THE KUZNETS CURVE HYPOTHESIS CHECKED OUT ON UP-TO DATE OBSERVATIONS IN AFRICAN COUNTRIES

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ABSTRACT

The purpose of this article is to study empirically whether the Kuznets' curve hypothesis on inequality and development is present in the economies located in Africa, as well as whether there is a minimum income for this hypothesis to begin to be fulfilled. In order to study this question, a panel of data from 45 countries is available for the period 1975-2019, and these data are analysed through a graphical point of view and through an econometric analysis using the pooled mean group (PMG) estimator. The results obtained allow us to conclude that there is evidence in favour of Kuznets' hypothesis and that a minimum level of income is required for it to be significantly observed. As well as the fact that today there is still a palpable heritage of European colonization.

KEY WORDS: Kuznets' Curve; Economic Inequality; Development; Africa.

JEL Classification: D63, O10, O11.

1. INTRODUCTION.

At present, there are many countries that are at different economic levels, and these can be classified according to different economic variables. In this article, we will focus on the relationship between the level of development and the level of inequality, as Kuznets (1955) proposed in his article. This approach is important in order to be able to design an economic policy that seeks to attack economic inequality, which can generate so much social conflict in the countries that suffer it, as well as erode the correct functioning of the economy. In recent years there seems to have been greater interest in the theory derived from it, the Environmental Kuznets Curve (EKC), which covers the environmental approach, which has aroused the interest of economic literature and, in fact, recently, numerous works have been developed in this field, such as those of Dogan and Inglesi-Lozts (2020); Sarkodie and Ozturk (2020); Ike et al. (2020); Kacprzyk and Kuchta (2020); Aziz, Sharif, Raza and Rong (2020); Purcel (2020); Caglayan-Akay and Kangalli-Uyar (2020); Usman et al. (2020) among others. However, the same priority is not given to studying the original hypothesis, which will be the objective of this work.

Among the world's poorest countries, the top ten are on the African continent as shown in the Human Development Report 2019, however, as we shall see below, the fact that these countries have low incomes does not mean that they have an equitable distribution of wealth.

There are also at least two major reasons for studying inequality on the African continent, namely: the fact that Africa is a continent very rich in natural resources and has great potential for development, and the existing debate on the strength of the Kuznets Curve.

Firstly, it is now understood that Africa's potential has not been exploited for its own development because of the turbulent history that has been written about this continent. Africa is notably marked by slavery, colonization and the subsequent independence of African colonies, a process that generated political instability on the continent that was aggravated by the cold war. Since the mid-twentieth century, this development has also been hindered by African elites and their ability to influence the politics and economy of the various countries that make up the continent. All this historical baggage has led to the fact that African resources have been used for the benefit of other continents or only for a certain segment of the African population.

Second, Kuznets' hypothesis on inequality and development has been long discussed since it was first put forward in 1955, having both supporters and detractors. This paper justifies and claims that the hypothesis is observable in Africa, as well as that these countries still have the heritage of the colonial era in mind. Besides, it is intuited that there is a minimum income to be able to experience the Kuznets' curve and in some African countries this minimum is not reached. To achieve this, initially a literature review will be conducted on the Kuznets curve to locate where the issue lies. This will be followed by some data on income and inequality in Africa to give insights into where the economy is. At this point, the empirical section will begin with the presentation of the model, as well as the results obtained and a section on robustness to check whether or not these results are sensitive to the variables that have been used. We will finish this work with our own conclusions.

2. BACKGROUND

2.1. THEORICAL LITERATURE

The Kuznets Curve, as proposed by the original author, describes that inequality, if studied in terms of economic development, measured by the Gini index and per capita income respectively, will find a form of U-inverted. That is, countries initially have low levels of inequality. Inequality grows as the country develops until it reaches a maximum where new economic forces will appear that will cause a decrease in inequality. The economic forces that would initially put upward pressure on inequality are the concentration of savings in the wealthy classes and rural-urban migration. Subsequently, productivity differentials, the generation of new job opportunities and the birth rates of different segments of the population would reduce the inequality initially created. This is the hypothesis put forward by Kuznets (1955).

Kuznets himself in the conclusions stated "The paper is perhaps 5 per cent empirical information and 95 per cent speculation, some of it possibly tainted by wishful thinking". This statement would provoke many economists to analyse his hypothesis. Finding both supporters [Lindert (1986); Greenwood and Jovanovic (1990); Higgins and Williamson (1999); Barro (2008); Shahbaz et al. (2015); Martínez-Navarro et al. (2020); León (2021)] as well as detractors who argued that there was no such relationship between inequality and development [Deininger and Squire (1996;1998); Castelló-Climent (2010); Kanbur (2017); Baymul and Sen (2019)] and even some who claimed to find no relationship [Thomas (2015); Theyson and Heller (2015);].

We also find extrapolations of the Kuznets hypothesis to other areas. The most popular and mature is known as the Environmental Kuznets Curve (EKC), which studies CO2 emissions in relation to development. This approach began in the 1960s with works such as Hakkert and de Zeeuw (1968), and has continued to be investigated since then, with works such as Cole et al. (1997), Dasgupta et al. (2002), Tsurumi and Managi (2010) and Ahmad et al. (2021). There are also studies that have tried to apply the Kuznets curve to particular cases. These include the Kuznets curve for obesity (Grecu and Rotthoff, 2015); the Kuznets curve for tourism (Raza and Shah, 2017); the Kuznets curve for crime (Buonanno et al. (2017); the Kuznets curve for suicide (Antonakakis and Collins, 2018); the Kuznets curve for alcohol consumption (Cantarero-Prieto et al. (2019), among other applications.

In conclusion, as has been the case since 1955, Kuznets' hypothesis has been studied by numerous authors and both pro and con evidence has been found. In this study we will provide a vision focused on African countries, as well as the repercussion that being a British or French colony has had for them. In addition to whether these economies, which have the lowest per capita income in the world, actually have enough income to experience Kuznets' hypothesis.

2.2. EMPIRICAL LITERATURE

Similar to the theoretical approach to the Kuznets curve, and its variants, there are a multitude of studies that have delved more into the empirical issues than others.

The most relevant empirical work in this respect is Piketty (2013). In this contribution Piketty expands on the work done by Kuznets, with three fundamental differences. First, Piketty calculated economic inequality through taxpayers' tax returns. Second, he based his study on the GDP growth rate instead of using GDP pc. And finally, his sample was larger, since in addition to the United States he also took into account France, Germany, Great Britain, Japan and Sweden. In this way, Piketty observed that since the 1950s economic inequality has increased,

especially due to the concentration of income, which is understood as the totality of property rights over capital, land, shares, bonds, etc.

For Piketty the reason for this increase in inequality is clear: it is due to the fundamental divergence force, that is: r > g. Where r is the average rate of return on capital and g is the rate of GDP growth. Thus, Piketty argues that whenever the average rate of return on capital is higher than the GDP growth rate, inequality will be generated. Based on this hypothesis, Piketty contradicts Kuznets by arguing that the reduction in inequality observed by Kuznets in 1955 was due to the reduction in the rate of return on capital together with the simultaneous increase in the rate of economic growth.

Piketty's theory seems to be well supported by data and empirical analysis to discredit Kuznets' hypothesis. However, his analysis is more limited than Piketty assumes in his book, since authors such as Acemoglu and Robinson point out that for Piketty's empirical model to be applied to the real case, 100% of the income received by the owners of capital must be saved, which is a starting hypothesis that could never be fulfilled. Likewise, other authors such as Fortin and Lemieux (2016) criticise that Piketty's empirical analysis is based on the richest 1% of the population in highly developed countries, while Lumieux points out that the remaining 99% of the population could behave differently. Based on these authors, we can conclude that Piketty's study is specific to a certain segment of the population, and not a general study.

Focusing on specific studies focusing on the case of Africa, we find that inequality on the continent has been studied in depth. However, most focus on the EKC (Sarkodie, 2018; Tenaw and Beyene, 2021). In our case, focusing on the inequality hypothesis in relation to development, we have collected the most notable and recent work to contextualise how many countries, methodology and findings the preceding empirical studies have found. This information has been compiled in Table 1.

TABLE 1. LIST OF SELECTED EMPIRICAL STUDIES.

[TABLE 1]

In conclusion, it is observed that there is generally evidence in favour of the Kuznets hypothesis within the context studied by each author (financial, environmental, etc.) except in the case of Adams and Klobodu (2019). Furthermore, it can be seen how they employ various methods for their analysis, with the GMM and PMG methods being among the most widely used. At this point it can be said that, following the results of the Hausman test, in this study the analysis has been carried out using the PMG estimator technique.

3. INCOME AND INEQUALITY IN AFRICA

Africa is a continent with great disparities between its countries. If we speak in terms of per capita income, we find that the country with the highest income (Equatorial Guinea with $31,486) exceeds the income of the poorest (Central African Republic with $619) by 50 times.

Inequality in Africa is difficult to measure, as the calculation of the Gini index requires a variety of data that are not always easy to obtain and are sometimes from an imprecise source, so that different Gini indices can be found for the same year for the same country. In particular we have used the information from the SWIID (Standardized World Income Inequality Database)

as it is the largest and most general database created to date, although we are aware of its limitations as evidence Wittenberg (2015).

We can then see in Table 2 the countries with the highest level of per capita income and in Table 3 the countries with the lowest level of per capita income. Both tables alone allow us to see that there are large disparities in the volume of income in these countries. However, we could also highlight these countries on a political map, as can be seen in Map 1 and Map 2.

TABLE 2. TOP 10 COUNTRIES WITH THE HIGHEST PER CAPITA INCOME

[TABLE 2]

TABLE 3. TOP 10 COUNTIRES WITH THE LOWEST PER CAPITA INCOME

[TABLE 3]

Source: Tables prepared by the authors based on data from PWT 9.1 (Feenstra, Inklaar and Timmer, 2015)

MAP 1. TOP 10 COUNTIRES WITH THE HIGHEST PER CAPITA INCOME

[MAP 1]

MAP 2. TOP 10 COUNTIRES WITH THE LOWEST PER CAPITA INCOME

[MAP 2]

Source: Maps produced by the authors based on PWT 9.1 data (Feenstra, Inklaar and Timmer, 2015)

On the other hand, the countries with the lowest levels of inequality are listed in Table 4. The countries of the euro zone, considered to be benchmarks in terms of inequality, have an average level of 30. Given this fact, the economies with the lowest prevalence of inequality are in a moderately good situation. Likewise, as was done previously, the countries will be represented on a political map in order to see the geographical distribution of these levels of inequality.

TABLE 4. TOP 10 MOST ECONOMICALLY UNEQUAL COUNTRIES

[TABLE 4]

TABLE 5. TOP 10 COUNTRIES WITH LEAST ECONOMIC INEQUALITY

[TABLE 5]

Notes: [1] observation from 2018; [2] observation from 2017; [3] observation from 2016; [4] observation from 2015; [5] observation from 2014; [6] observation from 2013; [7] observation from 2012; [8] observation from 2010. Source: Tables prepared by the authors based on SWIID Version 8.2 data (Solt, 2020).

MAP 3. TOP 10 MOST ECONOMICALLY UNEQUAL COUNTIRES

[MAP 3]

MAP 4. TOP 10 COUNTIRES WITH LEAST ECONOMIC INEQUALITY

[MAP 4]

Source: Maps produced by the authors based on SWIID Version 8.2 data (Solt, 2020).

If we look at the maps together, we see that Map 1 and Map 3 highlight countries in the same area, and that Map 2 and Map 4 also show quite a few similarities. All these countries also have a common factor historically, among others, that they were areas under the control of France and England, with the British area in particular showing higher levels of income and economic inequality, and the former French regions showing both lower levels of income and inequality. This indicates that, as Amate-Fortes, Guarnido-Rueda and Molina-Morales (2015) point out, European colonisation of the African continent has determined the development and economic evolution of Africa, and we can see the legacy of those years in the present.

Finally, if we decide to make a scatter plot in which we have in the abscissa axis the GDP pc and in the ordinate axis the Gini index, as it is expected from Kuznets' hypothesis, we obtain the figure 1. In this one, we can appreciate before entering the statistical analysis that indeed for the set of African economies a pattern in form of inverted u can be observed, because the trend line takes the form of a concave curve.

FIGURE 1. GRAPHIC PATTERN OF INEQUALITY WITH RESPECT TO DEVELOPMENT

[FIGURE 1]

Source: Prepared by the authors themselves based on SWIID versión 8.2 and PWT 9.1 data

4. A PANEL DATA MODEL FOR INEQUALITY CHANGES

Inequality has multiple factors that affect it directly. Many researchers have now investigated the issue and concluded that inequality is influenced by the level of education, gender, age, geographical location, form of government, etc. However, the contribution that has had the most relevance, both because of the successive studies it has generated, the controversy that surrounds it and the topicality of its approach even though more than half a century has passed, is the contribution of Kuznets (1955). In this research, in order to contrast this hypothesis, we will stick to the variables proposed by this author, which are the level of inequality measured by the Gini index and the country's development measured by the gross domestic product per capita.

4.1. DATA

The inequality variable was collected from the Standardized World Income Inequality Database (SWIID) V. 9.1 (Solt, 2020). This source of information has the advantage that it maximizes the comparability of data on income inequality and covers a wide range of countries

at different points in time. It is therefore the best database for studies that take into account the levels of inequality of different economies, in this case, those in Africa.

The development variable has been obtained from Penn World Tables (PWT) 10 (Feenstra, Inklaar and Timmer, 2015) published by the University of Pennsylvania. This database collects numerous data for 182 countries between 1950 and 2017. As with the SWIID, the data obtained through the PWTs are fully comparable since they have been obtained through a homogeneous process, with no distortion between the income levels of different countries due to the value of their currencies, inflation or any other factor. The variable collected from the PWTs is Real GDP at constant 2011 national prices (in thousand. 2011 US$).

On the other hand, the Human Development Index (HDI) variable will be used for subsequent sensitivity analysis. This variable has been obtained from the Human Development Report 2019 published by the United Nations Development Programme (UNDP). As in the case of the GDP pc variable, it is fully comparable since it has been calculated by the same body using similar criteria for each country.

Once the Kuznets' hypothesis has been studied in the strict sense, that is, only using the development and inequality variables, an extended model will be carried out that will try to better capture the behaviour of inequality. The variables that will extend the model will be:

The public spending made in the country, measured as a percentage of its GDP, which will give us an approximation of the size of the public sector in each country. This variable has been included following works such as that of Lee (2005) or more recently Dotti (2020). The source from which we have extracted the data has been The Heritage Foundation which offers this information openly for many countries.

The percentage of the population with access to electricity will be another relevant variable, this has been extracted from the World Bank. And it has been decided to introduce it following the recent work of Marrero and Rodríguez (2019) and that of Sarkodie and Adams (2020), in this case, we understand access to electricity as an incentive to equal opportunities.

Finally, the extended model has two dummy variables as a result of what was observed in the previous section, these variables will be "French Colony" and "British Colony" to distinguish whether the country in question was a British or French colony in the past. If country i was a colony of the generated dummy variable, the value will be equal to 1, and in any other case it will be equal to zero.

Table 6 below provides basic descriptive statistics on the variables to be used in this work.

TABLE 6. DESCRIPTIVE TABLE OF VARIABLES

[TABLE 6]

Note: All data provided are unweighted averages.

Initially, the information collected has been subjected to various tests in order to decide which econometric techniques are the most optimal and whether any processing of these data is required. The results of these tests are shown in Table 7.

TABLE 7. TESTS PERFORMED ON THE REGRESSIONS FOR THE TOTAL SAMPLE.

[TABLE 7]

Source: Prepared by the authors themselves based on SWIID versión 8.2 and PWT 9.1 data

Starting from the left, the first test we find in Table 7 is the Cumby-Huizinga autocorrelation test on three delays. In all three cases, we can see that the p-value is close to zero and therefore that there is autocorrelation in these delays, that is, we assume that our model suffers autocorrelation. This is to be expected a priori, since the data on inequality and on GDP pc have a lot of persistence and the value of one year is very related to that of the previous period.

The following is White's heterocedasticity test. The result of this test is clear, we have a p-value of 0.000 so we reject the Ho that the data distribution is homocedastic. Therefore, our sample has problems of heterogeneity. This result was also to be expected after observing the big differences that exist between the countries of the African continent, as it was said before, the richest country (Equatorial Guinea) has an income 50 times higher than the poorest country (Central African Republic).

In addition, we have the result of the Lagrange de Breusch-Pagan multiplier test. This test tells us that the individual effects of each country in the sample are relevant, so it is most appropriate to use panel data for the estimation.

Finally, in order to be confident that our estimates will be robust it is important to check the time series properties of the data. For this purpose we have run the Im-Pesaran-Shin unit root test on all the variables we use in this study. The results of the unit root test are presented in the bottom of table 7. Most of the variables are stationary at first difference, with the exception of the gini index, which is initially stationary. We are then certain how to make robust estimates.

In conclusion, we know that our sample does not comply with the hypothesis of non-self-correlation and homocedasticity. Therefore, we have to use an econometric technique that is efficient in spite of not complying with these basic assumptions. The method we will use will be the pooled mean group (PMG) estimation method, which makes efficient estimates in cases of heterocedasticity and cross-sectional dependence.

4.2. ESTIMATION TECHNIQUE

In this case we have a macro panel in which we have data for 45 countries over the period 1975-2019. After testing the characteristics of the data we have come to several conclusions, which lead us to believe that there may be cross-sectional dependence among the countries in the sample. Given the results of the above tests, we believe that this is a reasonable assumption. Authors such as Pesaran (2006) and Eberhardt and Teal (2011) showed that assuming this cross-sectional independence could lead to biased results. However, following Kaulihowa and Adjasi (2018) we will address this problem through heterogeneous dynamic panel estimators, since African countries are perfect candidates to have cross-sectional dependence given their heterogeneity and historical precedents as seen in section 3.

The estimation technique to be employed in this analysis will be chosen through the Hausman test of selection between pooled mean group (PMG) estimation and mean group (MG) estimation. These estimation techniques have been proposed following previous works such as Blackburne and Frank (2007), Kaulihowa and Adjasi (2018) Adams and Klobodu (2019) and Demissew Beyene and Kotosz (2020). These techniques have the ability to make consistent and efficient estimates despite having panel data with heterogeneity and cross-sectional dependence, allowing to defer to the parameters in the short-run estimates, and to analyse their convergence in the long run.

The Hausman test has the null hypothesis that the differences between the coefficients are not systematic. If the p-value is 0.7430, the null hypothesis of homogeneity cannot be rejected, so the Hausman test indicates that we should use the PMG technique.

According to Pesaran et al. (1999) the estimation of the PMG estimator technique is expressed as follows in ARDL models (p, q, q, ..., q):

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij}\, y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (1)$$

Where the subscripts "*i*" and "t" denote the individual and the year of the panel. Thus, "y_t" represents the vector of the dependent variable; "X_t" is the vector of the independent variables; "μ_i" captures the fixed effects; "λ_{ij}" and "δ'_{ij}" are parameters to be estimated and finally "ε_{it}" is the stochastic error term. From (1), the equation that defines the error correction model is given by the following expresión:

$$\Delta y_{it} = \phi_i \left(y_{i,t-1} + \frac{\beta'_i}{\phi_i} X_{it} \right) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q} \delta^{*}_{ij}{}' \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (2)$$

Where,

$$\phi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$$

$$\beta_i = \sum_{j=0}^{q} \delta_{ij}$$

$$\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im} (j = 1, 2, \ldots p-1)$$

$$\delta_{ij}^{*} = -\sum_{m=j+1}^{q} \delta_{im} (j = 1, 2, \dots q-1)$$

The main advantage of equation (2) is that its construction allows it to capture both short-run and long-run dynamics. The parameter ϕ_i captures the speed of adjustment; for us to establish that this is good, the estimated coefficient must be negative and also statistically significant. Similarly, the long-run relationship is given by $\left(y_{i,t-1} + \frac{\beta_i'}{\phi_i} X_{it}\right)$. In case there is no long-run relationship, the parameter ϕ_i will be zero. Finally, we impose the homogeneity constraint on the long-run coefficient such that $-\frac{\beta_i'}{\phi_i}$ remains the same $\forall_i$ to obtain the following expresión:

$$\Delta y_{it} = \phi_i \left(y_{i,t-1} + \theta X_{it}\right) + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij}^{*\prime} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (3)$$

Where,

$$\theta = \theta_i = \frac{\beta_i'}{\phi_i} \forall_i$$

4.3. MODEL

The model that we are going to estimate follows the one originally proposed by Kuznets (1955). Therefore, we will estimate the country's level of inequality according to its level of development. After this, we will be able to see whether the trend described by the coefficients follows an inverted U-shaped pattern or not. In this way, the model to be estimated will be the following:

$$\text{Gini}_{i,t} = \alpha + \beta_1 \cdot \text{GDP pc}_{i,t} + \beta_2 \cdot \text{GDP pc}^2_{i,t} + \mu_{i,t} \qquad (4)$$

In this we find the Gini variable that refers to the Gini Index and the GDP pc variable that refers to the country's Gross Domestic Product per capita. Finally we find μ is the random disturbance of the model and we also find the subscripts *i* and *t*, which indicate the country and the year, respectively, to which the observation refers.

A sensitivity analysis will also be carried out to check whether the results are robust. This analysis will be done by repeating the estimated model, but with another development variable. The variable GDP pc will be replaced by HDI, thus seeing if the results replicate or change. The equation would then look like this:

$$\text{Gini}_{i,t} = \alpha + \beta_1 \cdot \text{HDI}_{i,t} + \beta_2 \cdot \text{HDI}^2_{i,t} + \mu_{i,t} \qquad (5)$$

If Kuznets' hypothesis is true, the results we will find should give us a positive value for β_1 and a negative value of β_2 and less than β_1 so that an inverted U-shape is drawn as a function of the progression of the development variables.

Finally, after checking whether the hypothesis of the Kuznets curve is observable, an extended model will be estimated which will try to better capture the behaviour of the inequality. The equation of the extended model is the following:

$$\begin{aligned} Gini_{i,t} = {} & \alpha + \beta_1 \cdot GDP\ pc_{i,t} + \beta_2 \cdot GDP\ pc^2_{i,t} \\ & + \beta_3 \cdot PublicSpending_{i,t} + \beta_4 \cdot ElectricityAccess_{i,t} \\ & + \beta_5 \cdot FrenchColony_{i,t} + \beta_6 \cdot BritishColony_{i,t} + \mu_{i,t} \end{aligned} \quad (6)$$

As explained above, these variables have been chosen following recent work by other authors on inequality. We expect that the variable of public spending and the variable of access to electricity will have negative coefficients, since we understand that they tend to equal the opportunities of the population. Likewise, this expanded model, as it includes dummy variables that do not change over time, cannot be estimated through the PMG technique, since when differences are made the observations cancel each other out. For that reason, this model will be the only one that will be estimated through the Prais-Winsten technique, which has been shown to be robust with the results obtained through PMG and is an improved version of the Cochrane-Orcutt estimation, which has been shown to be robust in inequality studies as shown in Martínez-Navarro et al. (2020) due to its properties with data suffering from heteroskedasticity and AR(1).

5. RESULTS

The estimated model gives a clear result, there is evidence that economic inequality in Africa describes a pattern similar to that described by Kuznets.

The coefficients are favourable to the hypothesis. First, we find a constant term of 36.87. This informs us that there is a high level of inequality in the economies studied, having a base of 36.87 points of the Gini index. Secondly, in the long-run estimation we have obtained a coefficient for GDP pc of 0.0037 and for GDP pc ^{2} a coefficient of $-2.17 \cdot 10^{-7}$, both significantly different from zero. Therefore, for a low level of GDP pc the level of inequality will grow, until a point is reached in which the increases of GDP pc cause a decrease of the level of inequality, this relation initially raised by Kuznets in 1955 was found by other authors a posteriori in other studies like Anand and Kanbur (1993), Jovanovic (2017) or Martínez-Navarro (2020). With respect to the parameters obtained in the short-term estimation, these have not been found to be significant, so we cannot describe any behaviour in a reasoned way.

TABLE 8. THE ROLE OF DEVELOPMENT IN INEQUALITY

[TABLE 8]

Note: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Of course, it would be interesting to know approximately at what income level the turning point occurs that leads economies to decrease their levels of inequality. This point can be calculated as the vertex of a parable. Therefore, the turning point is calculated with the coefficients obtained for GDP pc and GDP pc^2 as follows: $\frac{-\beta_1}{2 \cdot \beta_2}$. From this expression we obtain the result of 8,683.87 million dollars in constant 2011 terms. This result is clearly an approximation, as not all the variables that influence inequality are being taken into account for its calculation. Nevertheless, it is useful to calculate the vertex of the parabola of the estimate because it gives us an approximation of the behavior of the inequality.

Similarly, if we look at column 3 of Table 8, we find an estimate of the equation in which the variable GDP pc is replaced by HDI. In this case, in the coefficients we again observe that the coefficient for HDI of 104.36 and for HDI ^{2} of -26.97. However, the coefficients obtained in this case for the development variables are not significantly different from zero, so the robustness test shows us that inequality in African countries is indeed high, and that the human development index variable does not capture changes in inequality as well as GDP pc. This is easy to see because the lack of more explanatory variables has meant that most of the weight of the estimate has fallen on the constant term. Finally, it is worth noting that convergence is indeed found in the models since both have a negative and significant ECT, but for the case of the estimation through GDP pc a particularly low speed of adjustment is found.

We also think it is as interesting as checking whether Kuznets' hypothesis is still valid, to know whether it requires a minimum income to be observed. Following this line of thought we have re-estimated equation (4) by dividing the sample in countries with more or less income of $ 4,291.63 of GDP pc because this amount is the average of the sample. After this, the same equation has been re-estimated again but differentiating in this case the sample in whether they have more or less than 8,683.87 of GDP pc, since this is the inflection point estimated above.

Table 9 shows the data for the estimate, differentiating between countries by whether they are above or below the average GDP pc. In these, it is noteworthy that in both cases they are similar in terms of what was stated above, in that the value of β_1 is positive and the value of β_2 is negative and lower than β_1. However, the estimates differ in that only the coefficients in the estimate for countries that are above the average GDP pc are significant. Therefore, it seems reasonable to indicate that for the Kuznets curve to be observed in a meaningful way, countries are required to reach a minimum level of income, which is to be expected since, if income does not increase to a certain extent, the inflection point that would generate the inverted U shape described by Kuznets is not reached. A high level of adjustment speed is also found, at 87%.

TABLE 9. THE ROLE OF DEVELOPMENT IN INEQUALITY BEFORE AND AFTER THE AVERAGE GDP

[TABLE 9]

Note: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Thus, as mentioned above, we re-estimate equation (4) this time differentiating the sample by whether they are above or below the tipping point. The results of these estimates are shown in Table 10. In this table, we can see that the relationship between β_1 and β_2 necessary to discuss Kuznets' hypothesis in a meaningful way is indeed fulfilled in those countries that have not yet reached the turning point. Meanwhile, for those countries that have surpassed the threshold of $8,683.87 we can see the inverse relationship, you can see that β_1 has a negative coefficient and β_2 a positive one, thus drawing a U-shaped relationship and totally opposite to the one described by Kuznets. Which, for high levels of income, would draw a decreasing curve. These regressions, if we observe them together, also indicate that the Kuznets curve is verified in the first instance, since from a minimum income to 8,683.87 an increase in inequality is observed that mitigates the inflection point, from which the equation gives us an inverse result and this begins to decrease. However, the mathematical equation tells us that from a certain level onwards, a

second turning point will be triggered, at which point inequality will go from decreasing to increasing again. This behavior of inequality, which in the very long term takes the pattern of a sinusoid, can be taken as the continuation of Kuznets' hypothesis, this approach being initially proposed by Milanovic (2016). Finally, it is worth noting that the speed of adjustment among countries with an income level below the tipping point is very low indeed. However, when we look at the ECT of the countries that have passed the turning point, we see that it has increased, offering a speed of adjustment of 41%. This leads us to conclude that the speed of adjustment accelerates as the country's GDP pc increases.

TABLE 10. THE ROLE OF DEVELOPMENT IN INEQUALITY BEFORE AND AFTER THE TURNING POINT

[TABLE 10]

Note: * Significant at 10%; ** significant at 5%; *** significant at 1%.

In conclusion, the Kuznets curve can indeed be seen in Africa. However, to differentiate the countries by their level of income we find that a minimum income is required to appreciate it and that a second turning point can be found for high levels of income, in which inequality increases again.

TABLE 11. THE ROLE OF DEVELOPMENT IN INEQUALITY. EXPANDED MODEL.

[TABLE 11]

Note: * Significant at 10%; ** significant at 5%; *** significant at 1%.

The results of the extended model are quite good, all the coefficients are significant and we have a better fit than in previous models. Again, coefficients are shown that support Kuznets' hypothesis, as we get a positive β_1 and a negative β_2 and less than the previous one, so we would be facing a parabola to be graphed. As for the Public spending variable, as expected, it has a negative coefficient associated with it, which would imply that the larger the size of the Public Sector, the smaller the inequality experienced in the country, which is in line with Kuznets (1955) himself and other authors such as Lee (2005), Dotti (2020) on the fact that the State tends to improve the social situation of a country. Electricity Access shows a similar result, it is understood that in a country where more population has access to electricity is a country where there are more equal opportunities than in another where not everyone has access to this energy resource (Sarkodie and Adams, 2020). Finally, the dummies variables indicate that the French colonies show a negative coefficient, i.e., smaller levels of inequality, while on the contrary the British colonies show a positive coefficient, i.e., higher levels of inequality. These coefficients are in line with what is shown in section 3., reaffirming that there is a verifiable legacy from the European powers in the distribution of income in Africa today, in this case, for greater inequality in the former British colonies and less inequality in the former French colonies.

6. CONCLUSIONS AND POLICY IMPLICATIONS

This study has tested Kuznets' hypothesis in 45 African countries from 1975 to the latest available data. Not many studies have focused on contrasting the non-linear relationship between inequality and the level of development in Africa, which is one of the novelties of this work. In order to deal with the large heterogeneity found among African countries as well as the unit root processes, estimations have been made based on the PMG technique that takes into account non-stationary and heterogeneous panels.

Using this technique, we have been able to document the validity of the Kuznets hypothesis that was put forward more than half a century ago. Our results show that Kuznets' patterns can be verified in African economies, which may still be in the upward phase of the inverted U-curve or very close to the turning point. We base this assertion on the high levels of inequality in African economies and the fact that many of them have incomes below $8,683.8 billion in constant 2011 terms, which we estimate to be approximately the inflection point at which inequality will start to decline.

Furthermore, we have seen how Kuznets' hypothesis correctly describes the relationship between inequality and development requires a minimum level of income to bring about the turning point that will decrease inequality. As well as for economies with relatively high levels of income, a second turning point seems to be found, which in the long term resembles more a sinusoidal pattern than an inverted U, according to Milanovic's contribution (2017).

African economies have a long way to go to achieve sustainable welfare states, as their income levels are insufficient to reach the turning point of the Kuznets curve. However, the policy implications of this study suggest that the way forward is to develop their public sectors and invest in infrastructure that will allow electricity to reach every household, enabling both greater opportunities for the population and a boost to infant industry. According to Jayne et al. (2018), Africa's economic transformation that has been underway since 2000 must be underpinned by improved governance, which should especially support rural activities, as it is these that will generate multiplier effects through complementary sectors (distribution and related industry). Moreover, these efforts by governments should focus especially on improving productivity and not on expanding the area devoted to agriculture. In this sense, as Haltiwanger and Spletzer (2020) point out, the development of industry will initially increase inequality, as Kuznets also argued, but it is a necessary process to achieve a modern economy in which the population enjoys a welfare state, and such development is strongly linked to access to electricity. This assertion is based on the fact that access to electricity will increase equality of opportunity for the population, positively impacting the overall economy as Marrero and Rodríguez (2019) argue, because a population with access to electricity will be able to develop their skills and engage in more specialised sectors. With all this, African countries will be able to increase their income levels and, according to Kuznets, this will lead to a fall in inequality in the future.

Furthermore, this paper is aware that inequality must be explained by numerous variables, as in our models we observe low significance in some cases, this is due to the omission of relevant variables. Nevertheless, it is interesting to note that in this field it has been shown that the GDP pc variable explains changes in inequality much better than the HDI variable. Therefore, it would be interesting to develop why the HDI does not capture inequality behaviour as powerfully as GDP pc does.

And finally, it should be noted that the current situation of the African economies is a direct legacy of their journey with the European powers as argued by Amate-Fortes et a. (2015). These European powers colonized these lands in the past, taking advantage of their resources and preventing the development of national industry among others. In this work, it is recorded that the countries that suffer most from these effects are those that were colonised by the United Kingdom, which have higher levels of inequality than any other country.

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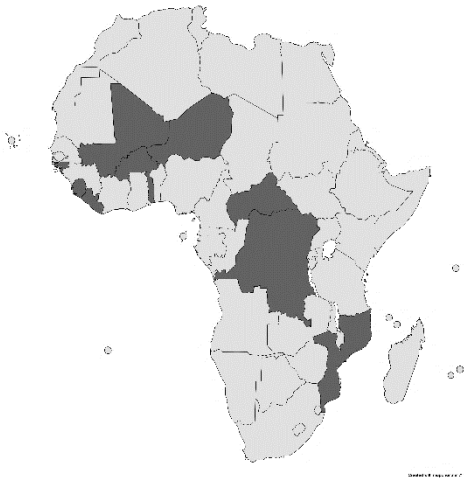
CHARTS

MAP 1. TOP 10 COUNTIRES WITH THE HIGHEST PER CAPITA INCOME

MAP 2. TOP 10 COUNTIRES WITH THE LOWEST PER CAPITA INCOME



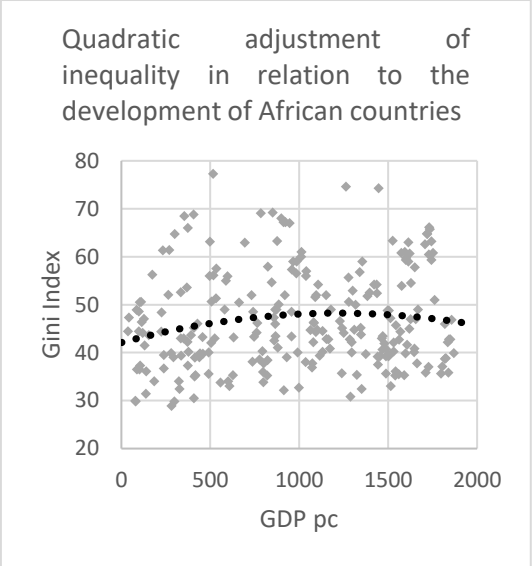
Source: Maps produced by the authors based on PWT 9.1 data (Feenstra, Inklaar and Timmer, 2015)

MAP 3. TOP 10 MOST ECONOMICALLY UNEQUAL COUNTIRES

MAP 4. TOP 10 COUNTIRES WITH LEAST ECONOMIC INEQUALITY

Source: Maps produced by the authors based on SWIID Version 8.2 data (Solt, 2019).

FIGURE 1. GRAPHIC PATTERN OF INEQUALITY WITH RESPECT TO DEVELOPMENT



Source: Prepared by the authors themselves based on SWIID versión 8.2 and PWT 9.1 data

TABLES

TABLE 1. LIST OF SELECTED EMPIRICAL STUDIES.

Author	Country	Methodology	Findings
Meniago and Asongu (2018)	48 African countries	Generalized Method of Moments (GMM)	These South African authors found that in their case an inverted U-shape could be observed in their results according to the financial perspective.
Chancel et al. (2019)	55 African countries	Systematic analysis combining survey, fiscal and national accounts data	They conclude that they are economies with a notable presence of inequality and that this will seem to increase, except in the northeastern part of the continent, where small falls in inequality can be seen
Adams and Klobodu (2019)	21 sub-Saharan countries	Pooled Mean Group (PMG) and Common Correlated Effects Mean Group (CCEMG)	This authors concluded that based on their results there is no support for Kuznets' hypothesis.
Le et al. (2020)	90 countries consisted of 14 African countries	Panel Corrected Standard Errors model (PCSE) and Feasible Generalized Least Squares (FGLS) for robustness check	These Vietnamese authors conclude that there is global evidence of a Kuznets curve between inequality and trade openness.
Baymul and Sen (2020)	48 countries consisted of 12 African countries	Fixed effect estimation and random effects estimation	These authors conclude that Kuznets' hypothesis is verified in the transformation of an industrial economy to a service economy, being in the rest of cases sensitive.
Demissew Beyene and Kotosz (2020)	12 East African countries	Pooled Mean Group (PMG)	They conclude that there is evidence of an inverted u-shape between economic activities and environmental degradation, i.e. it reaffirms the Environmental Kuznets Curve (EKC).
Bukhari et al. (2021)	8 SAARC countries	Fully modified ordinary least square (FMOLS)	These authors conclude that the level of enrolment at different levels of education affects inequality in different ways, which is why they propose that education policy should be formulated separately for each level of education.
Tchamyou (2021)	48 African countries	Generalized Method of Moments (GMM)	The results show that financial depth and financial stability are the best channels of reducing inequality. This envisages an inverted U-shaped relationship between inequality and financial development as other authors have previously done.
Ghosh and Mitra (2021)	39 countries consisted of 2 African countries	Dimitrescu and Hurlin panel causality methods.	Their key finding is that developed countries show Kuznets curve behaviour in terms of the relationship between tourism and inequality, while developing countries show inverted Kuznets curve behaviour between tourism receipts and income inequality.

TABLE 2. TOP 10 COUNTRIES WITH THE HIGHEST PER CAPITA INCOME

Equatorial Guinea	31486
Seychelles	24856
Mauritius	18852
Botswana	15015
Gabon	14334
Algeria	13328
South Africa	11949
Namibia	11741
Tunisia	10621
Angola	8397

TABLE 3. TOP 10 COUNTIRES WITH THE LOWEST PER CAPITA INCOME

Centr. African Rep.	619
Liberia	764
Dem. Rep. Congo	836
Niger	906
Sierra Leone	1070
Mozambique	1288
Guinea-Bissau	1354
Togo	1515
Burkina Faso	1561
Mali	1604

Source: Tables prepared by the authors based on data from PWT 9.1 (Feenstra, Inklaar and Timmer, 2015)

TABLE 4. TOP 10 MOST ECONOMICALLY UNEQUAL COUNTRIES

Rwanda	43.7[3]
Djibouti	43.7[1]
Zimbabwe	44.3[2]
Mozambique	44.7[3]
Comoros	48[1]
Algeria	51.3[1]
Guinea-Bissau	52.1[1]
Burkina Faso	53.3[4]
South Africa	56.3[2]
Zambia	57.1[4]

TABLE 5. TOP 10 COUNTRIES WITH LEAST ECONOMIC INEQUALITY

Niger	27[2]
Mali	31.3[3]
Cameroon	32.7[2]
Nigeria	32.8[8]
Gabon	33.7[7]
Cape Verde	33.8[6]
Sao Tome	34.2[5]
Ghana	34.4[2]
Eritrea	34.7[2]
Seychelles	35.7[1]

Notes: [1] observation from 2018; [2] observation from 2017; [3] observation from 2016; [4] observation from 2015; [5] observation from 2014; [6] observation from 2013; [7] observation from 2012; [8] observation from 2010. Source: Tables prepared by the authors based on SWIID Version 8.2 data (Solt, 2019).

TABLE 6. DESCRIPTIVE TABLE OF VARIABLES

VARIABLE	MEAN	STD. DEV.	MIN	MAX
Gini	45,96	7,34	32,7	67,1
GDP_{PC}	4.291,63	6019,34	134	46.643
HDI	7,81	0,94	4,89	10,75
Public Spending	73.68	18.53	4.6	99.3
Electricity Access	37.44	30.82	0.01	100

Note: All data provided are unweighted averages.

TABLE 7. TESTS PERFORMED ON THE REGRESSIONS FOR THE TOTAL SAMPLE.

Autocorrelation test		Heterocedasticity test		Breusch-Pagan Lagrangian multiplier	
Delay	t	F	t	Chi ^{2}	t
1	0.002	32.33	0.000	198.10	0.000
2	0.026				
3	0.087				

Im-Pesaran-Shin unit-root test				
Variable	IPS-level		IPS-first difference	
Gini index	-2.2849***	0.0028		
GDP_{PC}	10.6994	1.0000	-2.0383***	0.0001
HDI	-0.0460	1.0000	-3.7180***	0.0000
Public Spending	-2.1623	1.0000	-4.6866***	0.0002
Electricity Access	-0.3390	1.0000	-7.3125***	0.0000

Source: Prepared by the authors themselves based on SWIID versión 8.2 and PWT 9.1 data

TABLE 8. THE ROLE OF DEVELOPMENT IN INEQUALITY

	Gini			
Regressors	*Estimates*	*t*	*Estimates*	*t*
Long-run parameters				
$L.GDP_{PC}$	0.0037***	2.80		
$L.GDP_{PC}^2$	$-2.17 \cdot 10^{-7}$ *	-0.61		
L.HDI			104.36	0.54
$L.HDI^2$			-26.97	-0.21
Short-run parameters				
$D.GDP_{PC}$	-0.0007	-1.04		
$D.GDP_{PC}^2$	$3.2017 \cdot 10^{-7}$	1.34		
D.HDI			28.48	0.99
$D.HDI^2$			-18.74	-0.85
Constant	36.87**	0.86	26.45***	2.69
ECT	-0.005*	-0.71	-0.401***	-5.35
Observations	956		956	

Note: * Significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 9. THE ROLE OF DEVELOPMENT IN INEQUALITY BEFORE AND AFTER THE AVERAGE GDP

Gini

	GDP pc 4,291.63		**GDP pc > 4,291.63**	
Regressors	*Estimates*	*t*	*Estimates*	*t*
Long-run parameters				
$L.GDP_{PC}$	0.01298	0.57	0.00471**	1.49
$L.GDP_{PC}^2$	$-2.64 \cdot 10^{-6}$	-0.70	$-2.47 \cdot 10^{-7}$ *	-1.45
Short-run parameters				
$D.GDP_{PC}$	0.2486	1.00	0.00200*	0.35
$D.GDP_{PC}^2$	$-9.66 \cdot 10^{-6}$	-0.20	$-1.3 \cdot 10^{-6}$ *	0.36
Constant	32.53*	1.19	22.30**	1.50
ECT	-0.0053***	-18.04	-0.0418***	-13.26
Observations	480		476	

Note: * Significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 10. THE ROLE OF DEVELOPMENT IN INEQUALITY BEFORE AND AFTER THE TURNING POINT

Gini

	GDP pc < 8,683.87		**GDP pc > 8,683.87**	
Regressors	*Estimates*	*t*	*Estimates*	*t*
Long-run parameters				
$L.GDP_{PC}$	0.00019**	1.96	-0.0048*	-0.59
$L.GDP_{PC}^2$	$-1.38 \cdot 10^{-8}$ *	-2.19	$2.51 \cdot 10^{-7}$ *	0.59
Short-run parameters				
$D.GDP_{PC}$	0.00106 *	1.08	-0.00074 **	-0.74
$D.GDP_{PC}^2$	$-5.8 \cdot 10^{-8}$ *	-0.91	$3.86 \cdot 10^{-7}$ *	0.73
Constant	44.35*	1.84	25.24	0.61
ECT	-0.061***	-11.29	-0.41***	-7.84
Observations	704		252	

Note: * Significant at 10%; ** significant at 5%; *** significant at 1%.

TABLE 11. THE ROLE OF DEVELOPMENT IN INEQUALITY. EXPANDED MODEL.

	Gini	
Regressors	*Estimates*	*t*
GDP_{PC}	0.00013*	1.12
GDP_{PC}^2	$-5.55 \cdot 10^{-9}$ *	-1.18
Public Spending	-0.005*	-0.21
Electricity Access	-0.0143 **	-2.34
French Colony	-2.942 ***	-3.56
British Colony	1.265 *	1.48
Constant	46.22 ***	63.22
R^2	0.9604	

Note: * Significant at 10%; ** significant at 5%; *** significant at 1%.