

- **Ethics approval and consent to participate:** "Not Applicable"

- **Consent for publication:** "Not Applicable"

- **Availability of data and material**
  There was no special data generated for this study. Data sources for this study are stated in the manuscript in section 3.2.2 "Data Sources and Description of Variables". However, the complete dataset will be made available on demand.

- **Competing interests**
  The Authors declares that there is no potential conflict of interest.

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- **Authors' contributions**
  A.B Chukwu conceptualized the idea of this study, developed the literature and theory. While A.O Adewuyi designed the model and the computational framework and analysed the data. Both authors read the final draft of the manuscript before sending it out for assessment.

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Tables

Table 1. FDI inward and outward stock, by region and economy (Billion dollars), 1990-2017

	Inward Flow					**Outward Flow**				
Region/economy	2013	2014	2015	2016	2017	2013	2014	2105	2016	2107
World	**24764.74**	**25378.77**	**25664.96**	**27663.09**	**31524.36**	**1380.87**	**1262.01**	**1621.89**	**1473.28**	**1429.97**
Developed economies	16108.91	16299.37	16384.15	17672.20	20331.17	890.11	731.67	1183.57	1041.46	1009.21
Europe	9272.86	8944.20	8997.49	9194.74	10362.40	387.67	240.30	728.18	526.43	417.81
European Union	8228.78	7936.56	7933.00	8028.10	9123.98	340.88	222.24	606.65	452.87	435.74
Developing economies	7846.91	8452.64	8677.87	9234.03	10353.48	414.98	457.99	406.24	406.67	380.77
Africa	692.34	714.21	747.91	807.55	866.82	16.07	13.60	10.84	11.23	12.08
Asia	5175.08	5706.16	6020.75	6369.27	7262.95	362.13	411.96	358.73	384.66	350.15
• East and South-East Asia	4209.47	4644.91	4930.15	5220.33	5990.48	314.32	377.12	310.22	341.69	305.25
• South Asia	314.02	354.47	390.27	439.68	506.93	2.18	12.02	7.82	5.51	11.61
• West Asia	651.59	706.79	700.33	709.26	765.53	45.62	22.83	40.70	37.46	33.28
Latin America and the Caribbean	1955.52	2008.11	1884.95	2031.68	2194.40	34.60	31.04	35.63	9.34	17.33
Oceania	23.97	626.76	602.94	756.86	839.70	2.18	1.39	1.03	1.44	1.22
Transition economies	808.92	559.08	536.39	686.99	753.95	75.79	72.34	32.09	25.16	39.99
Structurally weak, vulnerable and small economies										
LDCs	199.15	223.05	255.71	287.97	312.11	7.99	3.71	2.42	4.29	2.86
LLDCs	284.08	309.15	323.81	346.32	369.65	4.50	5.75	4.30	-2.34	3.23
SIDS	73.52	76.09	79.01	80.96	85.77	0.49	2.70	0.68	0.37	0.32
Memorandum: percentage share in world FDI flows										
Developed economies	65.05	64.22	63.84	63.88	64.49	64.46	57.98	72.97	70.69	70.58
Europe	37.44	35.24	35.06	33.24	32.87	28.07	19.04	44.90	35.73	29.22
European Union	33.23	31.27	30.91	29.02	28.94	24.69	17.61	37.40	30.74	30.47
Developing economies	31.69	33.31	33.81	33.38	32.84	30.05	36.29	25.05	27.60	26.63
Africa	2.80	2.81	2.91	2.92	2.75	1.16	1.08	0.67	0.76	0.84
Asia	20.90	22.48	23.46	23.02	23.04	26.22	32.64	22.12	26.11	24.49
• East and South-East Asia	17.00	18.30	19.21	18.87	19.00	22.76	29.88	19.13	23.19	21.35
• South Asia	1.27	1.40	1.52	1.59	1.61	0.16	0.95	0.48	0.37	0.81
• West Asia	2.63	2.78	2.73	2.56	2.43	3.30	1.81	2.51	2.54	2.33
Latin America and the Caribbean	7.90	7.91	7.34	7.34	6.96	2.51	2.46	2.20	0.63	1.21
Oceania	0.10	2.47	2.35	2.74	2.66	0.16	0.11	0.06	0.10	0.09
Transition economies	3.27	2.20	2.09	2.48	2.39	5.49	5.73	1.98	1.71	2.80
Structurally weak, vulnerable and small economies*	2.25	2.40	2.57	2.59	2.43	0.94	0.96	0.46	0.16	0.45
LDCs	0.80	0.88	1.00	1.04	0.99	0.58	0.29	0.15	0.29	0.20
LLDCs	1.15	1.22	1.26	1.25	1.17	0.33	0.46	0.26	-0.16	0.23
SIDS	0.30	0.30	0.31	0.29	0.27	0.04	0.21	0.04	0.03	0.02

Compiled by Author. Data Source: (UNCTAD, 2018). Web page:https://unctad.org/en/Pages/DIAE/World%20Investment%20Report/Regional-FDI-at-a-glance.aspx
LDCs- Least Developed Countries, LLDCs - Landlocked Developing Countries, SIDS - Small Island Developing States *without double counting.

Table 2: Distribution of FDI projects by Sectors, cumulative 2015-2017 (Millions of dollars)

	Destination (Inflow)				Investor (Outflow)			
Sector	Africa	Asia	LAC*	Transition	Africa	Asia	LAC	Transition
Agriculture	29259	15744	10486	39974	383	10481	116	901
Manufacture	55623	371306	94719	63299	11389	284897	9721	20394
Services	161537	492628	111338	35182	18961	434039	14052	43147
Total	**246419**	**879678**	**216543**	**138455**	**30733**	**729417**	**23889**	**64442**

Authors' computation (Data source: World Investment Report, UNCTAD, 2018). * Latin America and Caribbean

Table 3: Magnitude of FDI Inflows to Africa (by Regions)

	FDI/GDP				FDI/Merchandise Export				FDI/per capita			
Region	80-89	90-99	00-09	10-17	80-89	90-99	00-09	10-17	80-89	90-99	00-09	10-17
Eastern	6.24	10.62	31.21	89.81	61.77	106.33	257.50	591.44	143.58	293.99	920.67	2611.16
Central	8.48	35.61	61.45	50.27	56.81	110.10	504.67	871.21	139.09	153.23	1534.54	3448.70
Northern	10.05	20.36	33.14	52.52	55.40	96.41	159.46	239.33	-45.83	141.57	938.10	1597.17
Southern	20.98	19.90	36.14	66.32	60.90	69.57	99.48	183.65	198.72	325.70	1085.06	2336.35
Western	11.55	17.35	42.62	103.58	43.23	199.59	701.79	1096.2	65.08	86.16	258.71	780.79

Source: **Author's compilation (Data sources: UNCTAD Statistics, 2018)**

Table 4: Magnitude of FDI Inflows to some African Countries

	FDI/GDP				FDI/Export			
Country	02-05	06-09	10-13	14-16	02-05	06-09	10-13	14-16
Nigeria	1.99	2.50	1.61	0.91	0.48	1.48	1.78	0.06
Ghana	0.97	5.50	7.69	8.41	0.55	1.30	1.34	0.21
Senegal	0.95	2.62	2.11	2.50	0.51	0.99	0.88	0.09
Mozambique	0.64	0.69	1.40	29.47	0.64	0.69	1.40	1.05
Zambia	0.75	0.74	0.83	6.48	0.75	0.74	0.83	0.16
South Africa	0.32	0.06	0.25	1.15	0.78	2.03	2.26	0.04
Tanzania	3.79	4.35	6.30	4.28	0.20	0.18	0.22	0.22
Uganda	3.53	5.93	5.18	3.99	0.28	0.31	0.23	0.22
Ethiopia	4.04	1.44	1.39	3.25	0.29	0.11	0.10	0.36
Rwanda	0.27	1.89	1.52	3.56	0.03	0.16	0.12	0.22
Kenya	0.29	0.76	0.67	1.61	0.01	0.04	0.13	0.09

Source: Author's computation (Data sources: World Development Indicator (WDI, 2018); UNCTAD Statistics, 2018)

Table 5: Descriptive Statistics and Correlation Analysis

	HDI	AGPRICE	AGR	FDI	INV	MANPRICE	MAN	OPEN	PCPC	POPGR	SER	RLAW
Summary Statistics												
Mean	0.495	4.264	21.387	5.121	2.981	4.164	20.917	4.239	6.771	0.754	22.507	39.158
Median	0.487	4.194	21.224	5.281	3.030	4.207	20.819	4.195	6.650	0.954	22.323	42.244
Maximum	0.781	4.800	25.424	9.357	4.119	4.753	24.731	5.138	8.826	2.069	26.322	83.663
Minimum	0.208	3.849	18.400	-4.605	-1.228	3.613	16.811	2.980	5.211	-1.877	19.519	0.500
Std. Dev.	0.113	0.295	1.493	2.150	0.474	0.329	1.645	0.446	0.870	0.521	1.499	21.357
Skewness	0.154	0.381	0.256	-0.612	-2.374	0.053	0.293	-0.022	0.273	-1.897	0.677	-0.068
Kurtosis	2.643	1.708	2.586	3.889	17.638	1.733	2.682	2.260	2.177	8.367	2.866	1.992
Jarque-Bera	5.668	57.417	11.056	58.353	6039.105	41.192	11.338	14.004	24.877	1101.848	47.256	26.406
Probability	0.059	0.000	0.004	0.000	0.000	0.000	0.003	0.001	0.000	0.000	0.000	0.000
Sum	303.000	2609.372	13088.770	3133.833	1824.519	2548.342	12801.460	2594.007	4143.548	461.459	13774.490	23964.910
Sum Sq. Dev.	7.802	53.232	1362.393	2823.587	137.307	66.090	1653.575	121.579	462.547	165.567	1372.879	278684.600
Observations	612	612	612	612	612	612	612	612	612	612	612	612
Correlation Results												
HDI	1.000	0.280	0.044	0.455	0.349	0.252	0.497	0.389	0.872	-0.551	0.509	0.454
AGPRICE		1.000	0.118	0.452	0.254	0.930	0.191	0.160	0.181	-0.051	0.203	0.003
AGR			1.000	0.502	-0.220	0.107	0.709	-0.624	-0.022	0.225	0.812	-0.278
FDI				1.000	0.241	0.408	0.558	0.041	0.328	-0.114	0.656	0.017
INV					1.000	0.212	0.063	0.412	0.230	-0.124	0.007	0.463
MANPRICE						1.000	0.171	0.140	0.161	-0.045	0.182	0.003
MAN							1.000	-0.271	0.471	-0.174	0.904	0.072
OPEN								1.000	0.374	-0.369	-0.318	0.285
PCPC									1.000	-0.599	0.462	0.479
POPG										1.000	-0.125	-0.335
SER											1.000	0.023
RLAW												1.000

Source: Computed by the Authors.**Note:** All variables are expressed in logs except Rule of Law, population growth rate and Human development Index

Table 6: Cross Sectional Dependence Test[10]

Variable	Pasaran (2004) CD Test	Pasaran (2015) CADF Test
MAN	-64.874* (0.000)	119.362* (0.000)
AGR	-62.353* (0.000)	119.389*(0.000)
SER	-108.865* (0.000)	119.387*(0.000)
OPEN	-13.403* (0.000)	119.078*(0.000)
FDI	-62.563* (0.000)	103.426*(0.000)
INV	-14.037* (0.000)	117.128*(0.000)
RLAW	-0.688 (0.491)	110.475*(0.000)
HDI	-81.484* (0.000)	118.785*(0.000)
POPG	-6.191* (0.000)	106.545* (0.000)
AGPRICE	-82.650*(0.000)	82.650*(0.000)
MANPRICE	-82.650*(0.000)	82.650*(0.000)
PCPC	-59.577*(0.000)	82.602*(0.000)

Source: Computed by the Authors

[10]**Notes:** The test assume null hypothesis of cross-section independence, CD ~ N(0,1) with P-values close to zero indicate data are correlated across panel groups, while the Pasaran (2015) CADF test assumes that errors are weakly cross sectional dependent.

Table 7: Panel Unit Root Test Results

	Hadri (2000) LM Test				Pesaran's CADF, (2003)		Pesaran's CIPS, 2007				Decision
		Hadri Z test	No. of Periods	No of Panels	t-bar	N, T	CIPS*	N, T	Critical Values		
MAN	L	8.965*	27		-1.989***	33, 27	-1.909	33, 27	0.01	-2.3	I(0)
	D	3.866*	26		-2.528*	33, 26	-4.301*	33, 26			
AGR	L	11.257*	27		-1.745	33, 27	-1.897	33, 27			I(1)
	D	1.297***	26		-2.620*	33, 26	-4.247*	33, 26			
SER	L	12.698*	27		-2.162*	33, 27	-2.360*	33, 27			I(0)
	D	4.994*	26		-2.596*	33, 26	-4.927*	33, 26			
OPEN	L	6.823*	27		-1.736	33, 27	-2.431*	33, 27			I(0)
	D	0.063	26	34	-2.600*	33, 26	-5.016*	33, 26	0.05	-2.16	
FDI	L	6.735*	27		-2.848*	33, 27	-3.775*	33, 27			I(0)
	D	0.904	26		-3.626*	33, 26	-5.722*	33, 26			
INV	L	5.414*	27		-2.235*	33, 27	-2.893*	33, 27			I(0)
	D	0.213	26		-3.036*	33, 26	-5.007*	33, 26			
RLAW	L	11.160*	27		-1.131	33, 27	-1.246	33, 27			I(1)
	D	1.497***	26		-2.282*	33, 26	-4.356*	33, 26	0.1	-2.08	
HDI	L	12.104*	27		-1.637	33, 27	-1.224	33, 27			I(1)
	D	3.442*	26		-2.030***	33, 26	-3.346*	33, 26			
POPG	L	2.843*	27		-2.179*	33, 27	-2.915*	33, 27			I(0)
	D	-1.421	26		-2.631*	33, 26	-3.034*	33, 26			

Source: Computed by the Authors. Note (a) *, **, *** represent 1%, 5% & 10% significant levels respectively, while L & D denote Stationarity at level and at first deference respectively. L= level, while D=difference

Table 8: Results of Heterogeneous Panel Granger causality Test following Dumitrescu and Hurlin (2012)

Dependent Variable	FDI	AGRS	MAN	SER	HDI	PCPC
FDI	-	14.737(0.000)***	14.899(0.000)***	23.809(0.000)***	-	-
AGRS	9.548(0.000)***	-	-	-	20.189(0.000)***	15.368(0.000)***
MAN	17.772(0.000)***	-	-	-	47.228(0.000)***	22.244(0.000)***
SER	6.204(0.000)***	-	-	-	20.667(0.000)***	14.098(0.000)***
HDI	-	24.726(0.000)***	16.199(0.000)***	26.526(0.000)***	-	-
PCPC	-	10.803(0.000)***	6.315(0.000)***	13.868(0.000)***	-	-

Source: Author(s) estimate using STATA 15. **Note:** The Z-bar Statistics were reported with a single optimal lagged chosen from a range of 1 to 7, with probability value in parenthesis. The system was allowed to determine the optimal lagged value by using Bayesian information criterion (BIC) option in the Dumitrescu and Hurlin (2012) Granger non-causality estimates. ***, ** and * denote a significant value at 1%, 5% and 10% respectively.

Table 9a: Linear and Non-linear Multivariate Granger causality test for FDI, sectoral output and HDI

Variables	Null hypothesis: FDI does not cause Sectoral output and HDI		Null hypothesis: Sectoral output and HDI do not cause FDI		Result
	Chi-square	P-value	Chi-square	P-value	
Linear Multivariate Granger causality					
HDI, AGR and FDI	1.911	0.384	13.734	0.001	HDI, AGR→ FDI
HDI, MAN and FDI	5.703	0.793	6.301	0.042	HDI, MAN → FDI
HDI, SER and FDI	2.891	0.235	3.141	0.127	No linear multivariate Granger causality
Non-Linear Multivariate Granger causality					
HDI, AGR and FDI	3.126	0.048	0.726	0.484	FDI → HDI, AGR
HDI, MAN and FDI	2.242	0.084	0.231	0.793	FDI → HDI, MAN
HDI, SER and FDI	3.711	0.025	1.360	0.257	FDI → HDI, SER

Note: HDI = human development index; AGRS = Agricultural output, MANS=Manufacturing output; SERV = service output; FDI = foreign direct investment.

Table 9b: Linear and Non-linear Multivariate Granger causality test for FDI, Sectoral output and PCPC

Variables	Null hypothesis: FDI does not cause Sectoral output and PCPC		Null hypothesis: Sectoral output and PCPC do not cause FDI		Result
	Chi-square	P-value	Chi-square	P-value	
Linear Multivariate Granger causality					
PCPC, AGR and FDI	4.587	0.100	35.559	0.000	PCPC, AGR↔ FDI (feedback)
PCPC, MAN and FDI	9.391	0.009	7.131	0.028	PCPC, MAN ↔ FDI(feedback)
PCPC, SER and FDI	6.994	0.030	2.597	0.272	FDI →PCPC, SER
Non-Linear Multivariate Granger causality					
PCPC, AGR and FDI	2.480	0.084	0.0437	0.957	FDI → PCPC, AGR
PCPC, MAN and FDI	0.268	0.764	0.312	0.731	No Non-linear multivariate Granger causality
PCPC, SER and FDI	2.047	0.130	0.358	0.690	No Non-linear multivariate Granger causality

Note: PCPC = Per capita private consumption; AGR = Agricultural output, MAN = Manufacturing output; SER = service output; FDI = foreign direct investment.

Table 10: Regression on FDI, Agricultural Sector output and Poverty (HDI)

Dependent Variable	**AGRS (1)**	**HDI (2)**	**AGRS (3)**	**HDI (4)**	**AGRS (5)**	**HDI (5)**
	OLS		2SLS		3SLS	
FDI	0.344***(0.0207)	0.0128***(0.00226)	0.220(0.203)	-0.0158(0.0213)	0.00881(0.137)	0.00484(0.0139)
INV	-0.216**(0.0893)	-0.00487(0.00832)	2.800**(1.315)	-0.217***(0.0352)	3.969***(1.017)	-0.223***(0.0327)
POPGR	0.0953***(0.0329)	-0.0207***(0.00296)	-0.119(0.115)	0.00920(0.00786)	-0.165(0.109)	0.00925(0.00735)
OPEN	-2.046***(0.0888)	0.107***(0.0104)	-2.730***(0.443)	0.208***(0.0595)	-3.095***(0.357)	0.160***(0.0449)
RLAW	-0.0108***(0.00200)	0.00206***(0.000171)	-0.142***(0.0537)	0.0109***(0.00115)	-0.190***(0.0416)	0.0104***(0.00102)
HDI	2.783***(0.423)		12.95**(5.230)		17.93***(3.854)	
AGPRICE	0.00273(0.00245)	9.31e-05(0.000227)	0.00224(0.00727)	-7.40e-05(0.001)	-0.000339(0.00695)	8.08e-05(0.000502)
FDIMEAN	-0.145(0.150)	0.000441(0.0117)	-0.0434(0.511)		-0.0146(0.0867)	
INVMEAN	0.554(0.821)	0.0587(0.0640)	-2.716(2.983)	0.252(0.156)	-5.461***(1.975)	0.335**(0.134)
POPGRMEAN	-1.112(0.943)	0.0740(0.0846)	0.290(2.853)	0.0336(0.209)	0.984(2.535)	-0.0653(0.183)
OPENMEAN	0.603(1.215)	-0.203*(0.109)	0.964(3.739)	-0.0907(0.253)	1.404(3.360)	-0.0796(0.236)
HDIMEAN	-4.333(4.397)		-12.07(14.30)		-4.073(4.241)	
RLAWMEAN	0.0160(0.0472)	0.000937(0.00414)	0.148(0.147)	-0.0103(0.00975)	0.173(0.126)	-0.00905(0.00908)
AGPRICEMEAN	-	-	-	-	-	-
AGRS		0.0239***(0.00363)		0.0755**(0.0302)		0.0489**(0.0214)
AGRSMEAN		0.0364(0.0316)		0.0927(0.0685)		
Constant	25.65***(4.434)	-0.812(0.736)	26.28**(13.22)	-3.777*(2.248)	26.87**(12.84)	-1.327(1.247)
Observations	621	621	621	621	621	621
R-squared	0.697	0.575				
F-Stat (P-Value)	107.82(0.000)	63.29(0.000)	14.30(0.000)	21.00(0.000)	262.20 (0.000)	286.01(0.000)
Hansen-Sargan Test			90.770 (0.000)		2.145 (1.000)	
Haussmann Test			2.10 (0.998)			

Source: Computed by the Authors; Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. All the variables are expressed in logs except Rule of Law and Human development Index. Note: Chi-Square value and probability value are reported in the F-Statistics column for 3SLS models.

Table 11: Regression results on FDI Service Sector output and Poverty (HDI)

Dependent Variable	SERV (1)	HDI (2)	SERV (3)	HDI (4)	SERV (5)	HDI (6)
	OLS		2SLS		3SLS	
FDI	0.340***(0.0193)	-0.00270(0.00193)	1.179***(0.302)	0.0850**(0.0358)	1.191***(0.297)	0.0850**(0.0355)
INV	-0.0986(0.0834)	-0.00184(0.00681)	-5.301**(2.241)	-0.387***(0.103)	-5.412**(2.197)	-0.387***(0.102)
POPGR	-0.0433(0.0307)	-0.0102***(0.00247)	0.178(0.191)	0.0131(0.0118)	0.183(0.188)	0.0131(0.0117)
OPEN	-1.686***(0.0828)	0.123***(0.00721)	-0.237(0.713)	-0.0146(0.0607)	-0.210(0.701)	-0.0146(0.0601)
RLAW	-0.00647***(0.00187)	0.00153***(0.000141)	0.204**(0.0919)	0.0149***(0.00334)	0.209**(0.0900)	0.0149***(0.00331)
HDI	7.488***(0.394)		-13.51(8.547)		-13.96*(8.368)	
FDIMEAN	-0.153(0.140)	0.00710(0.0105)	-0.266(0.807)		0.0199(0.181)	
INVMEAN	0.600(0.749)	0.0268(0.0553)	8.223*(4.774)	0.623**(0.286)	9.094**(4.085)	0.623**(0.283)
POPGRMEAN	-0.870(0.873)	0.0712(0.0693)	-3.099(4.410)	-0.204(0.297)	-2.524(4.074)	-0.204(0.294)
OPENMEAN	0.401(1.091)	-0.129(0.0885)	-4.102(5.664)	-0.372(0.363)	-5.210(4.726)	-0.372(0.360)
HDIMEAN	-3.953(4.085)		-8.603(22.77)		-15.64(11.86)	
RLAWMEAN	0.0182(0.0438)	0.000543(0.00338)	-0.0981(0.230)	-0.00662(0.0142)	-0.0640(0.208)	-0.00662(0.0140)
SERVS		0.0497***(0.00262)		-0.0712(0.0455)		-0.0712(0.0450)
LSERVSMEAN		0.0319(0.0278)		-0.0997(0.0942)		-0.0997(0.0933)
Constant	24.21***(3.919)	-1.568**(0.643)	36.52*(19.50)	4.765(3.114)	38.68**(18.37)	4.765(3.083)
Observations	621	621	621	621	621	621
R-squared	0.745	0.714				
F-Stat (P-Value)	147.88(0.000)	126.36(0.000)	6.91(0.000)	10.42(0.000)	364.74(0.000)	116.83(0.000)
Hansen-Sargan Test			274.775(0.999)		0.135(1.000)	
Haussmann Test			0.13(0.987)			

Source: Computed by the Authors; (a) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (b) All variables are expressed in logs except Rule of Law, population growth rate and Human Development Index. (c) Chi-Square value and probability value are reported in the F-Statistics column for 3SLS models.

Table 12: Regression results on FDI Manufacturing Sector output and poverty

Dependent variable	MANS (1)	HDI (2)	MANS (3)	HDI (4)	MANS (5)	HDI (6)
VARIABLES	OLS		2SLS		3SLS	
FDI	0.277***(0.026)	0.007***(0.002)	1.732*(0.904)	0.051***(0.0175)	1.946**(0.850)	0.044***(0.014)
INV	0.144(0.113)	-0.0127*(0.00731)	-10.59(7.051)	-0.313***(0.0638)	-13.00**(6.229)	-0.300***(0.0579)
POPGR	-0.109***(0.0417)	-0.0106***(0.00268)	0.410(0.479)	0.0122(0.00981)	0.541(0.443)	0.0127(0.00928)
OPEN	-1.831***(0.112)	0.107***(0.00756)	0.972(2.034)	0.0295(0.0401)	1.551(1.865)	0.0377(0.0364)
RLAW	-0.00619**(0.00254)	0.00161***(0.000151)	0.436(0.291)	0.0129***(0.00229)	0.539**(0.255)	0.0125***(0.00210)
HDI	8.098***(0.535)		-33.71(26.99)		-42.98*(23.82)	
MANPRICE	0.00245(0.00234)	-1.12e-05(0.00223)	0.00568(0.0175)	0.000250(0.0234)	0.00331(0.0169)	5.70e-05(0.0200)
MANS		0.0337***(0.000160)		-0.0290(0.000565)		-0.0219(0.000469)
FDIMEAN	-0.0575(0.191)	0.00700(0.00952)	-0.337(1.666)		-0.0769(0.251)	
INVMEAN	0.942(1.020)	0.0255(0.0772)	15.79(12.13)	0.553*(0.287)	17.32(11.12)	0.389**(0.160)
POPGRMEAN	-0.106(1.237)	0.0116(0.0815)	-5.365(9.841)	-0.111(0.252)	-5.166(9.159)	-0.112(0.239)
OPENMEAN	0.563(1.591)	-0.177*(0.102)	-7.488(12.91)	-0.275(0.311)	-11.27(10.72)	-0.271(0.295)
HDIMEAN	-8.070(5.672)		-10.15(47.46)		-2.315(7.528)	
RLAWMEAN	-0.0100(0.0604)	0.00231(0.00370)	-0.320(0.508)	-0.0102(0.0125)	-0.356(0.449)	-0.00802(0.0115)
LMANPRICEMEAN	-	-	-	-	-	-
MANSMEAN		0.0333(0.0378)		-0.0812(0.115)		
Constant	21.78***(5.882)	-0.891(0.787)	44.00(45.23)	2.804(2.545)	56.28(41.11)	1.310(1.342)
Observations	621	621	621	621	621	621
R-squared	0.608	0.668				
F-Stat (P-Value)	72.66 (0.000)	94.29(0.000)	1.57(0.086)	13.86(0.000)	272.60(0.000)	184.56(0.000)
Hansen-Sargan Test			122.436 (4.104)		0.616 (0.432)	
Haussmann Test			0.60 (0.999)			

Source: Computed by the Authors (a) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (b) All variables are expressed in logs except Rule of Law, population growth rate and Human Development Index. **(c)** Chi-Square value and probability value are reported in the F-Statistics column for 3SLS models.

Table 13: Robustness Check on the Dynamics of Poverty, FDI and Sectoral Output

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS		2SLS		3SLS	
Agricultural						
FDI	0.368***(0.0199)	0.0664***(0.0179)	0.314**(0.140)	-0.200(0.155)	0.149(0.0957)	-0.0373(0.0988)
INV	-0.157*(0.0917)	-0.262***(0.0659)	2.572**(1.010)	-1.758***(0.238)	3.599***(0.766)	-1.817***(0.216)
POPGR	0.109***(0.0346)	-0.237***(0.0234)	0.0557(0.0843)	-0.0378(0.0558)	0.0732(0.0831)	-0.0363(0.0515)
OPEN	-2.008***(0.0893)	0.746***(0.0823)	-2.628***(0.342)	1.759***(0.441)	-2.934***(0.281)	1.383***(0.324)
RLAW	-0.0104***(0.00207)	0.0178***(0.00135)	-0.117***(0.0361)	0.0794***(0.00760)	-0.153***(0.0276)	0.0759***(0.00665)
PCPC	0.296***(0.0546)		1.467***(0.500)		1.996***(0.368)	
AGPRICE	0.00291(0.00247)	0.000103(0.00179)	0.00314(0.00599)	-0.00125(0.00399)	0.00114(0.00567)	-0.000107(0.00355)
FDIMEAN	-0.169(0.145)	-0.0231(0.0923)	-0.0679(0.407)		-0.0216(0.0774)	
INVMEAN	0.388(0.719)	0.306(0.506)	-2.423(2.032)	1.624(1.132)	-4.373***(1.579)	2.335**(0.954)
POPGRMEAN	-1.194(0.951)	0.714(0.670)	-0.275(2.324)	0.601(1.518)	0.219(2.100)	-0.195(1.316)
OPENMEAN	0.471(1.215)	-1.128(0.865)	0.427(3.017)	-0.327(1.845)	0.449(2.748)	-0.202(1.698)
PCPCMEAN	-0.496(0.617)		-1.543(1.642)		-0.447(0.478)	
RLAWMEAN	0.0120(0.0451)	-0.0130(0.0327)	0.126(0.113)	-0.0927(0.0710)	0.168(0.104)	-0.0836(0.0652)
AGPRICEMEAN	-	-	-	-	-	-
AGRS		0.156***(0.0287)		0.663***(0.223)		0.452***(0.154)
AGRSMEAN		0.324(0.250)		0.749(0.487)		
Constant	27.29***(5.467)	-2.757(5.826)	28.72**(14.54)	-28.35*(16.20)	22.19**(10.65)	-8.851(8.974)
Observations	621	621	621	621	621	621
R-squared	0.691	0.530				
F-Stat (P-Value)	104.4820.24(0.000)	52.6720.24(0.000)	20.24(0.000)	19.07(0.000)	345.85(0.000)	266.34(0.000)
Hansen-Sargan Test			166.184(1.000)		2.953(0.999)	
Haussmann Test			2.90(0.998)			
Service						
FDI	0.384***(0.0184)	-0.0676***(0.0151)	-33.67(1,057)	0.188(0.147)	1.754(29.17)	0.193***(0.0453)
INV	0.108(0.0846)	-0.230***(0.0533)	335.1(10,328)	-1.952***(0.359)	-9.510(287.7)	-1.961***(0.212)
POPGR	0.0303(0.0319)	-0.157***(0.0194)	3.575(110.8)	-0.0208(0.0511)	-0.0983(9.272)	-0.0209(0.0504)
OPEN	-1.657***(0.0824)	0.929***(0.0564)	-88.04(2,666)	0.530**(0.239)	1.079(76.15)	0.523***(0.133)
RLAW	-0.00819***(0.0019)	0.0138***(0.00110)	-12.42(382.4)	0.0725***(0.0109)	0.334(10.64)	0.0728***(0.00625)
PCPC	0.956***(0.0504)		170.0(5,213)		-3.889(143.5)	
FDIMEAN	-0.161(0.133)	0.0271(0.0819)	14.65(458.1)		-15.34(11.83)	
INVMEAN	0.573(0.637)	-0.0472(0.433)	-368.4(11,384)	2.248*(1.175)	-15.89(326.8)	2.267**(1.004)
POPGRMEAN	-1.026(0.870)	0.661(0.543)	107.8(3,363)	-0.439(1.313)	-37.66(224.0)	-0.447(1.277)
OPENMEAN	0.131(1.082)	-0.626(0.692)	156.1(4,864)	-1.200(1.626)	58.48(157.5)	-1.219(1.498)
PCPCMEAN	-0.487(0.568)		-37.05(1,110)		0.0409(0.0692)	
RLAWMEAN	0.0293(0.0413)	-0.0183(0.0264)	11.39(349.5)	-0.0599(0.0632)	-1.991(10.99)	-0.0598(0.0625)
SERVS		0.389***(0.0205)		0.0173(0.175)		0.0116**(0.00578)
SERVSMEAN		0.301(0.218)		-0.0337(0.397)		-0.0409(0.325)
Constant	22.90***(4.813)	-9.355*(5.035)	-1,015(32,383)	8.024(12.84)		8.369(6.926)
Observations	621	621	621	621	621	621
R-squared	0.745	0.690				
F-Stat (P-Value)	147.84(0.000)	112.91(0.000)	0.00(1.000)	24.83(0.000)	357.02(0.000)	289.23(0.000)
Hansen-Sargan Test			352.030(1.000)		0.123(0.726)	
Haussmann Test			0.14(1.000)			
Manufacturing						
FDI	0.320***(0.0245)	0.00456(0.0140)	15.45(127.8)	0.209**(0.0974)	-5.230(15.69)	0.219***(0.0463)
INV	0.382***(0.113)	-0.317***(0.0563)	-145.8(1,251)	-1.997***(0.289)	52.01(160.2)	-2.030***(0.215)
POPGR	-0.0198(0.0426)	-0.157***(0.0206)	-1.630(14.04)	-0.0222(0.0528)	0.506(4.110)	-0.0237(0.0512)
OPEN	-1.820***(0.110)	0.820***(0.0582)	36.00(323.9)	0.498**(0.205)	-15.50(41.77)	0.465***(0.134)
RLAW	-0.00881***(0.0026)	0.0143***(0.00116)	5.395(46.29)	0.0740***(0.00974)	-1.904(5.935)	0.0754***(0.00630)
PCPC	1.079***(0.0673)		-72.77(631.6)		26.96(80.30)	
MANPRICE	0.00298(0.00227)	-0.000993(0.00123)	-0.0120(0.245)	-8.75e-05(0.00312)	-0.0112(0.204)	-0.00378(0.0267)
FDIMEAN	-0.0625(0.178)	0.0404(0.0733)	-6.519(58.67)		9.004(7.213)	
INVMEAN	0.742(0.851)	-0.0726(0.594)	162.0(1,381)	2.444(1.567)	-57.72(162.4)	2.258**(0.878)
POPGRMEAN	-0.367(1.221)	0.327(0.628)	-45.26(399.6)	-0.385(1.391)	35.21(95.76)	-0.371(1.365)
OPENMEAN	0.208(1.538)	-0.820(0.784)	-66.42(575.5)	-1.250(1.725)	-2.798(61.98)	-1.285(1.686)
PCPCMEAN	-1.141(0.765)		14.47(161.6)		-19.99(16.09)	
RLAWMEAN	-0.00847(0.0568)	0.00219(0.0285)	-4.841(41.86)	-0.0601(0.0685)	2.530(5.033)	-0.0565(0.0653)
MANPRICEMEAN	-	-	-	-	-	-
MANS		0.275***(0.0172)		-0.0105(0.117)		-0.0324**(0.0152)
MANSMEAN		0.319(0.291)		-0.106(0.643)		
Constant	23.67***(7.064)	-5.229(6.061)	470.7(3,793)	9.919(14.11)		8.839(7.059)
Observations	621	621	621	621	621	621
R-squared	0.621	0.652				
F-Stat (P-Value)	76.69(0.000)	87.74(0.000)	0.01(1.000)	21.76(0.000)	367.55(0.000)	408.59(0.000)
Hansen-Sargan Test			409.061(1.000)		0.246(0.884)	
Haussmann Test			0.24(1.000)			

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. All the variables are expressed in logs except Rule of Law and Human Development Index. Note: Chi-Square value and probability value are reported in the F-Statistics column for 3SLS models.

Table 14: Dynamic Threshold Regimes Results: Dependent variable is sectoral output

Sector	HDI Threshold Value	Bootstrap LM Test	Regime 1 ($\alpha_{it} < \gamma$)		Regime 2 ($\alpha_{it} \geq \gamma$)	
			Intercept(s.e.)	FDI (s.e.)	Intercept(s.e.)	FDI (s.e.)
Agriculture	0.444	99.011*	22.419(0.679)*	0.156(0.040)*	34.331(0.734)*	0.364(0.032)*
Manufacturing	0.429	118.704*	19.477(1.544)*	0.183(0.043)*	30.199(0.628)*	0.214(0.028)*
Service	0.444	126.658*	21.861(0.402)*	0.184(0.038)*	31.322(0.551)*	0.294(0.027)*

Source: Computed by the Authors from STATA 15. Note: * indicate the *bootstrap P-values (LM test) and significant t-test statistics at 10%, 5% and 1% level of significance*, while *s.e. in parenthesis are the standard error.*

Table 15: Dynamic Threshold Regimes Results: Dependent variable is HDI

Sector	Sectoral Output Threshold Value	Bootstrap LM Test	Regime 1 ($\alpha_{it} < \gamma$)		Regime 2 ($\alpha_{it} \geq \gamma$)	
			Intercept(s.e.)	FDI (s.e.)	Intercept(s.e.)	FDI (s.e.)
Agriculture	19.98	97.24*	-0.790 (0.125)*	0.0076 (0.002)*	-0.217 (0.106)**	0.003 (0.002)
Manufacturing	21.31	89.97*	0.818 (0.233)*	0.003 (0.003)	0.654 (0.110)*	0.003 (0.002)
Service	20.23	25.02*	-0.007 (0.249)	0.021 (0.003)*	0.515 (0.116)*	0.001 (0.002)

Source: Computed by the Authors from STATA 15. Note: **, and * indicate the *bootstrap P-values (LM test) and significant t-test statistics at 5% and 1% level of significance*, while *s.e. in parenthesis are the standard error.*

Table 16: Dynamic Threshold Regimes Results: Dependent variable is Sectoral output

Sector	FDI Threshold Value	Bootstrap LM Test	Regime 1 ($\alpha_{it} < \gamma$)		Regime 2 ($\alpha_{it} \geq \gamma$)	
			Intercept(s.e.)	HDI/PCPC (s.e.)	Intercept(s.e.)	HDI/PCPC (s.e.)
Main Results						
Agriculture	3.988	101.369*	25.959(0.693)*	1.454(0.464) *	29.792(0.709)*	-0.461(0.623)
Manufacturing	4.243	88.642*	22.823 (0.891)*	6.917(0.755)*	25.919(0.881) *	3.980(1.093)*
Service	4.054	112.714*	23.614(0.394)*	6.157(0.566)*	28.264(0.663)*	3.579(0.691)*
Robustness check using PCPC as a proxy for Poverty Measure						
Agriculture	4.045	118.231*	25.131(0.705)*	0.175(0.053)*	30.031(0.867) *	-0.065(0.070)
Manufacturing	3.974	111.351*	19.082(0.908)*	0.982(0.079)*	23.784(1.102) *	0.490(0.134)*
Service	3.988	135.536*	20.694(0.388)*	0.676(0.069)*	23.660(0.758) *	0.767(0.074)*

Source: Computed by the Authors from STATA 15. Note: * indicate the *bootstrap P-values (LM test) and significant t-test statistics at 10%, 5% and 1% level of significance*, while *s.e. in parenthesis are the standard error.*

Figures

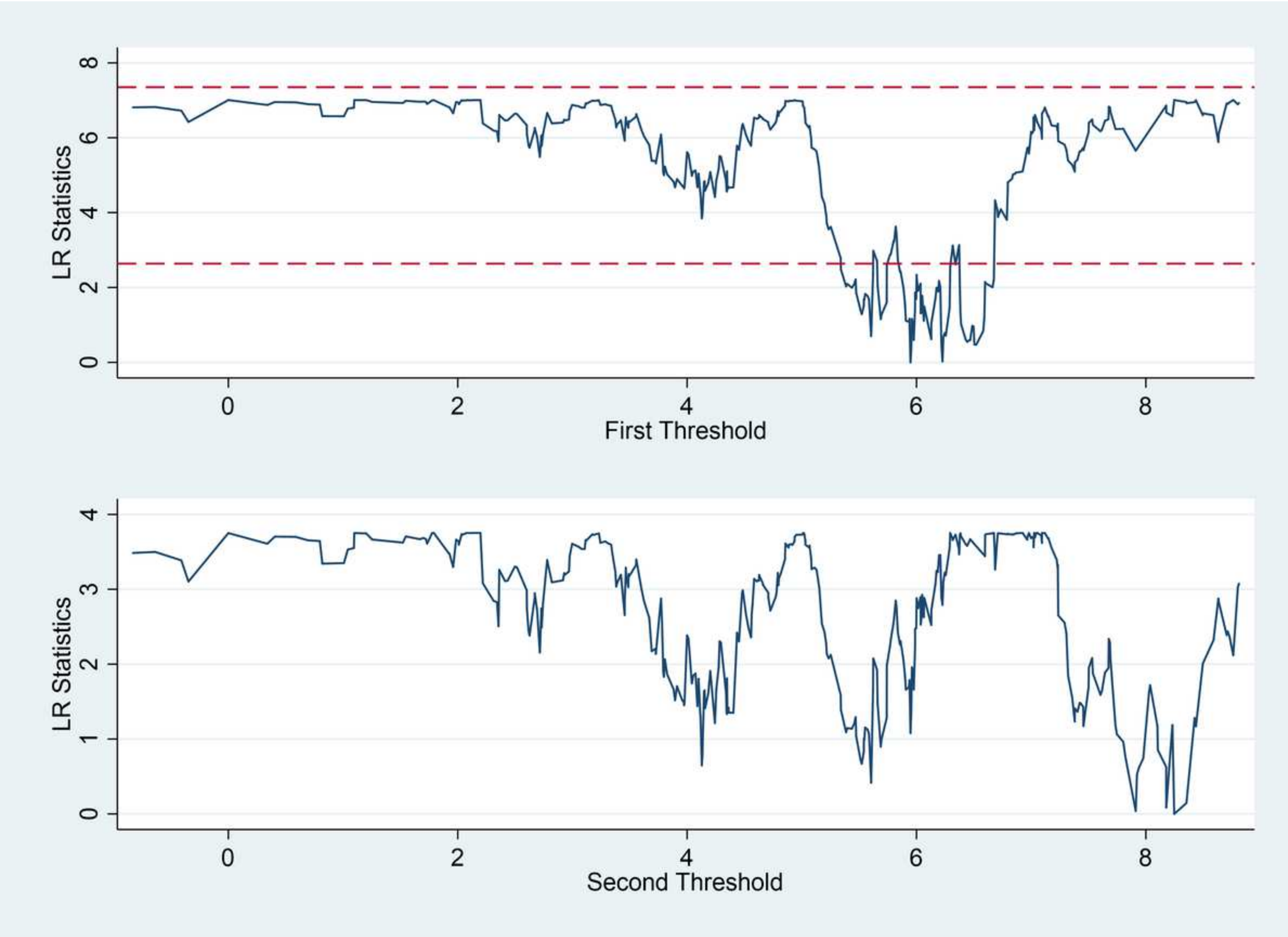

Figure 1

LR statistic of Two Thresholds for Manufacturing Sector

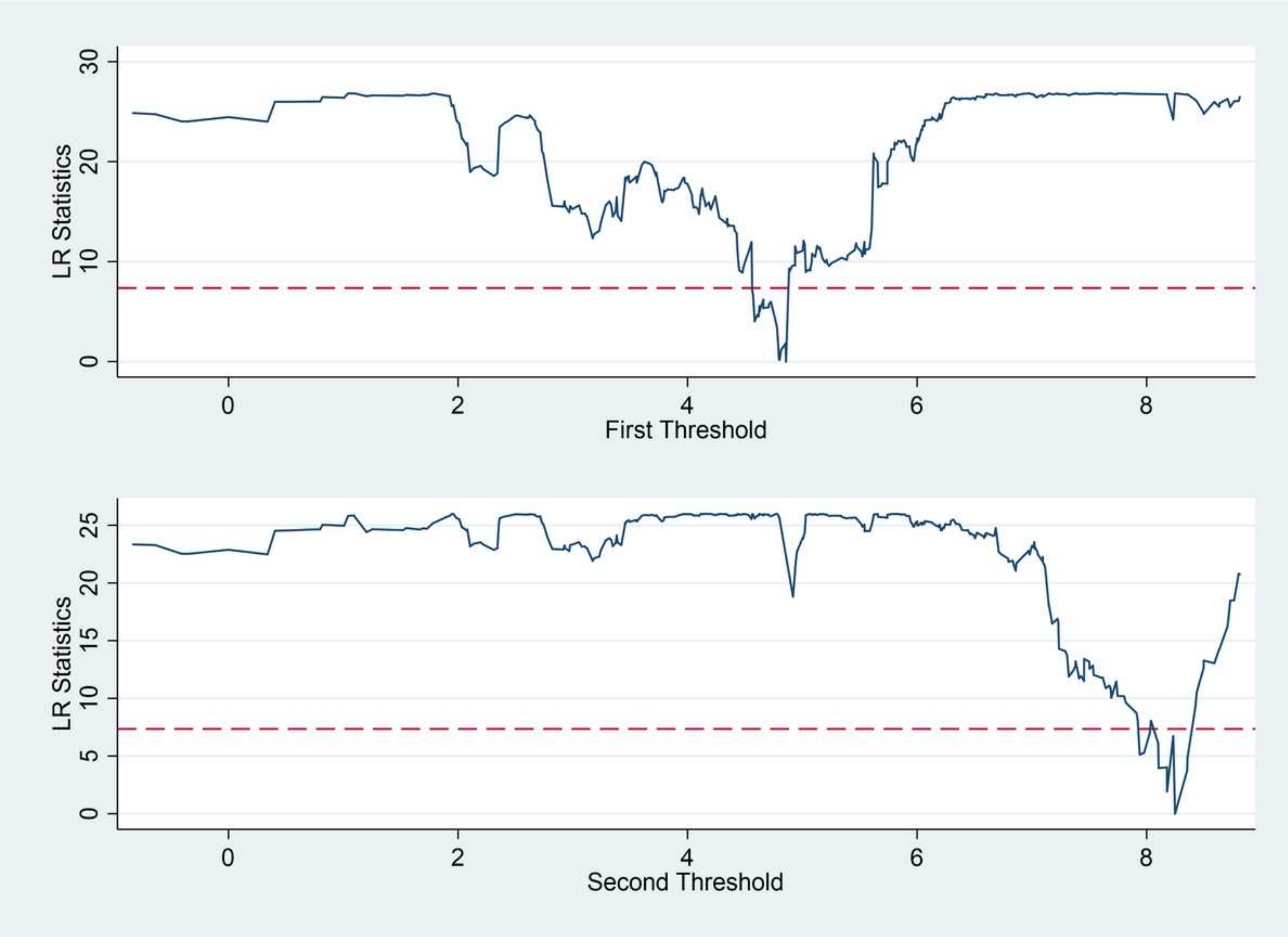

Figure 2

LR statistic of Two Thresholds for Services Sector

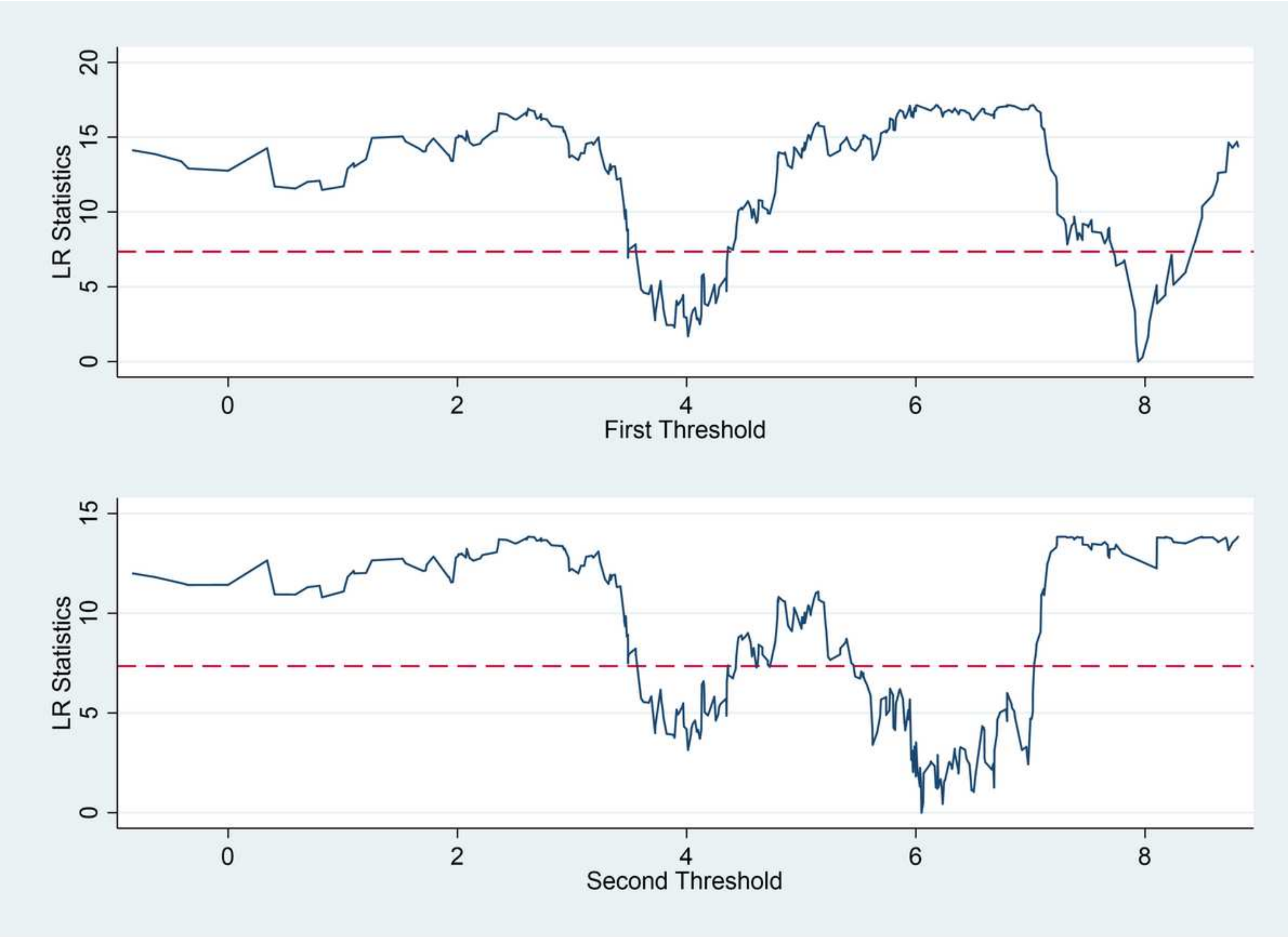

Figure 3

LR statistic of Two Thresholds for Agricultural Sector

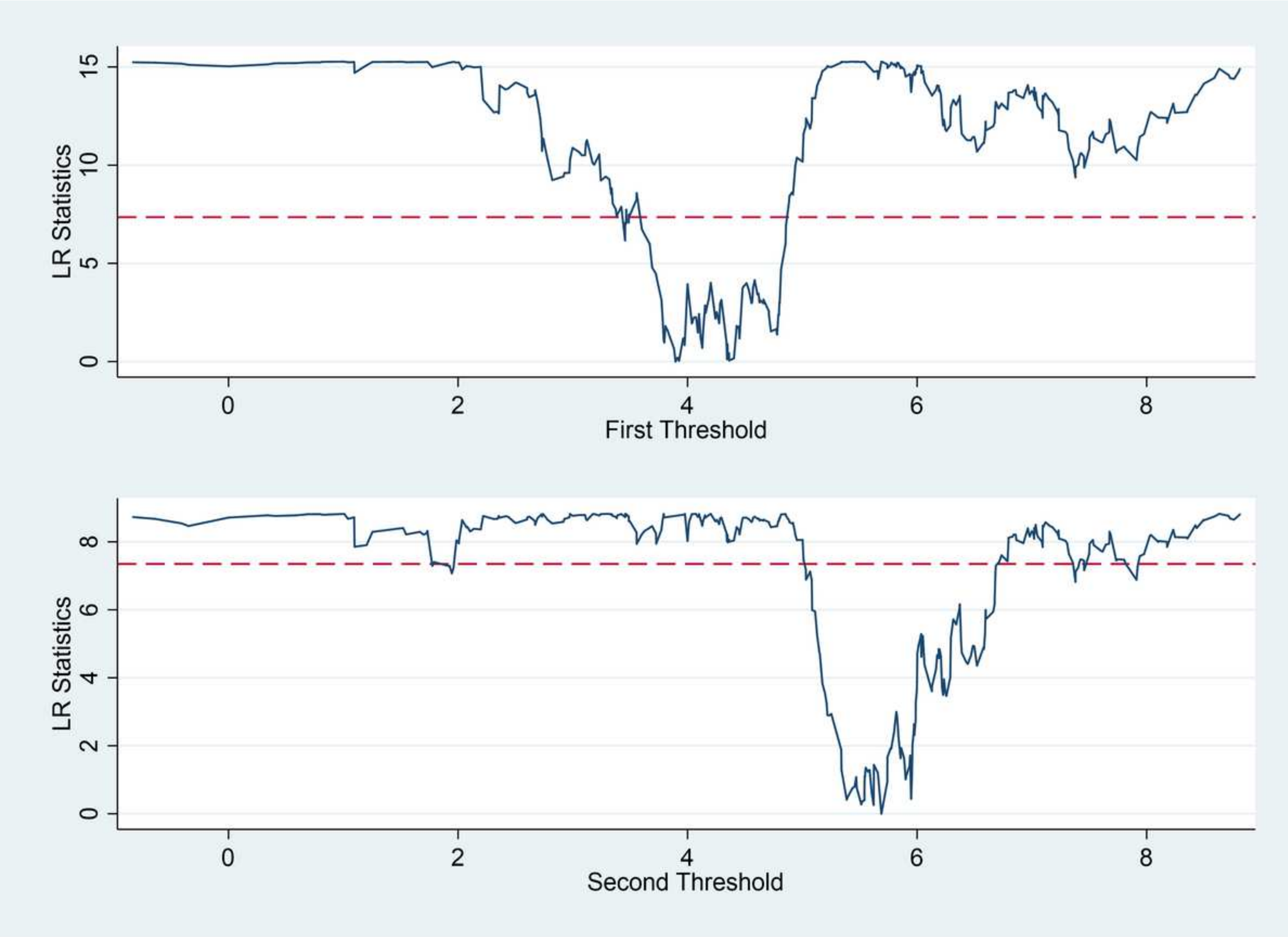

Figure 4

LR statistic of Two Thresholds for Manufacturing Sector (Robustness Analysis)

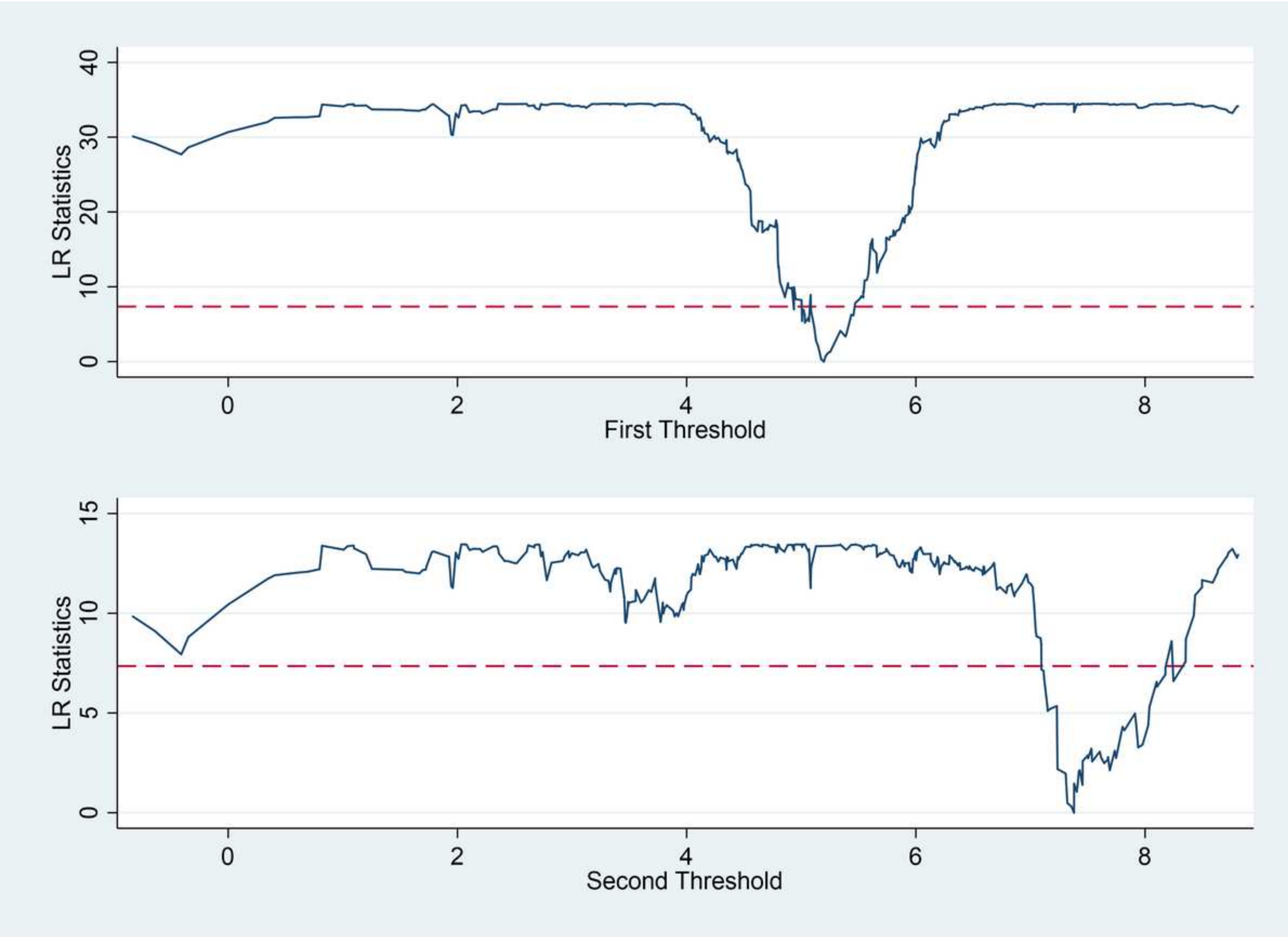

Figure 5

LR statistic of Two Thresholds for Services Sector (Robustness Analysis)

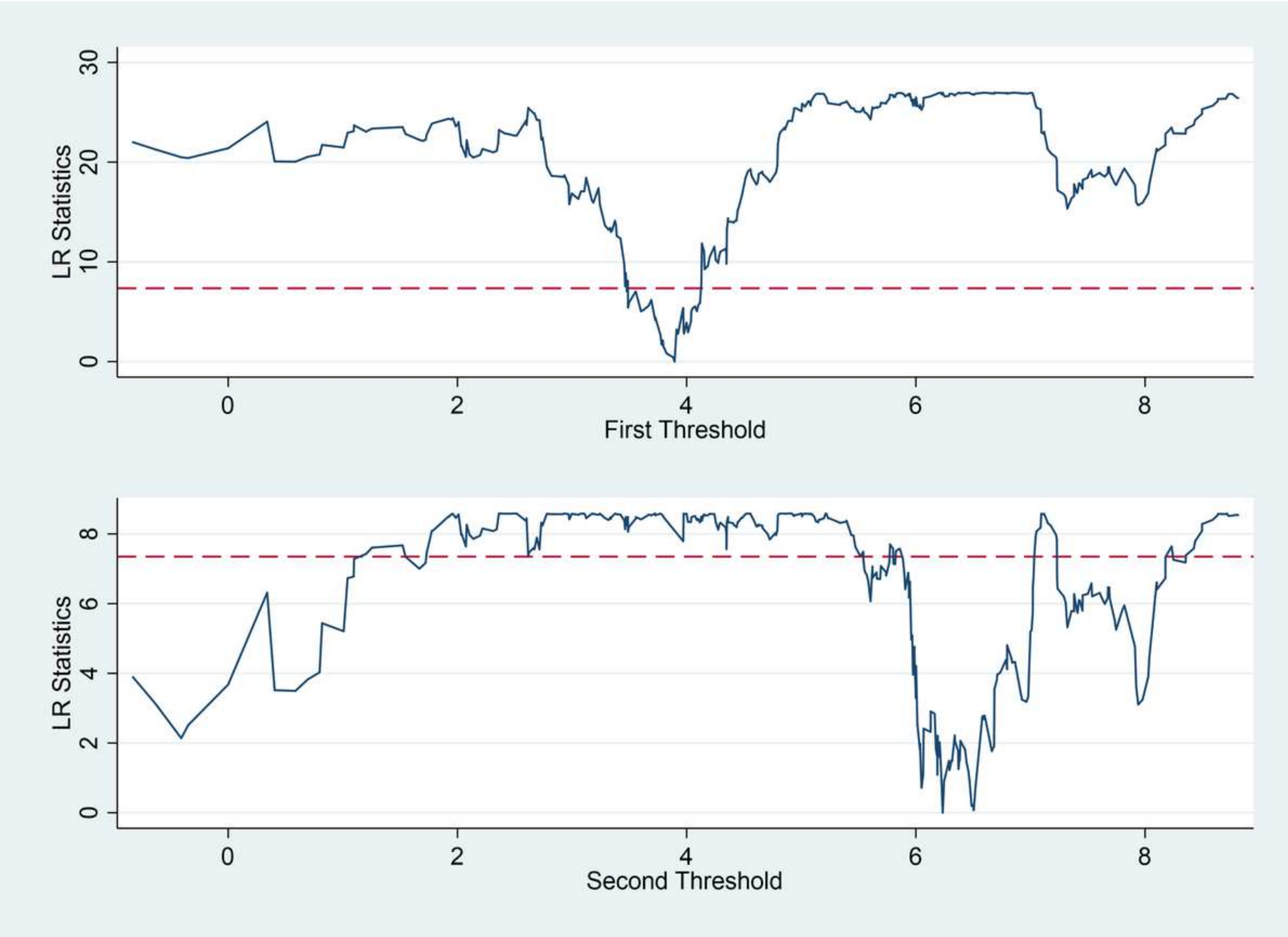

Figure 6

LR statistic of Two Thresholds for Agricultural Sector (Robustness Analysis)