The Impact of Income Inequality on Economic Growth in Algeria: The ARDL Approach

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Abstract

This paper investigates the impact of income inequality on economic growth in Algeria over the period 1980-2015, by using the Autoregressive Distributive Lags (ARDL) approach and the Error Correction Model (ECM). The findings of Bound-test suggest that there is a long-run equilibrium between income inequality and economic growth. There is a positive and significant impact of income inequality on growth in Algeria, an increase in inequality by 1% will enhance economic growth by 7 % in the long run. However, reducing income and wealth inequality is a necessity to prevent further increases and maintain the sustainable growth in Algeria.

Keywords: Income Inequality, Gini index, Economic Growth, ARDL, Algeria
Jel Classification: D63, D31, O47, C13, O55

1. Introduction

During the last decades, Algeria reported a significant achievement in human development indicators. According to the most recent human development report (UNDP,2015), Algeria is one of the African countries that achieved the greatest human development index deficit reduction between 1990 and 2015. Despite the improvement of GDP per capita and the social condition of the individuals, economic and regional inequalities persist and continue to be a key issue.

Since independence, Algeria has experienced a high inequality level due to the large disparity in the distribution of assets and capital amongst the individuals. In the early 1990s the inequality increases due to the repercussions of economic reforms adopted by the government, which provided substantial opportunities for some groups to raise their wealth through privatization decisions and ownership agricultural lands, unlike other groups, witnessed a decline in the general level of wages, which negatively affected savings and investment rates.

In this regard, the Algerian authorities adopt a series of reforms of social protection, which help direct the poor and the needy by providing free basic goods and services and subsidy the food.[i] These efforts lead to a decline in the overall income inequality over time.

Today, Algeria experiences a marked distinction between the littoral areas and the Sahara. The metropolitan areas of the north include the dynamic country's economic activities and are less affected by poverty, unlike the areas in the south, which contain the majority of the population living below the poverty line. Therefore, the polarization of the resources in favor of metropolises aggravate the regional economic inequalities and cause unemployment in disadvantaged regions, Saharan in particular. And lead to higher inequality in the distribution of income and the average monthly spending of households between the coastal area and the Sahara. [ii]

This study aims to investigate the long run relationship between income inequality and economic growth in Algeria. This paper contributes in the recent literature by studying the nexus inequality-growth in Algeria using the Auto Regressive Distributed Lags (ARDL) model.

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This paper is organized as follow. Section 2 provides a brief literature on the link between inequality and economic growth. Section 3 presents the empirical studies. Section 4 deals with the data and the methodology. Section 5 reports the results of the ARDL approach, and we conclude in Section 6.

2. Literature review on inequality and growth

The traditional theory of growth established a direct relationship between economic growth and standard of living. The first thesis, developed by Kuznets (1955), showed that the relationship between GDP per capita and inequality is in the form of a U-inverted. Kuznets argued that higher inequality promotes growth at the early stage of economic development, and diminishes economic growth at the later stage of economic development.[iii]

Following the pioneering work of Kuznets (1955), the link between income inequality and growth has dominated the development literature to determine whether inequality is good or bad for growth. Some of these studies indicate that income inequality inhibits economic growth, while others argue that high inequality is associated positively with growth.

From a theoretical perspective, high levels of income inequality are enhancing growth for a number of reasons.

- Classical and neoclassical theories (Keynes, 1920; Kaldor, 1957) predicted that high inequality stimulates economic growth through the ***saving*** and ***investment*** channel. Since the rich have higher propensity to save then the poor, a rise in income inequality level increases the aggregate savings and the capital accumulation which translate into higher investment.[iv]
- Kuznets (1955) argued that a high level of inequality in the distribution of resources is necessary to realize large investments at the first stages of development, which in turn lead to raise factor productivity and promote economic growth.
- In addition, high wage inequality encourages the workers to work hard and to seek for employment in innovative sectors, which requires higher skills labor and provides higher wages, which lead to increase the productivity of the economy on overall and enhance the growth.[v]

On the other hand, greater inequality can adversely affect economic growth through many transmission channels:

- John Maynard Keynes (1936) argued that inequality is harmful to growth. Since the marginal consumption rates are fairly equal among all income groups, the aggregate consumption depends on changes in aggregate income. Therefore, an increase in income inequality reduces aggregate consumption and slows economic growth.[vi]
- Higher inequality retards growth by reducing effective aggregate demand in the economy. In highly unequal societies, the poor have limited disposable income for the purchase of manufactured goods. This limit reduces the size of the domestic market and declines the potential for industrialization, which is the engine driver of growth.[vii]
- Greater inequality affects growth negatively through the ***capital market imperfections*** channel. Due to the capital market distortions, the exploitation of investment opportunities is limited only to individuals with a high enough level of income of wealth. As a result, poor families tend to abandon investment in human capital, which offers relatively high rates of return that benefits them and society. Therefore, an increase in inequality slows human capital accumulation and growth.[viii]
- Contemporary studies argued that inequality is bad for growth. Higher income inequality creates pressure to adopt redistributive policies through the ***Fiscal channel***. These efforts may undermine capital accumulation and investment, and lead to decrease growth.[ix]

- In addition, greater inequality hinders growth through the ***Socio-political instability*** channel. Inequality supports social unrest by increasing the likelihood of coups, revolutions, and collective violence. These activities threaten property rights and motivate the poor to engage in crime. These actions cause social dysfunction and reduce the productivity of the economy.[x]
- Higher inequality can adversely affect economic growth through the ***Fertility*** channel. Poor families tend to have more children and invest less in education. Therefore, large fertility differentials decrease human capital accumulation and growth (De la Croix, Doepke; 2001).[xi]

3. Empirical studies

In recent decades, the issue of income inequality attracts much attention in the world. Several studies have covered various aspects of inequality in both developed and developing countries. The findings of these studies were not conclusive and offered contradictory results. Alesina and Rodrik(1994) claim that inequality in assets and income ownership is associated negatively with subsequent economic growth. High inequality calls for redistributed policies and taxation, which reduce the aggregate investment and growth.[xii] Barro (2000) investigated the relationship between income inequality and rates of growth and investment for a panel of countries. He argues that high inequality promotes growth in rich countries and slows growth in poor places.[xiii]

Banerjee and Duflo (2003) found a nonlinear relationship between inequality and growth rates, by using data across countries and using a non-parametric method the authors suggested that the relationship between the growth rates and net inequality takes a shape of inverted U and that Changes in the inequality in any direction are associated with lower growth in the coming period.[xiv]

Voitchovsky (2005) examined the importance of the shape of income distribution as a determinant of economic growth based on comparative data on disposable income for 25 countries in 1970-1995. The author argues that inequality at the top end of the distribution is positively correlated with growth, while the inequality at lower down of the distribution is associated negatively with subsequent growth.

Knowles (2005) used consistent data on inequality of expenditure to explore the nexus between inequality and growth in a sample of developing countries. He finds a significant negative correlation between consistently measured data and economic growth. And he argues that all of the recent empirical work on the relationship between income inequality and economic growth has used inequality data that are not consistently measured.[xv]

4. Data and Methodology

4.1. Data

Based on the previous work on the link between inequality and economic growth such as Barro (2000), Forbes (2002), Voitchovsky (2005), Cingano (2014), and Ostry et al. (2014), Naguib (2015), we specify the following model.

$$LnY = \beta 0 + \beta 1\, Gini + \beta 2\, Life + \beta 3\, Edu_F + \beta 4\, Edu_M + \beta 5\, Inv + \beta 6\, Opens + \varepsilon i$$

Where:
LnY: The natural log of GDP per capita
Gini: Gini index
Life: Life expectancy at birth
Edu_F: Primary enrollment ratio, Female
Edu_M: Primary enrollment ratio, Male
Inv: Total investment (% GDP)

Opens: Economic openness (% GDP)
εi: the white noise error term

All the variables are annual data covered the period 1980-2015 collected from The World Development Indicators Database (WDI.2018), The World Economic Outlook Database (WEOA.2018), The Lahoti et al. (2016) dataset of income inequality. The summary statistics of the variables are expressed in table 1.

Table 1: Summary statistics of the data series

	LY	Gini	Life	Edu_M	Edu_F	Inv	Opens
Mean	8.251307	50.32588	69.08831	108.1779	95.07886	32.02150	71.31693
Median	8.227340	49.74872	69.13601	106.4855	94.64779	30.25350	69.00948
Maximum	8.467918	51.52361	75.85529	123.4057	115.9805	52.76800	89.64018
Minimum	8.059876	49.74871	58.16402	97.96403	78.75323	22.44000	53.11851
Std. Dev.	0.120614	0.780342	4.841779	7.498917	12.46048	7.383299	11.18881
Observations	36	36	36	36	36	36	36

4.2. Methodology

This paper applied the autoregressive distributed lags (ARDL) approach introduced by Pesaran et al. (1996) to examine the long relationship between income inequality and economic growth.

The first advantage of this approach is that it allows us to explore both the short and long-run relationship between growth and its determinants. Second, it can be applied irrespective of whether underlying variables are stationary at the level I*(0)*, or at the first difference *I(1)* or mutually co-integrated (Pesaran and Shin, 1999). Third, the ARDL takes a sufficient number of lags to capture the data generating process in general-to-specific modeling framework. And, finally, it is robust in finite samples.[xvi]

The ARDL approach is consists of four steps. First, we applied the unit root test of augmented dicky-fuller to ensure that all the variables are not integrated into order two. Second, we select the optimal lag length based on the Akaike criterion. Third, we examine the long relationship between the variables by using Bound-test of cointegration, and then the error correction model (ECM) for the short run relationship. Fourth, we apply different diagnostic tests to ensure the stability and the efficiently of the estimated model.

In this paper we use the following model:

$$\begin{aligned}\Delta \mathrm{LnYt} = \alpha 0 &+ \sum_{i=1}^{n} \alpha 1 i \Delta \mathrm{LnYt} - 1 + \sum_{i=1}^{n} \alpha 2 i \Delta \mathrm{Ginit} - 1 + \sum_{i=1}^{n} \alpha 3 i \Delta \mathrm{Life\ t} - 1 \\ &+ \sum_{i=1}^{n} \alpha 1 i \Delta \mathrm{Edu\_Mt} - 1 + \sum_{i=1}^{n} \alpha 2 i \Delta \mathrm{Edu\_Ft} - 1 + \sum_{i=1}^{n} \alpha 4 i \Delta \mathrm{Inv\ t} - 1 \\ &+ \sum_{i=1}^{n} \alpha 5 i \Delta \mathrm{Opens\ t} - 1 + \beta 1\ \mathrm{LnY} + \beta 2\ \mathrm{Gini} + \beta 3\ \mathrm{Life} + \beta 4\ \mathrm{Edu\_M} \\ &+ \beta 5\ \mathrm{Edu\_F} + \beta 6\ \mathrm{Inv} + \beta 7\ \mathrm{Opens} + \varepsilon \mathrm{i} \ldots (1)\end{aligned}$$

Where:
Δ: Denotes the first difference operator
α: is the drift component
εi: is the white noise residuals

5. Empirical results

5.1. Unit test root

The estimation starts with applying a unit root test of Augmented Dickey-Fuller (ADF) to check the stationery of the variables. The results mentioned in Table (2) show that

Gini and life are stationary at the level, while the other variables are stationary at the 1st difference. Then, we ensure that no series under consideration is integrated of order 2.

Table 2: Unit root test results

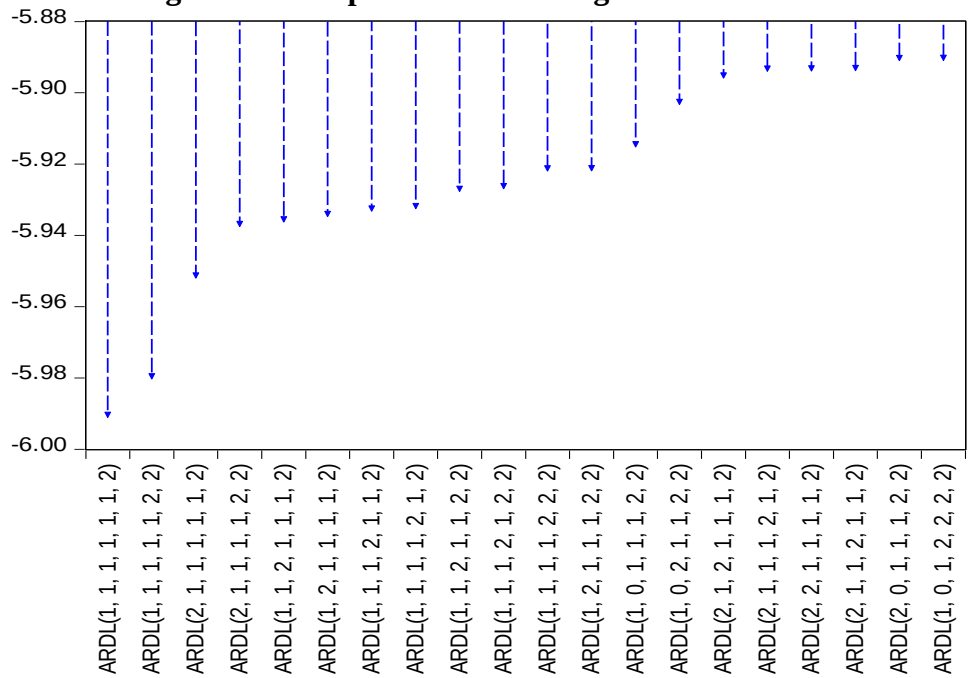
Variable	At level		At 1st difference	
	Constant	trend and constant	constant	trend and constant
LY	-0.31	-0.71	-3.13***	-3.34***
Gini	-15.69***	0.46	-2.41	-5.06***
Life	-3.69***	0.46	-2.41	-5.06***
Edu_M	0.47	-3.12	-2.98**	-2.90***
Edu_F	0.25	-3.28	-3.36**	-2.49**
Inv	-0.15	-1.74	-6.77***	-5.26***
Opens	-0.64	-2.47	-4.12***	-4.54***

Notes: (*) significant at the 10%; (**) significant at the 5%; (***) significant at the 1% and (no) not significant

5.2. Lags selection

The ARDL procedure starts by determining the appropriate lag order based on Akaike Information Criterion (AIC) in order to select the optimal lag length. The figure 1 shows that the model ARDL (1,1,1,1,1,1,2) is the optimal model because it has the lowest AIC criterion.

Figure.1: The optimal model using Akaike criterion



5.3. Cointegration test

The results of the Bound-test approach of long-run cointegration mentioned in the table (3) indicate that the calculated F-statistic for the model (10.81) exceeds the lower and the upper Bound critical value at 1%, 2.5%, 5%, and 10%. Therefore, we reject the null hypothesis of no cointegration. Thus, there is long-run cointegration among the variables.

Table 3: The Bounds test outcomes

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif	I(0)	I(1)
F-statistic	10.81	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Source: Author's estimation in Eviews 10

Table 4: The estimated short-run coefficients ARDL model

Dependent variable: D(LY)
Included observations: 34 after adjustments
Selected model: ARDL(1,1,1,1,1,1,2)

Variable	**Coefficient**	**Std.Error**	**t-Statistic**	**Prob ***
D(Gini)	-0.08	0.02	-4.02	0.00
D(Life)	0.29	0.02	12.43	0.00
D(Edu_M)	-0.01	0.00	-2.68	0.01
D(Edu_F)	0.01	0.00	2.65	0.01
D(Inv)	0.00	0.00	1.24	0.22
D(Opens)	0.00	0.00	3.20	0.00
D(Opens(-1))	0.00	0.00	4.87	0.00
CointEq(-1)*	-0.71	0.06	-10.87	0.00

Source: Author's estimation in Eviews 10

The results of the ECM model reported in the table (4) reveal that income inequality is associated negatively and significantly with economic growth. In the short-run an increase in inequality by 1 % reduces the growth by 8 %.

The error correction term CET-1, which measures the speed of adjustment to restore the equilibrium in the dynamic model is negative and highly significant. This finding confirms the existence of a long-run equilibrium between economic growth and income inequality. The coefficient of *CE(-1)* is equal to 0.71 this implies that the deviation from the short run in economic growth is corrected by 71 % percent over each year in a long span of time.

Table 5: The estimated long-run coefficients ARDL model

Dependent variable: LY
Included observations: 34 after adjustments
Selected model: ARDL(1,1,1,1,1,1,2)

Variable	**Coefficient**	**Std.Error**	**t-Statistic**	**Prob ***
Gini	0.07	0.02	3.02	0.00
Life	0.06	0.01	5.54	0.00
Edu_M	0.01	0.00	1.13	0.27
Edu_F	-0.01	0.00	-1.37	0.18
Inv	0.005	0.00	2.52	0.02
Opens	0.001	0.00	0.36	0.72
C	-0.06	0.77	-0.08	0.93

R-Squared= 0.89
Adjusted R-Squared=0.87
Durbin –Watson stat= 2.31

Source: Author's estimation in Eviews 10

The long-run results mentioned in the table (5) indicate that there is a positive and significant impact of income inequality on economic growth, implies that in the long run, a 1% increase in income inequality will stimulate economic growth in Algeria by nearly 7 %. Life expectancy, economic openness, human capital accumulation as measured by the primary enrollment ration for both male and female, appear to be associated positively with subsequent growth.

5.4. Diagnostic test

In the last step, we run various diagnostic tests to establish the stability of the estimated model we perform the Jarque-Bera test for normality, the ARCH test for heteroscedasticity and the Breusch-Godfrey test for serial correlation. Table (6) reveals that the estimates are free from serial correlation, heteroscedasticity, and normally distributed (All P. values are higher than critical values of 0.05).

Table 6: The diagnostic test outcomes

Test	Results
Heteroscedasticity	0.82 (0.63)
Normality	0.68 (0.70)
Serial correlation	0.65 (0.53)

Source: Author's estimation in Eviews 10

The figures 2 and 3 show the cumulative sum of recursive residuals (CUSUM) and the cumulative of the sum of squares of recursive residuals (CUSUMQ) plots respectively. It can be seen that the estimated model is structurally stable. The plots fall within the lines of the critical values of 5 %. It is further improved the reliability of the model.

Figure.2: The cumulative sum of recursive residuals (CUSUM)

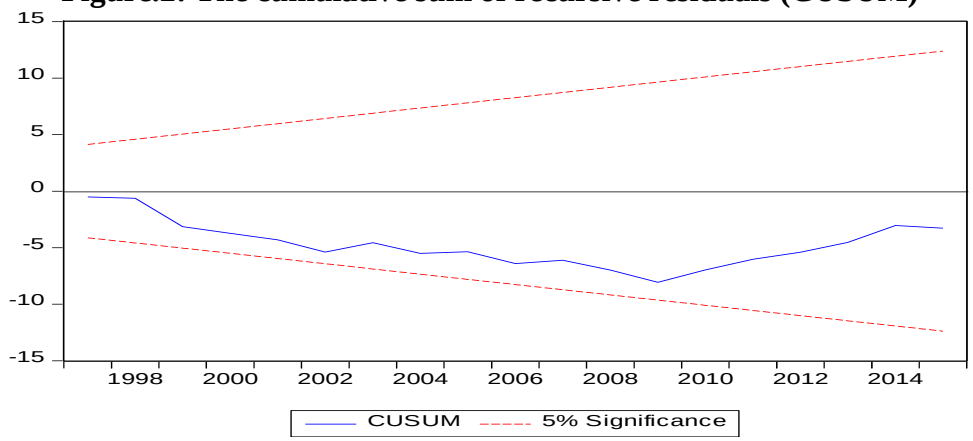
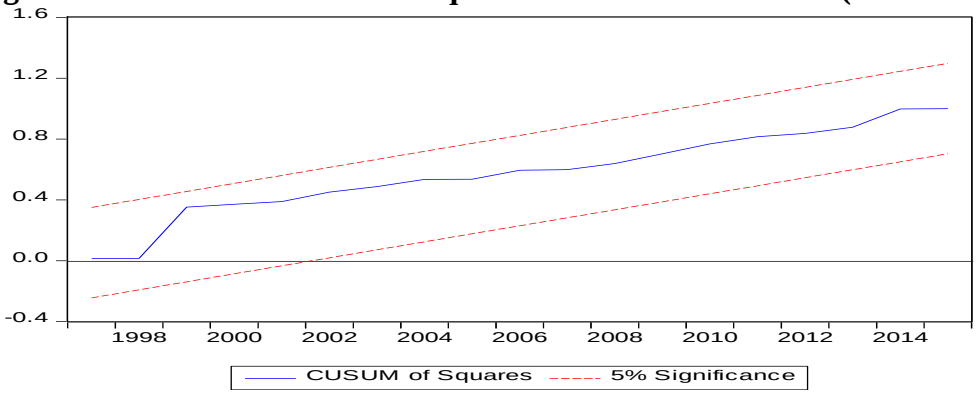


Figure.3: The cumulative sum of squares of recursive residuals (CUSUMQ)



6. Conclusion

This paper investigates empirically the impact of income inequality on economic growth in Algeria over the period 1980-2015, by using Auto Regressive Distributed Lags (ARDL) approach to explore the long-run cointegration, and the error correction model to examine the relationship in the short run. The findings of Bound-test of cointegration reveal that there is a long-run equilibrium between income inequality and economic growth in Algeria. The estimation, in the long run, indicates that income inequality has a positive and significant effect on economic growth in the period under study.

These findings are consistent with the theoretical assumptions, which argue that inequality enhances growth. The concentration of wealth and income in the hands of a few individuals in Algeria leads to increase accumulation of physical and human capital, which stimulates investment and benefits the economy as a whole.

However, there is a need to tackle the existing inequality to prevent further increases and stimulate the performance of the Algerian economy. This fight against this issue becomes a necessity for governments to ensure greater equity and support sustainable growth.

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