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**EFFECTS OF ECONOMIC GROWTH ON INCOME  
INEQUALITY IN THE MAGHREB COUNTRIES: A CASE OF  
ALGERIA**

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**Abstract**

This work aims to analyze the effects of economic growth on income inequality (the Kuznets inverted U hypothesis) in Algeria using the Lydall test (1977) for the time period from 2009 to 2018. The assumption of the inverted U hypothesis – Kuznets (1955) – indicates that in the short term, there is a positive correlation between income inequality and per capita income levels. In the long term, however, the inverted U relationship emerges, as the relationship is reversed. In order to verify the correlation between income inequality and economic growth, the Ordinary Least Squares Models were used. This work confirms the Kuznets hypothesis in Algeria, in the short term.

**Keywords:** Economic growth, Income inequality, Ordinary Least Squares Models.

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آثار النمو الاقتصادي على عدم المساواة في الدخل في بلدان المغرب العربي: دراسة  
حالة الجزائر

فاطمة الزهراء بوذن- المدرسة الوطنية العليا للإحصاء و الإقتصاد التطبيقي-الجزائر  
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الملخص

يهدف هذا العمل إلى تحليل آثار النمو الاقتصادي على عدم المساواة في الدخل (فرضية Kuznets، U المقلوبة) في الجزائر باستخدام اختبار Lydall (1977) للفترة الزمنية من 2009 إلى 2018. فرضية U المقلوبة لـ Kuznets (1955) تشير إلى وجود علاقة إيجابية بين عدم المساواة في الدخل ومستويات دخل الفرد على المدى القصير. ومع ذلك، في المدى الطويل، تظهر علاقة U المقلوبة، حيث يتم عكس العلاقة. من أجل التحقق من العلاقة بين عدم المساواة في الدخل والنمو الاقتصادي، تم استخدام نماذج المربعات الصغرى العادية. يؤكد هذا العمل فرضية Kuznets في الجزائر على المدى القصير. الكلمات المفتاحية: النمو الاقتصادي، عدم المساواة في الدخل، نماذج المربعات الصغرى العادية.

## **The entrance**

**Research goals:** the purpose of this paper is to examine the effects of the economic growth on income inequality in Algeria.

**The importance of this research:** the Main contribution of this research is to test the KUZNETS hypothesis in Algeria.

**Domain:** The Sustainability.

**Findings:** The findings of this study suggest that inequalities in income and educational level are the principal determinants of different growth rates among Brazilian states. More specifically, it is found that additional years of schooling positively influence growth. By contrast, income inequality negatively affects this indicator.

**The methodology of this research:** Firstly, a descriptive and analytical study of the gini index of the three Maghreb countries (Algeria, Tunisia, Morocco and Mauritania) was carried out in order to know the position of Algeria among these countries in terms of income inequality. Secondly, this paper analyses the extensions of the KUZNETS hypothesis, which establishes a relationship between income inequality and level of development using Lydall test and the Ordinary Least Squares (OLS) model.

## **Introduction**

Income inequality creates tensions between the poor and the rich, and leads the country or society to social instability accompanied by social conflicts. Also, income inequality refers to the disparity in income between individuals from different nations of the world, within a country (a measure of inequality between rich and poor individuals within a country), and between countries.

Debates on the relationship between economic growth and income inequality were more prevalent in the 1950s, thanks to the pioneering work of Simon Kuznets. Since then, other studies and methods have been proposed to measure income inequality, both in developed and developing countries.

The fight against inequalities is important to reduce vulnerabilities and support progress. Rising inequality in developed and developing countries has been related with increased economic vulnerabilities and slower progress in human development.

The correlation and weighting of economic growth and income inequality is important and numerous. Studies by Deininger and Squire (1996, 1998),

Ravallion and Chen (1997), Easterly (1999) and Dollar and Kraay (2002) indicate that economic growth is not associated with high income inequality. In contrast, Alesina and Rodrick (1994) and Alesina and Perotti (1996) found that income inequality is indeed related to economic growth. The seminal work of Kuznets (1955) is both important and controversial. Kuznets (1955) has documented that income distribution is more equal in industrialized countries than in developing or agrarian economies. In the course of development, income distribution first becomes more unequal, goes to its peak but latter there is a tendency for income to become less unequally distributed with increasing per capita income (Paukert, 1973). So, it is called Kuznets hypothesis, which is explained by using the inverted U-shaped curve. Previous studies have documented different results when considering rich and poor countries, regions versus nations, and cross-sectional versus time series evidence (Partridge, 2005). One possible explanation for such conflicting findings is that inequality's impact on growth can vary greatly depending on economic conditions. It is even possible that inequality limits growth at the national scale while it is associated with an increase in economic incentives at the regional/local level, where most of the factors (labor) are exceedingly mobile (Sylwester, 2000; Wan, 2002; Knowles, 2003; Moran and Korzeniewicz, 2005; Angeles-Castro, 2005, 2006; Partridge, 2006).

According to classical theories, there is a positive relationship between income inequality and economic growth, (Bell and Freeman, 2001) found that greater inequality is associated with higher returns on working hours. In addition, (Siebert, 1998) appeared to link income inequality to growth-promoting factors such as entrepreneurship, innovation, and risk taking. In contrast, (Barro, 2000) documented that economic growth is negatively linked with income inequality in developing countries while inequality in income seems to promote economic growth in developed world.

Our purpose is to examine the effects of the economic growth on income inequality in Algeria. We analyze the extension of the KUZNETS hypothesis, which establishes a relationship between income inequality and level of development. In order to achieve the objective, the study employed the Ordinary Least Square (OLS) technique.

### **Literature review**

Simon Kuznets (1955) was one of the first to evaluate the determinants of inequalities, and to develop a model which establishes a relationship between income inequality and level of development. Kuznets documented in his hypothesis that economic development may tend to deteriorate income inequality in the early stages but income distribution is improved at the later stages of economic development.

The process of inverted U-curve has been explained by many studies using relative weight of different independent variables in literature. In the original contribution, Kuznets seems to focus on the shifts in the relative weight of modern and traditional sectors, because, it is linked with the productivity growth, population growth, and the sectorial distribution of labor force (Ahluwalia, 1976; Crenshaw, 1992; Gupta and Singh, 1984; Kuznets, 1955, 1963; Paukert, 1973; Robinson, 1976; Weede and Tiefenbach, 1981b).

The investigation of relationship between growth and inequality is one of the recent routes that have followed to study the evolution of income distribution.

There is no much study done on the relationship between national income per capita and income inequality. But, few studies available showed a mixed conclusion. In China, Tian (2012) studied the impact of income inequality on economic growth from 1985 to 2007. The study employed the Ordinary Least Square (OLS) technique. The result revealed that Gini coefficient which serves as a measure of income inequality has a negative impact on economic growth.

Wang (2017) in another study employed annual data from 1980 to 2012 to review the effects of income inequality on real GDP per capita and real GDP of the USA and China. The study used co-integration technique to investigate the short and long-run relationship between the variables. The result revealed that in the short run, income inequality has a negative impact on economic growth but positive in the long run in the USA. In China, however, the result showed that income inequality promotes economic growth in the short and long runs.

Shinhye et al. (2015) used wavelet analysis to test the causality between per capita real GDP and income inequality in the United States from 1917 to 2012 with breaks. The result showed robust evidence of a positive correlation between economic growth and inequality across frequencies. The study also exposed that periods and direction of short and long term causality vary.

Constanza (2017) used Arellano-Bond GMM technique to analyze the relationship between inequality and economic growth in 146 countries from 2010 to 2014. This study used wealth Gini coefficient as a proxy for inequality. The result showed that there is a positive relationship between wealth inequality and real per capita GDP growth.

Nemati and Raisi (2015) used panel data and OLS to analyze impact of economic growth on income inequality in 28 developing countries (Argentina, Bangladesh, Brazil, Colombia, Dominican Republic, Ecuador, Egypt, Georgia, Guatemala, Honduras, Hong Kong, Iran, Jordan, Kazakhstan, Kyrgyzstan, Malaysia, Nigeria, the Philippines, Paraguay, Peru, Singapore, Thailand, Tunisia, Turkey, Venezuela, North Korea, and

Macedonia) from 1990 to 2010. The result revealed that there is a positive and significant relationship between per capita income and income inequality in the selected countries. It concluded that economic growth is an important factor in addressing income inequality.

To support the findings of Nemati and Raisi (2015); Irma et al. (2018) studied the impact of economic growth per capita and foreign direct investment on income inequality in Indonesia. The study used OLS (multiple regression analysis) on annual data from 2007 to 2016. The results revealed that GDP per capita and foreign direct investment has a positive influence on income inequality. The study concluded that GDP per capita and foreign direct investment has a positive impact on income inequality in Indonesia.

Similarly, Utari and Cristina (2014) used dynamic data panel with 26 provincial panel data from 2000 to 2011 to test whether the Kuznets Curve Hypothesis is true for Indonesia. The results revealed that the Kuznets Curve Hypothesis is true and that inequality is expected to decline after the average per capita income of the region reached 18,000 U.S dollars per year.

To reaffirm the finding of Utari and Cristina (2014), Oksana and Jakub (2014) tested the Kuznets hypothesis using panel data for 145 countries from 1979 to 2009. The study employed marginal Probability Density Function (PDF) to examine the relationship between Gini index and GDP per capita. The result revealed that social contributions have strong influence on income inequality and that inverted U-curve was found in countries with low amount of social contributions.

In general, from empirical literature reviewed, there is no clear relationship between GDP per capita and income inequality especially in Algeria.

This may be the initial step to start particular direction in economic development because there is lot of literature on this issue but not in the case of Algeria.

**Empirical study of the relationship between economic growth and income inequality:**

Income inequality creates tensions between the poor and the rich, and leads the country or society to social instability accompanied by social conflicts. Also, income inequality refers to the disparity in income between individuals from different nations of the world, within a country (a measure of inequality between rich and poor individuals within a country), and between countries.

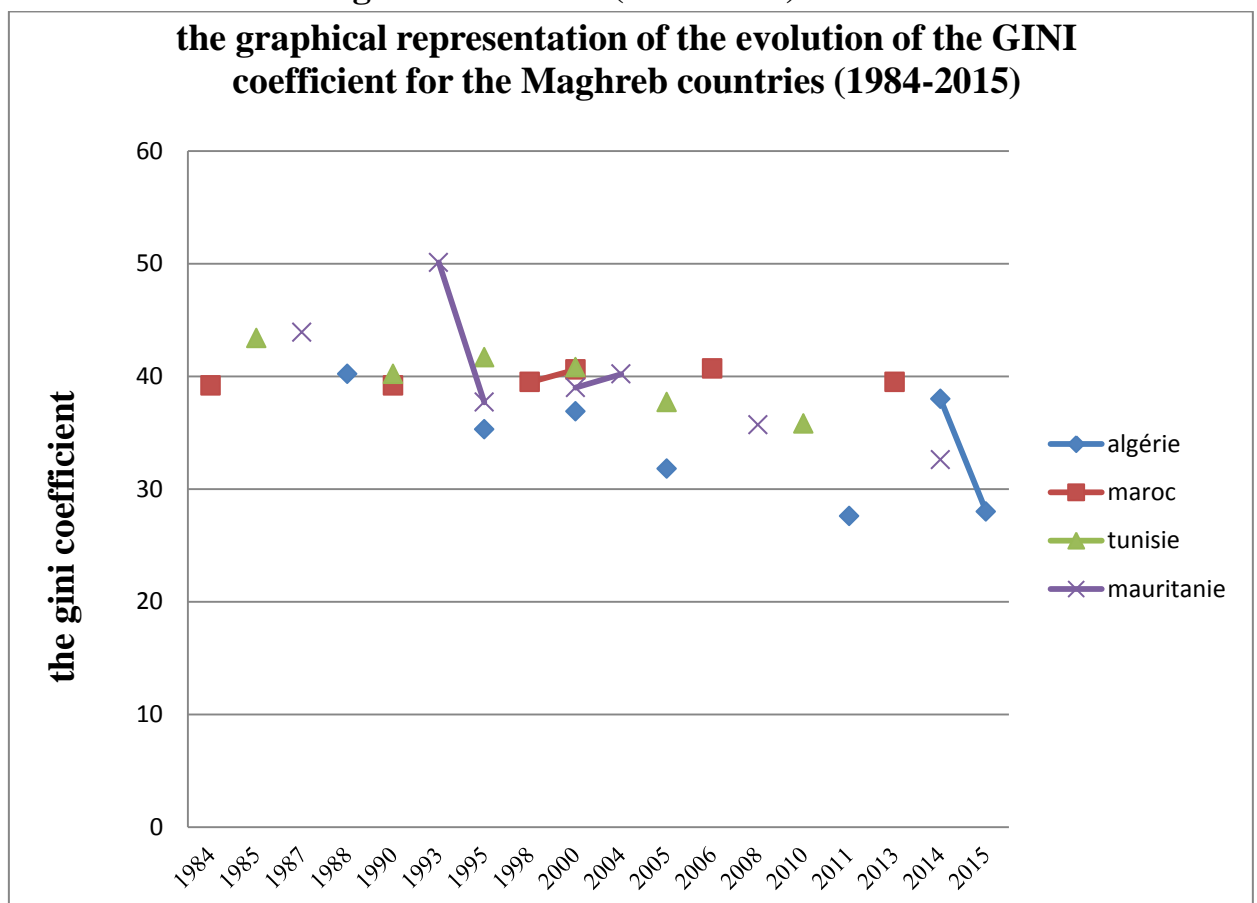
The Gini coefficient, used as a measure of inequality, is taken from per capita household income. This index is frequently used to express the degree of income inequality and may be associated with the Lorenz curve

determined by the set of points which, based on incomes ordered by increasing level, relate the cumulative proportion of people and income.

It should be noted before starting any work on the analysis of inequality using the GINI index that this latter is not systematically calculated every year at the national or regional level as is the case for many countries in the world, particularly developing countries. We tried to collect some available indicators calculated by the World Bank.

Before doing the empirical case, we will make a comparative study between the different gini coefficients of the Maghreb countries, and then we will see the extension of the Kuznets hypothesis for Algeria using the Lydall test.

**Graph 1: The graphical representation of the evolution of the GINI coefficient for the Maghreb countries (1984-2015)**



*Set up by the student with World Bank data*

The analysis of the graph shows that Algeria belongs to the class of the least unequal countries. Indeed, we note that the GINI index did not exceed the value of 40%, which is a value that indicates a low inequality.

Comparatively, the value of the GINI coefficient in Algeria is about (28%) in 2015, (39.5%) in Morocco in 2013, (35.8%) in Tunisia in 2010 and (32.6%) in Mauritania in 2014.

According to the graph, Algeria has a coefficient (2015) equal to 28%, which is the lowest compared with the other three countries, it can also be concluded that Algeria is non-inegalitarian country in terms of income distribution,

It can conclude that among these countries, Morocco is the most inegalitarian country, in contrast Tunisia and Mauritania, according to their coefficients are non-inegalitarian countries.

In order to examine the effects of the economic growth on income inequality in Algeria, we analyze the extension of the KUZNETS hypothesis, which establishes a relationship between income inequality and level of development.

The aim Kuznets assumption means that income inequality begins by increasing, peaks and then decreases for higher levels of per capita income. This paper analyzes the behavior of income inequality in Algeria as related to the gross domestic product, rate of population which hold a salary, urban population and rural population from 2009 to 2018.

The relationship between the dependent variable and the independent variables is analyzed using an ordinary least squares model in the following equation:

$$G_t = c + b_1 \log GDP_t + b_2 1/GDP_t + b_3 RP_t + b_4 UP_t + b_5 W_t + \varepsilon_t \dots\dots(1).$$

Where the dependent variable  $G_t$  is the GINI index;  $c$  is the intercept;  $GDP_t$  gross domestic product (constant 2011 purchasing power parity \$);  $RP_t$  is the rural population (% of total population);  $UP_t$  is the urban population (% of total population);  $W_t$  is the rate of population which hold a salary and  $\varepsilon_{it}$  is the error term. The subscript  $t$  represents the time period.  $b_1, b_2, b_3, b_4$  and  $b_5$  are parameters to estimate.

The sample consists of annual data ranging from 2009 to 2018. The data used in the present analysis are derived from a World Bank global sample and the national statistics office (ONS). The results for the estimation are presented in Table 1.

**Table 1: estimation by the least squares method**

Dependent Variable: LGINI

Method: Least Squares

Sample: 2009 2018

Included observations: 10

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1543.983	324.1523	4.763140	0.0089



LLGDP	2921.454	1008.141	2.897863	0.0442
LINGDP	751.4526	260.2049	2.887926	0.0447
LRP	-217.9241	41.19315	-5.290298	0.0061
LUP	-516.6690	96.32979	-5.363543	0.0058
LW	82.30293	28.32449	2.905716	0.0439
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R-squared	0.900997	Mean dependent var	3.495549	
Adjusted R-squared	0.777244	S.D. dependent var	0.127219	
S.E. of regression	0.060043	Akaike info criterion	-2.503788	
Sum squared resid	0.014421	Schwarz criterion	-2.322237	
Log likelihood	18.51894	Hannan-Quinn criter.	-2.702949	
F-statistic	7.280597	Durbin-Watson stat	1.938718	
Prob(F-statistic)	0.038716			

*Set up by the student using the EViews software*

The R-squared is the proportion of variation of the dependent variable that is explained by the independent variables. The coefficient of determination is (0.900), which indicates that the variables: GDP per capita growth, the rate of population which holds a salary, the urban population and the rural population will explain 90 % (percent) of variations in GINI index (income inequality).

Also, the F - statistic (7.280597) is greater than the Prob F- statistic (0.038716), so this suggests that the statistical fit of the model is adequate. Next, we observe the p- values of each dependent variable to see the type of correlation that exists between them and the independent variable.

According to the Student test, we conclude that:

- The intercept (c) explain the variation of GINI index in Algeria during the period of 2009 to 2018 because (P-value (0.0089) <  $\alpha$  (0.05));
- Le log (GDP) explain the variation of GINI index in Algeria during the period of 2009 to 2018 because (P-value (0.0442) <  $\alpha$  (0.05));
- Le 1/GDP explain the variation of GINI index in Algeria during the period of 2009 to 2018 because (P-value (0.0447) <  $\alpha$  (0.05));
- UP explain the variation of GINI index in Algeria during the period of 2009 to 2018 because (P-value (0.0058) < (0.05));
- RP explain the variation of GINI index in Algeria during the period of 2009 to 2018 because (P-value (0.0061) < (0.05));
- W explain the variation of GINI index in Algeria during the period of 2009 to 2018 because (P-value (0.0439) < (0.05)).

The p – values for all the variables prove to be statistically significant at the 5% level. This suggests that they are important predictors of income inequality in Algeria.

$$G_t = 1543.983 + 2921.454 \log GDP_t + 751.4526(1/GDP_t) - 217.9241 RP_t - 516.6690 UP_t + 82.30293 W_t + \varepsilon_t \dots\dots\dots(2).$$

GDP per capita growth is statistically significant at the 5% level. It has a positive coefficient of (2921.454) which corresponds with Kuznets hypothesis. This suggests that as economic growth increases in Algeria, the level of income inequality also increases. According to the literature, there are various channels through which growth can cause higher inequality such as credit market imperfections and a concentration of savings amongst higher income earners.

The same thing with the inverse of GDP per capita is positively related with the income inequality.

Rural population growth is negatively related to income inequality (-217.9241). It is statistically significant.

Urban population growth is negatively related to income inequality (-516.6690) and it is statistically significant.

It is concluded that the urban area is more unequal in terms of income than the rural area in Algeria and this is consistent with the Kuznets hypothesis.

In general, it means that a decrease in the rate of population growth will lead to an increase in income inequality. One of the possible reasons for this is that to lead a waste of economic resources due to the shortage of human capital in the labour market. Thus causing the level of output and growth to decline and income inequality to rise.

W is positively related to income inequality (82.30293), an increase in the rate of population which holds a salary will lead to an increase in income inequality.

**The robustness of the model:**

Fist we analysis the Fisher test:

$$H_0: b_1=b_2=b_3=b_4=0$$

$$H_1: b_1 \neq b_2 \neq b_3 \neq b_4 \neq 0$$

F p-value (0.038716) < 0.05 we accept H<sub>1</sub>, this is means that the model is accepted.

The second one is the serial correlation test:

The value of the Durbin Watson statistic is (1.93) around 2, it means that, there is no serial correlation.

The third is the normality test. The kurtosis (2.32) is close to 3 and Jacque – Berra statistic which tests the normality of the residuals has a p- value of (0.59) which implies that the data is normally distributed.

The final test is for the heteroskedasticity which is calculated using the Breusch- Pagan Godfrey Test. We test the null hypothesis of: homoscedasticity against the alternative: of heteroskedasticity. The calculated p- value is (0.9196) and the R<sup>2</sup> is (2.38), so regarding the P-

value which is greater than 5% ( $0.9196 > 0.05$ ), we conclude that there is no heteroskedasticity.

**Table 2: Heteroskedasticity Test: Breusch-Pagan-Godfrey**

Heteroskedasticity Test: Breusch-Pagan-Godfrey

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F-statistic	0.250008	Prob. F(5,4)	0.9196
		Prob. Chi-	
Obs*R-squared	2.381014	Square(5)	0.7943
Scaled explained		Prob. Chi-	
SS	0.251882	Square(5)	0.9985

*Set up by the student using the EViews software*

### **Conclusion**

Aiming to demonstrate the existence of an inverted U relationship between income inequality and economic growth, as proposed by Simon Kuznets (1955), between 2009 and 2018 in Algeria, this work emphasized some studies on a variety of theoretical and econometric debates relevant to the topic at hand. Using different estimates, some of these corroborated and others rejected the Kuznets hypothesis.

The study tries to examine the impact of economic growth on income inequality. The findings suggest that significant relationship exist between gini index and the independent variables which are GDP per capita, rural population, urban population and rate of population which holds a salary.

Empirically, our baseline estimation and the sensitivity analysis have shown that economic growth has a positive impact on income inequality in short run. Our findings rejected the existence of Kuznets' inverted U-curve in Algeria in the short run.

Finally, we carried out an econometric analysis by OLS models to determine what type of relationship exists between income inequality and growth in Algeria. The results showed that economic growth is positively related to income inequality. This means that the more economic growth increases in Algeria, the more income inequality increases. The results also indicate that the other explanatory variables: rural population, urban population and rate of population which holds a salary are important determinants of income inequality in Algeria.

Although this research has achieved its objective, it would be useful to broaden the number of physical and economic characteristics of the country taken into account, by examining other explanatory variables and for a longer period of time to prove Kuznets' hypothesis and opt for a panel analysis for the Maghreb countries.

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