

## Original Research Article

**The Dynamics of economic globalization and income inequality in SSA: An empirical insight from 2STLS and FE approach.**

### **ABSTRACT**

Many empirical studies have examined the nexus between economic globalization and income inequality. However, findings are controversial, especially for developing countries, which require further investigation. This study, therefore, aims to examine the effect of economic globalization on income inequality using unbalance panel data in 19 Sub Saharan African countries (SSA) from 2000 – 2015. Due to endogeneity problem and cross sectional dependence, the model was analyzed using a two-stage least square (2SLS) regression and the fixed effect model with Driscoll-Kraay standard errors regression respectively. The findings reveal that FDI, Trade openness, and ICT development are positive and significantly link to income inequality while remittances have a negative and significant effect. This is an indication that economic globalization indicators (FDI, Trade openness, ICT) have failed to bring a fairer income distribution in these countries while remittances have contributed to income distribution. On basis of this conclusion, policymakers should pursue policies, which will enhance a balanced development and improvement in the socioeconomic welfare of the population by improving measures of income distribution.

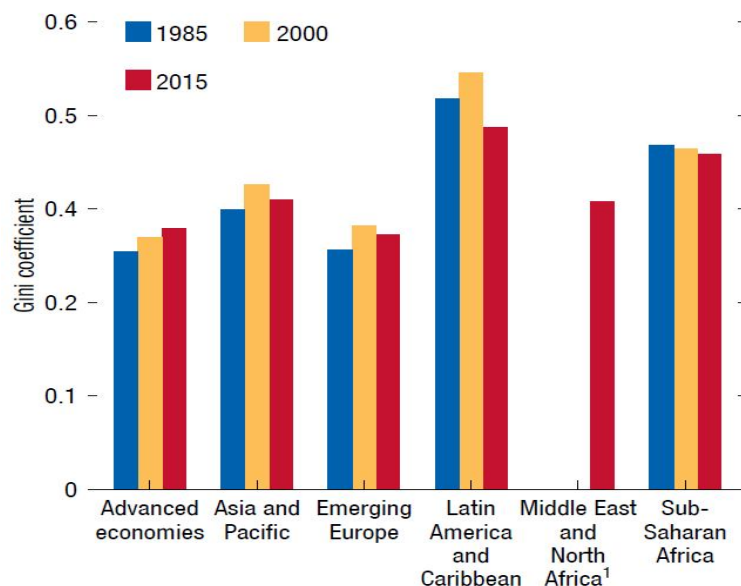
**Keywords:** economic globalization, income inequality, 2SLS, SSA

## 1. INTRODUCTION

The relationship between economic globalization and income inequality is not new but remains a significant panacea for equality in income distribution as it integrates the world into a global village. Hence, Economic globalization is an indispensable activity that integrates the world's economy through trade liberalization and finance [1]. The study of [2] indicates that the social and economic outcomes of globalization such as driving growth, gender equity, and human rights improvement are paramount in achieving income equality. With a fast-growing trend of the global economy, the debate of economic globalization's effect on income inequality has been widely contested from numerous viewpoints due to rising inequality in both developing and developed countries [3]. In some countries where the population is managed and control by a specific group, income inequality may worsen due to rising economic globalization[1,4–7]. However, other scholars believe economic globalization reduces income inequality [8,9]. Hence, the link between economic globalization and income inequality is not robust across studies[1].

This scenario is not different in Sub-Saharan Africa (SSA) as it represent one of the regions in the world with the worst rate of income inequality. Though, in the first 15 years of the 21st Century, its witness a significant economic performance [9], the benefits of this economic performance, which emanate from the amalgamation of the global economy, are still far fetch as income inequality remain the slogan of most of these countries. It is evident that while economic globalization has brought a considerable rise in trade volume, the economic benefit of capital flows and income to some regions is uneven with the rich and the poor having a broadening gap in terms of all aspects of economic gratification. While Economic Globalization is expected to drive FDI by improving the efficiency of enterprises through technology transfer, capital market flows, and boost trade openness[10], sub-Saharan African economies remain in the bottom line

of poverty and income inequality despite the abundant natural resources and economic interaction with the global economy[11]. After Latin America and the Caribbean, SSA is the world's second region with the highest level of inequality in income distribution[12] (see figure 1). [13] also indicates that it is the least unequal region even with a moderate decline in its unweighted Gini coefficient from 0.47 to 0.43 between 1991 and 2011. This persistent income inequalities obstruct economic development and causes political instability[9]. In this light, the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) was adopted in September 2015 to draw more considerable attention to income inequality in SSA. However, achieving the objectives of reducing income inequality by 2030 and the goal of 'no one behind', Sub Saharan African countries need to carry out an in-depth analysis of their disparities, trends, and determinants[9]. [13] indicates that SSA has multi-dimensional and complex factors that determine its inequality making it challenging to address the situation. SSA has been further marginalized in the world economy as its share of world trade, investment, and output have declined to negligible proportions compare to other regions of the world [11].



## Figure 1. Average income inequality across regions and over time, 1985–2015

**Source: IMF (2017)**

Looking at economic globalization as a multi-dimensional phenomenon, this study decomposes economic globalization into FDI, trade openness, and remittances, and then examines the effects on income inequality in SSA.

This study aims to contribute to scholarly literature by providing empirical evidence on the relationship between trade openness, ICT development, FDI, and remittance on income inequality, which is limited in SSA. The study represents one of the initial studies to present the first quantitative evidence of the impact of economic globalization on income inequality in SSA. Another significant ingredient of this study is incorporating many economic globalization regressors unlike in past empirical studies in SSA. For robustness checks, the study also integrates both the GINI coefficient and atkinson2 for comparative analysis.

## **2. Literature review**

### **2.1 Theoretical literature**

Numerous studies have established a theoretical bond between economic globalization and income inequality [14–17]. However, the theories will be examined based on the variables used in this study.

With regard to trade openness, one of the crucial theory is the Stolper-Samuelson theorem, which is an extension of the Heckscher–Ohlin (HO) model. It envisages that in LDCs, economic globalization will narrow income inequalities[18]. The [19] theory originally assume that

countries will be specialized in areas with more factor endowment. It explains that the effect of inequality resulting from trade openness is due to relative factor endowment and productivity differences of countries[20]. Hence, a country will benefit from trade openness based on factor endowment and trade specialization. For instance, developing countries that are endowed with unskilled labour would benefit from trade openness through an increase in their wages and income. This is because the demand for unskilled workers from these countries will cause an upward push in their wages due to external trade and hence reduce income inequality within the country[20]. Also, since capital and skilled labor are relatively abundant in developed countries while unskilled labour is scarce, income inequality is expected to augment [21]. This is because trade openness will raise the real return of abundant skilled labour and lower returns for scarce unskilled labour. Thus, the theory predicts that inequality will decrease due to trade openness in developing countries while it will increase in advanced countries[21]. [22] state that when countries are involved in free trade and they equalized product price between countries, it also makes factors price equalized. However, the level of development of a country plays a pivotal role in the nexus between trade openness and income inequality[19].

The conventional HO has limitations as pointed out by several studies. For instance, sub-Saharan African countries with majority of unskilled labour are supposed to have a reduced gap in income inequality but instead the region is top rank in the world on income inequality.

Concerning FDI and income inequality, the Neoclassical and Dependency theories are of principal interest. The neoclassical scholars contend that FDI boosts growth and reduces inequality in the host country. They hypothesize that FDI does not only fill the income gap but assists in the growth and development of a nation via diffusion of technology, human capital development, and export market access [23].

The dependency theory on its part argues that the exploitation of the low incomes nations by high-income nations is the cause of global inequality[24]. They theorized that FDI negatively affects economic growth and increases income inequality[25]. Hence, the economic reliance of developing countries on advanced countries leads to income inequality.

In addition, the [26,27] technological change hypothesis posits that there is a rapid demand for skilled labour and new technology in the early stage of development, which increases inequality but when low-skilled workers develop more skilled, there is a reduction in income inequality over time as the supply of skilled labour equates demand[28].

The North-South hypothesis of [29] also contends that FDI deteriorates income inequality in the global North since business corporations in the more advanced countries will want to take advantage of low production costs by investing less in the global South to develop unskilled labour. Hence, FDI widens the inequality gap as it demands more skilled workers with higher wages as compared to unskilled workers in the South[28].

Theories that support the relationship between remittance and income inequality are the optimistic and pessimistic perspectives [30]. For optimistic view, [31] argued that remittance offers financial supports to poor household which reduce income inequality through entrepreneurial innovation, aggregate money demand, and employment. For pessimistic view, [32,33] argued that due to external shocks, remittance can impede economic growth. In addition, [34] indicates an inverted U-shaped between the theory of remittances and inequality, in which remittances initially widen the income inequality gap amongst households but reduce inequality over time.

Furthermore, the social capital theory argue that private property can be passed on from one generation to another. Therefore, those who inherit capital can enjoy high income even without any effort. They have access to the best private education and jobs. This creates inequality of opportunity as well as inequality of outcome. Hence, Differential access to such resources is one of the most enduring features of social inequality and a key reason for its reproduction across time and space[35,36].

## **2.2 Empirical literature**

The relationship between economic globalization and income inequality is heterogeneous with mixed results. However, many empirical studies have found a positive link between both concepts, although the outcomes are mixed in developed and developing economies [1,4–7,37].

Specifically in developing countries,[5,6,37] found economic globalization to have a reducing effect on income distribution. Contrary, [5] conclude that economic globalization deteriorates income inequality. Moreover, [38] argue that the driving force to income convergence through countries is economic globalization. [8] using developed and emerging economies in Europe finds that globalization has no effect on income inequality. For in-depth analysis in this study, the literature will be examined under separate headings.

### **2.2.1 Trade openness and income inequality.**

The relationship between trade openness and income inequality is mixed[21]. In the 1990s, the relationship have been investigated in several empirical investigations [39–42], and from 2000s onward, the study receives the highest momentum [21,43–45]

[45] using 32 developed countries from 1963– 2002 reveals that trade openness increases income distribution. They also finds that imports from LDCs correlate positively with income inequality

in advance countries. Similarly, [44] use 65 developing countries for 19 years to contrast the HO model by suggesting that trade increases income disparity. Likewise, [46] indicates that inequalities can be reduced in countries that integrated into the world economy. Equally, [47] found that there is a drop in rural-urban income distribution in Chinese cities that experience trade openness to a greater degree. [48] using a panel of 71 countries reveals that countries endowed with capital, witness an increased in inequalities when trade is liberalized.

Contrarily, [43] using a sample of 31 developing and 20 developed countries for 22 years conclude that trade openness lower income inequality. Similarly, [49] also found trade openness to reduce inequality in wages between skilled and low-skilled workers in India. [50] argues that domestic inequality can be reduced if a country is integrated into international trade. [51] used 60 countries (both developed and undeveloped) to conclude that Globalization reduces inequality. Contrarily, [52] criticize [51] for their conclusion based on the selection of the countries. They claim that in developing countries, globalization instead worsens inequality.

Some empirical studies found contradictory results. [53] using 102 countries for 30 years found that for developed countries, trade openness increases inequalities but decreases inequalities in developing countries. The findings are true with that of Dorn et al (2022) using 139 countries from 1970-2014.

### **2.2.1 FDI, ICT development, and income inequality**

[54] reveals that hi-tech FDI has significant positive effects on income distribution but the impact depends on the level of technology and human capital development in the host country. [28] using 38 countries in Sub-Saharan Africa (SSA) for 28 years conclude that FDI does not directly affect income inequality. In a related study [55] used 16 African countries for 33 years to

establish a link between FDI and income inequality. Using a Pooled Mean Group estimator, they finds FDI to increase income equality. However, once there is a further increase in FDI, the effect diminishes. Similarly,[56] conclude that inequality in the EU-27 has been increasing since 1995 due to financial globalization via FDI. Their findings is accurate with that of [43] who conclude that financial globalization, particular foreign direct investment increased income inequality in 51 countries for 23 years.

[57] examine the main drivers of income inequality in 17 West African countries for 41 years. They found that FDI, trade openness, and remittances are the core drivers of income inequality in SSA. [58] reveals that the role of FDI on income inequality depends on technology diffusion, human capital development, and institutional quality in the host country. [59] using a sample of 42 countries in Sub-Saharan Africa for 18years reveals good governance is primordial in reducing income inequality. Similarly,[60]indicates that ICT lessens income inequality but the type of ICT and measurement of income inequality is paramount. This is contrary to the findings of [61] who indicates that ICT increase wealth inequality in the society.

### **2.2.3 Remittance and income inequality**

[62] investigate the effect of remittances on income inequality in 42 African countries. The GMM results indicates that remittances worsen income inequality in Africa. Similarly, [63] using African countries as a case study for 46 years conclude that international migrant remittances positively and significantly affects income inequality in Africa. Other empirical studies have found remittance to increase income inequality [64–67]. Syne's (2019) study analyze the effect of globalization on income inequality for 25 countries in sub-Saharan Africa from 1996-2015 using institutional quality. The fixed-effect results indicates that remittances improve income

inequality. Contrary, [68] using Mexico to examine the impact of remittances on inequality conclude that remittances lower inequality. Other empirical studies have found remittance to reduce income inequality [69–74] while others finds no significant effects [75,76]

#### **4 Data and methodology**

The study makes used of unbalance panel data from World Bank data for 19 SSA countries (Burkina Faso, Burundi, Cabe Verde, Cameroon, CAR, Ethiopia, Ghana, Guinea, Kenya, Liberia, Madagascar, Mali, Mozambique, Namibia, Niger, Sierra Leone, Swaziland, Tanzania, and Uganda), ranging from 2000-2015.

To be consistent with literature, we used the Gini coefficient as the best measure of income inequality [77–81]. It is obtained by taking into account the disposable income of the selected countries[81]. Considering the disadvantages of the GINI index, which may be misleading when a country is large with unequal region, we also used the atkinson2 index as a measure of inequality. FDI, trade openness, ICT, and remittances are the explanatory variables while unemployment, inflation, natural resource endowment, and GFCE as a percentage of GDP are control variables. FDI inflows and trade openness is used in this study following the work of [81]. Trade openness is used to show trade links between SSA and other countries. It is calculated as the sum of imports plus export over GDP[81]. Remittances which is also one of the explanatory variables is used based on the study of [30] while [60] inspires ICT development inclusion. The descriptive statistics in Appendix 1 shows that the averages of Gini index and atkinson2 between the study period 2000–2015 stand at 0.585% and 0.693% respectively.

The Two Stage Least Squares (2SLS) and the fixed effect model will be employed in this study.

The rationale of the 2SLS method is to tangle the endogeneity problem witness in the model.

Using the Durbin-Wu-Hausan endogeneity test, four endogeneity cases were discovered when tested with Gini index, that is; remittance, population, inflation and natural resource endowment(see appendix 6). Also, remittances, urbanization, inflation, and natural resource endowment when tested with atkinson2 also show evidence of endogeneity (see appendix 5). In this case, the OLS is substituted with the two stage least square (2SLS) which is an alternative approach used when face with the problem of endogeneity in OLS. This happens when the explanatory variable correlate with error term. Hence, the 2SLS where we use instrumental variable is more suitable for the study. It should be noted that the study found no evidence of serial correlation amongst the variables as all coefficient were below 0.7 (see Appendix 2)

The fixed effect model is also applied in this study base on the outcome of the Pesaran's test of cross sectional independence (see table 1). The Hausman test also indicate the fixed effect model is the most appropriate (see table 2). However, the presence of cross sectional dependence and heteroskedasticity as indicated in table 1 and 2 respectively, warrant the usage of fixed effect model with Driscoll and Kraay standard errors regression [82–84].

### 5 Econometric specification

To realize how income inequality being a dependent variable is affected by economic globalization and other variables, we specify the following model based on the works of [85]

$$GINI_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 TO_{it} + \beta_3 Remit_{it} + \beta_4 ICT_{it} + \beta_5 unemp_{it} + \beta_6 urban_{it} + \beta_7 \ln la_{it} + \beta_8 NRE_{it} + \beta_9 GFCE_{it} + \varepsilon_{it} \dots \dots \dots 1$$

Where Gini is the GINI coefficient; ICT is ICT development; FDI is foreign direct investment; TO is trade openness; Remit is remittances; unemp is unemployment; Infla is inflation; NRE is natural resource endowment; GFCE is government final consumption expenditure as a

percentage of GDP,  $\beta_0$  = is the intercept,  $\beta_i$ =parameter estimators, t=time;  $\varepsilon_t$  is random error term.

In the case of fixed effect model, our specification look thus;

$$\bar{w}_{it} = \delta \bar{x}_{it} + \mu_i + \bar{\varepsilon}_{it} \dots \dots \dots 2$$

Where;  $\mu_i$  is the each entity intercept,  $\bar{w}_{it}$  is the dependent variable,  $\bar{x}_{it}$  is the independent variables,  $\delta$  is the coefficient of independent variables,  $\bar{\varepsilon}_{it}$  is the error term

**6. Unit root test.**

Ascertaining stationarity is primordial to avoid spurious regression[86]. Also, since time series for different cross-sectional units may be correlated, which may arise due to presents of common shocks, unobserved factors, spillover effects, or due to similarity in political, cultural, and economic cross-sectional units, it is essential to conduct cross-sectional dependent tests[87,88]. The cross-sectional dependence test helped in deciding whether to use first generation panel unit root test [89,90] or the second generation panel unit root tests[87,88,91]. However, the second-generation unit root tests is supreme in case of cross-sectional dependence to avoid spurious [92]. The study applied the[88] test for cross-sectional dependency (CD) which can be applied to small and large pane[92]. The outcome of the cross sectional dependence test in table 1 makes it suitable for both the first and second-generation unit root tests to be conducted in this study (see appendix 3 and 4).

**Table 1:Pesaran CD test for cross sectional dependence**

variables	CD test	P-values
Gini index	5.620	0.000
atkinson2	4.807	0.000
ICT	25.056	0.000

Unemployment	9.903	0.000
Urban	13.593	0.000
infla	3.892	0.000
NRE	8.557	0.000
GFCE	0.216	0.829
FDI	6.374	0.000
trade	5.033	0.000
remit	8.817	0.000

**Source: Author's computation**

**Table 2: preliminary Panel data investigation**

Gini index as the dependent variable		Atkinson2 as the dependent variable	
Test	p-values	Test	p-values
Hausman Test	0.0000	Hausman Test	0.0000
Breusch-Pagan LM test of independence	0.0000	Breusch-Pagan LM test of independence	0.0000
Wald test for heteroskedasticity	0.0000	Wald test for heteroskedasticity	0.0000

**Source: author's computation**

## 7. Results and discussion

Regression results based on two stage least squares estimation are reported in Table 3 while that of fixed effect are display in table 4. We limit our interpretations to the main explanatory variables that address the study objectives. For two stage least square, the results show that FDI and trade openness have influenced the degree of inequality not only positively but also significantly. This implies that, increasing the inflow of foreign capital penetration and trade volume fails to equalize the distribution of income. This findings is consistent with that of [54,77]. Contrary, remittances have a negative impact on inequality. This also implies that by

increasing the inflow of remittances equalizes the distribution of income. The results are in line with that of [71]. ICT development was found to be positive insignificant.

To check for robustness of the results, the fixed effect model display in table 4 also indicates that trade and ICT were found to exert a positive and significant influence on income inequality while remittances reduces income inequality as it was found to be negatives and significant. However, FDI did not have any significant influence on income inequality. The results of both Gini index and Atkinson2 show that most of the variables maintain the same sign and effect, implying that Gini and atkinson2 could be good and similar measures of inequality.

**Table 3: Two stage least square estimates**

Variables	Atkinson2 as the dependent variable	Gini index as the dependent variable
FDI	0.000618** (0.000247)	0.000303** (0.000150)
trade	4.52e-05 (3.09e-05)	3.45e-05* (1.88e-05)
ICT	-2.17e-06 (3.81e-05)	2.35e-07 (2.32e-05)
remit	-5.42e-05* (3.05e-05)	-4.54e-05** (1.85e-05)
Unemplo	0.00194*** (0.000438)	0.00126*** (0.000267)
urban	-8.66e-05 (0.000219)	-0.000269** (0.000133)
infla	1.07e-05	-2.86e-05

	(3.00e-05)	(1.82e-05)
NRE	-0.00306***	-0.00167***
	(0.000409)	(0.000249)
GFCE	-2.96e-05	-1.61e-05
	(2.92e-05)	(1.78e-05)
remit	-2.62e-05	1.58e-05
	(2.40e-05)	(0.000105)
Constant	0.711***	0.606***
	(0.0118)	(0.00720)
Number of groups	19	19
Observations	285	285
R-squared	0.3582	0.3270
Prob > F	0.0000	0.0000

Note:\*\*\* denote 1% level of significant,\*\* 5% level of significant and \* 10% level of significant.

Robust standard errors in parentheses

Source: Author's computation

**Table 4: Fixed effect estimates with Driscoll-Kraay standard errors regression**

Variables	Atkinson2 as the dependent variable	Gini index as the dependent variable
FDI	-5.99e-05 (8.56e-05)	-0.000203 (0.000159)
trade	1.27e-05** (3.27e-05)	3.81e-05 (2.58e-05)
ICT	0.000118*** (3.18e-05)	-1.81e-05 (2.74e-05)
remit	-9.98e-05*** (1.87e-05)	-1.58e-05 (0.000105)
unemplo	0.00117 (0.00316)	0.00152 (0.000921)
urban	-0.00808*** (0.00133)	-0.000751** (0.000258)

infla2	4.27e-05*** (9.84e-06)	-2.78e-05 (2.88e-05)
NRE	-0.00128** (0.000495)	-0.00140** (0.000533)
GFCE	9.23e-06 (1.66e-05)	-1.79e-05*** (6.04e-06)
remit	-3.65e-05** (1.37e-05)	-3.93e-05 (8.19e-05)
Constant	0.928*** (0.0407)	0.613*** (0.0277)
Observations	285	285
Number of groups	19	19
R-square	0.2660	0.2625
Prob > F	0.0000	0.0000

Note:\*\*\* denote 1% level of significant,\*\* 5% level of significant and \* 10% level of significant.

Robust standard errors in parentheses

**Source: Author's computation**

Considering table 3, the coefficient of determination (R-squared) is 0.3582 for atkinson2 while it is 0.3270 for Gini index, implying that variation in income inequality is explain by economic globalization variables used in this study by 35% and 32% respectively. In table 4, the R-square of Atkinson2 is 0.2660 and 0.2625 for Gini index indicating that explanatory variables contribute in explaining income inequality by 26% in both cases. In addition, the F-statistic is significant at 1%, indicating the performance and acceptance of the overall model.

## 9. Conclusion and policy implications

Globalisation – the process of integrating different economies is one of the most significant trends shaping the world today. It has undoubtedly boost economic growth, globalized trade, diffused knowledge, and equalized income distribution. However, empirical verification are controversial. Thus, this study was out to investigate the effects of economic globalization on income inequality in SSA. The study utilized the 2STLS regression due endogeneity problem face in the model and fixed effect model due to cross sectional dependence. The results reveals that FDI, Trade openness, and ICT development positively and significantly affects income

inequality in SSA while remittances have a negative and significant effect. The results relatively disfavor the conventional reasoning of HO theory that trade lower income inequality in developing countries. Based on this conclusion the study recommends the following;

The governments should be cautious in the invitation of foreign investors in their countries as opening up their economy for investors and inflows of technology worsen their income inequality. More specifically, they should place ownership restrictions, tax rates, and sanctions for investors increasing income inequality. Thus, fostering FDI and trade should be geared towards equalizing the distribution of income. In addition, they should encourage the inflow of remittance through tax reduction as it reduces income inequality.

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## APPENDIX

### Appendix 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Gini index	296	.585	.029	.527	.788
Atkinson2	296	.693	.052	.583	.812
FDI	304	5.338	10.96	-2.739	103.337
Trade	293	67.107	38.97	20.964	311.354
Remit	280	2.658	3.604	.001	21.81

ICT	302	4.635	7.277	.015	42.683
Unemplo	304	6.142	6.466	.32	28.24
Urban	304	31.9	13.17	8.246	64.3
Infla	282	7.316	6.77	-8.238	44.391
NRE	304	9.962	7.142	.414	40.492
GFCE	286	14.577	4.698	3.541	28.015

Source: Authors computation

### Appendix 2: correlation matrix table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Gini index	1.000										
(2) Atkinson2	0.874	1.000									
(3) FDI	-0.108	-0.037	1.000								
(4) Trade	0.074	0.201	0.310	1.000							
(5) Remit	-0.086	-0.020	0.628	0.323	1.000						
(6) ICT	0.096	0.156	0.014	0.150	0.303	1.000					
(7) unemplo	0.344	0.395	-0.094	0.488	0.007	0.283	1.000				
(8) urban	-0.011	0.069	0.271	0.418	0.327	0.399	-0.139	1.000			
(9) Infla	-0.132	-0.061	0.000	0.162	-0.096	-0.119	-0.052	0.008	1.000		
(10) NRE	-0.435	-0.467	0.306	0.045	0.190	-0.277	-0.440	-0.138	0.309	1.000	
(11) GFCE	0.181	0.144	0.086	0.195	0.060	0.108	0.353	-0.141	-0.255	-0.082	1.000

Source: Authors computation

### Appendix 3: Levin-lin-chu unite root test

Number of countries =19, number of years = 16

Variables	Test at level		Test in difference		Conclusion
	t-statistics	p-value	t-statistics	p-value	
GINI	-1.8901	0.0294**			I(0)
Atkinson2	-2.4517	0.0071***			I(0)
FDI	-3.9541	0.0000***			I(0)
Remit	-2.1753	0.0148**			I(0)
Trade	-3.4602	0.0003***			I(0)
ICT	10.8544	1.0000	9.3257	1.0000	I(1)
Unemplo	-3.6731	0.0001***			I(0)
Urban	-2.3508	0.0094***			I(0)
GFCE	-0.9088	0.1817	-8.6458	0.0000	I(1)
Infla	-7.5636	0.0000***			I(0)
Pop	- 6.1278	0.0000***			I(0)
NRE	- 4.3356	0.0000***			I(0)

Source: Authors computation \*\*\*( $p < 1\%$ ), \*\*( $p < 5\%$ ), \*( $p < 10\%$ ).

#### Appendix 4: PESCADF unit root test

variables	Test statistics at levels	p-values	Test statistic at first difference	P-values	Decision
Atkinson2	-1.018	0.154	2.312	0.000	1(1)
Gini index	-3.889	0.000	--	--	1(0)
FDI	-2.425	0.001	--	--	1(0)
trade	-2.033	0.097	-2.647	0.000	1(1)
ICT	-1.525	0.810	-2.302	0.009	1(1)
remi	-2.101	0.061	--	--	1(0)
unempl	-2.261	0.012	--	--	1(0)
urban	-1.087	0.997	-2.196	0.026	1(1)
infla	-2.925	0.000	--	--	1(0)
NRE	-1.586	0.731	-2.413	0.000	1(1)
GFCE	-1.671	0.599	-3.341	0.000	1(1)

Source : Authors computation

#### Appendix 5: Durbin-Wu-Hausman endogeneity test with Atkinson2 as the dependent variable

HO: variables are exogenous, Ha: variables are endogenous

Variable	Robust score chi2(1)	p-value	Robust regression	p-value
FDI	0.369613	0.5432	F(1, 274) = 0.377861	0.5393
Remit	7.88595	0.0050*	F(1, 260) = 7.70992	<b>0.0059 *</b>
Trade	0.611698	0.4341	F(1, 274) = 0.845783	0.3586
ICT	0.954175	0.3287	F(1, 274) = 1.11946	0.2910
Unemplo	0.459385	0.4979	F(1, 274) = 0.485307	0.4866
Urban	3.13198	0.0768*	F(1, 274) = 3.20923	<b>0.0743 *</b>
Pop	0.418943	0.5175	F(1, 274) = 0.381093	0.5375
Infla	3.22225	0.0726*	F(1, 274) = 3.714383	<b>0.0550 *</b>
NRE	6.62697	0.0100*	F(1, 274) = 6.70118	<b>0.0101 *</b>
GFCE	0.163948	0.6855	F(1, 274) = 0.152376	0.6966

Source: Authors computation \*(p-value less than 10%)

#### Appendix 6: Durbin-Wu-Hausman endogeneity test with Gini as the dependent variable

HO: variables are exogenous, Ha: variables are endogenous

Variable	Robust score chi2(1)	p-value	Robust regression	p-value
FDI	1.31776	0.2510	F(1, 274) = 1.50039	0.2217
Remit	5.27009	0.0217*	F(1, 260) = 6.33287	<b>0.0125 *</b>
Trade	0.241692	0.6230	F(1, 274) = 0.2918	0.5895
ICT	2.06527	0.1507	F(1, 274) = 2.46194	0.1178
Unemplo	1.17975	0.2774	F(1, 274) = 1.28417	0.2581
Urban	0.517406	0.4720	F(1, 274) = 0.516249	0.4731
Pop	2.76016	0.0966*	F(1, 274) = 3.21553	<b>0.0740 *</b>
Infla	7.13265	0.0076*	F(1, 274) = 9.01033	<b>0.0029 *</b>
NRE	4.56327	0.0327*	F(1, 274) = 5.0295	<b>0.0257 *</b>
GFCE	1.96553	0.1609	F(1, 274) = 1.55912	0.2129

Source: Authors computation \*(p-value less than 10%)