The effect of inequality and economic growth shocks on poverty rates in Arabic countries: A SVAR approch

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Abstract :
This analytical review explores the relationships between poverty rate, inequality index and economic growth rate in 21 Arabic countries for the period 1970-2013, we use in this paper SVAR approach to investigate the relationships between poverty as measured by the consumption per capita, inequality measured as Thail index and economic growth measured as GDP per capita, using data from different sources, we use both of structural impulse response functions SIRF and structural variance decomposition SVD and also the Granger causality to reinforcement the results, The paper aims at contributing to the literature by utilizing the recently develop Thail index instead of the traditional Gini coefficient; The results of the estimation showed that there is an independence between the three variables both in the short-run and long-run terms.

Keywords: Poverty, Inequality, Growth, SVAR model
JEL classification: C33, E25, O11, O4

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Introduction.

Poverty reduction is a major goal and issue for many organizations such as the World Bank and the United Nations, in 2008, the World Bank declared that 1.29 billion people were living under 1.25 $ a day (equivalent to 1.00$ a day in 1996 US prices); more than 500 million of them concentrated in India and China, but as regional population the Sub-Saharan Africa had the highest incidence rate of absolute poverty in 2008 with 47%; than the South Asia with 21% of people, at the global level, the poverty rate has been estimated at 15% of the total world population in 2010, from the World Bank 2013a it's claimed that the global poverty rate at 1.25$ a day fell in 2010 to less than half the 1990 rate, however 1.2 billion people are still living in extreme poverty more than 80% of them concentrated in Sub-Saharan Africa and South Asia.

Since the Global Report of Human Development (1990), the economic growth was considered the fundamental factor to fight against poverty, economic growth regarded as an effective tool to reduce poverty rates is due mainly to the theoretical studies, for example, Kraay (2006) showed from a panel data of 80 developing countries that the correlations between average income and poverty indicators are all negatives, Ravaillon and Chen (1996) adopted on an econometric model, by estimated the elasticity of poverty to economic growth and they found it always negative (-2.00 to -3.00), from this results Dollar and Kraay (2000) conclude that "any increase in the average level of income in a country contributes to benefit indirectly to its weakest members".

However, many studies have shed light on the role of Inequality in poverty reduction, as Squire (1993), Bruno et al. (1998), Heltberg (2002), Bourguignon (2003), Ravaillon (2005), Gries and Redline (2010), Chee Man and Sial (2012), Adams (2004), Ram (2007), Fosu (2009) and (2010) and many others, showed that inequality played significant roles in affecting poverty, Kakwani (2001), conclude that the inequality index should always have a positive elasticity to poverty reduction, and there is a consensus between this result and Bourguignon (2003) results when he showed that the trends in poverty are not related to growth because of the inequality, Kakwani and Perinia (2000) showed that growth will be pro-poor if and only if it accompanied by a decrease in inequality indicator.

From the Economist Journal (2000) we find two main opposing views on the matter:" Growth really does help the poor: in fact it raises their incomes by about as much as it raises the incomes of everybody else … globalization raises incomes, and the poor participate fully" (The Economist, May 27, 2000, p.6), In other side; in the same year in June the Economist declared that "there is plenty of evidence that current patterns of growth and globalization are widening income disparities and hence acting as a brake on poverty reduction" (Justin Forsyth, Oxfam Policy Director, Letter to The Economist, June 20, 2000, p.6), here we have two conflicting positions about how much the poorest people benefit from the economic growth that is fueled by the openness to foreign trade and FDI, through this contradiction we must put this question :" what is the relationships between the three variables in Arabic countries? And does the economic growth reduce poverty? Does the inequality index impedes the growth reducing of poverty?".

This paper makes a contribution to existing literature in the following points. First, the utilizing of new indicators for each poverty rate and inequality index

(consumption per capita for poverty and Theil index for inequality) instead of both headcount ratio as index to measuring the poverty rate and Gini index which allows to measure the inequality; which are not available for a long period and for all Arabic countries in our sample. Second, this paper tries to examine the relationships between poverty rate, inequality index and economic growth rate by utilizing the structural VAR which allows us to study the effects of structural shocks of any variable to the other two variables according to structural impulse response functions and structural variance decomposition; unlike the majority of the previous studies that were limited with the unstructured VAR and the ordinary impulse response functions and variance decomposition. Third, all the previous studies that test the relationship between the three variables for Arabic countries do not tend to cover all the Arabic countries for a long period as 1970-2013 because the absence of the data and especially Gini index, and our study is the first paper that use a panel data for a long period unlike all the other previous studies in Arabic countries that use a cross-sectional data because the lack of Arabic data for both poverty rate and inequality index.

The aim of this paper is to econometrically investigate the links between poverty, inequality and economic growth in 21 Arabic countries (all the Arabic countries except Palestine because the absence of data) to have a clear idea about relationships between the three variables; by using yearly data for the period 1970-2013, according to SVAR model. This study seeks to analyze the effects of an economic growth and inequality shocks on poverty rate by applying a VAR approach, For this reason we used the methodology proposed by Perotti (2002) based on Blanchard and Perotti (1999).

1. Literature review:

The relationship between poverty, inequality and economic growth has been an area ongoing study for over five decades, in the past many studies as Cheney et al. (1974) have argued that the economic growth tend to increase poverty in the developing countries, as declared "it is now clear that more than a decade of rapid growth in underdeveloped countries has been of little or no benefit to perhaps of third of their population … Paradoxically, while growth policies have succeeded beyond the expectations of the first development decade, the very idea of aggregate growth as a social objective has increasingly been called into question".

There is many papers on poverty-inequality-growth triangle (as named by Bourguignon (2003)), one of them Ravaillon and Chen (1996) when they showed that the elasticity of poverty to growth is always negative for all poverty lines (absolute, relative and national poverty lines), Dollar and Kraay (2000) declared that any increase in the average level of income in a country contributes to benefit indirectly to its weakest members, Bourguignon (2003); Ravaillon (1997); Epaulard (2003); World Bank (2006b); Kalwij and Verschoor (2007) and Fosu (2009) proved that inequality influences the growth's transformation to poverty reduction as explained before by Adams (2001) when he considered that inequality as the impediment to pro-poor growth, in the other hand Ali and Thorbecke (2000) find that poverty rates are more sensitive to income inequality than it is to the level of income. Many other studies focused on the growth elasticity of poverty that increases with inequality (Ravaillon (1997); Easterly (2000) and Adams (2004)), these studies provided that the growth elasticity of poverty is higher in the countries with the smaller Gini coefficient (less than 0.35), the same results are

concluded by Ravaillon (1997) who showed that low inequality helps the poor people to share in the benefits of growth, Kakwani and Pernia (2000) considered that growth is pro-poor if and only if it is accompanied by an important reduction in inequality index.

In the recent study of Ben Rejeb (2012) conducted an econometric analysis using panel data from 52 developing countries over the period 1990-2005, showed that there is a strong interdependence between the three variables, therefore, the Kuznets hypothesis is based on relationship between economic growth to income inequality is most appropriate. Similarly, Adams R (2004) using a data set of 126 intervals from 60 developing countries to analyze the growth elasticity of poverty, results of the study showed that while economic growth does reduce poverty in developing countries; the rate of poverty reduction depends very much on how economic growth is defined, when economic growth is measured by changes in survey mean income (consumption); the growth elasticity of poverty is -2.79, but when growth is measured by changes in Gross Domestic Product (GDP) per capita; the growth elasticity to poverty is insignificant -2.27. In the same context, Neube et al. 2013 presented the patterns of poverty, growth and inequality in MENA countries, using a cross-sectional time series data for the period 1985-2009, the results showed that income inequality reduces economic growth and increases poverty in the region.

On the other hand, Almas H (2004) examined the causal relationship between inequality and other macroeconomic variables, using panel data from 146 countries over the period 1950-1998, regression results suggest that income inequality is declining over time, inequality is also declining in growth of income, and the Kuznets hypothesis represents a global U shape relationship between inequality and economic growth. Also De Janvery and Sadoulet (1999) by using data for the period 1970-1994 for 12 Latin American countries showed that income growth is only effective in reducing poverty if the initial levels of inequality and poverty are not high and if educational levels are sufficiently high, and it showed that income growth following structural adjustment reforms is more effective in reducing poverty than income growth under import substitution industrializations policies, but that it remains ineffective in reducing inequality. Finally, Garbis I (2005) examined the relationship between inequality, poverty and economic growth using a panel data from 82 countries over the period 1965-2003, the empirical results in this paper confirmed the validity of the Kuznets curve, in credit market imperfections in low and medium income countries are identified as the likely reason for the positive link between inequality and growth over the short to medium term, and in long term; inequality may have an adverse impact on growth.

3. Model and Data:

3.1 Model specification:

To assess the effects of growth and inequality shocks on poverty we use the SVAR methodology, in order to estimate the dynamic impact of growth and inequality on poverty rates, the SVAR model is estimated according to the method developed by Sims and Zha (1999), the models of structural vector auto-regressions (SVAR) use the restrictions imposed by economic theory to identify the system to pass from reduced form to obtain an economic interpretative function of impulse response,

we used in this paper Blanchard and Perroti (1999) approach for SVAR estimation, and the model is as follow:

$$A_0 x_t = A(L)x_{t-1} + B\varepsilon_t, \quad (1)$$

Where A_0 is the matrix of contemporaneous influence between the variables, x_t is a (n×1) vector of the endogenous macroeconomic variables (poverty rate P, inequality index I and economic growth G), A(L) is a (n×n) matrix of lag-length L, representing impulse-response functions of the shocks to the elements of x_t, B is a (n×n) matrix that captures the linear relations between structural shocks and those in the reduced form, ε_t is a (n×1) vector of structural shocks. The structural shocks are uncorrelated and identically normally distributed.

By multiplying equation (1) by an inverse matrix A_0^{-1} we obtain the reduced form as follow:

$$X_t = C(L) X_{t-1} + \mu_t \quad (2)$$

Where: $C(L) = A_0^{-1}(L)$ and $\mu_t = A_0^{-1}B\varepsilon_t$, μ_t is a (n×1) vector of shocks in reduced form that are uncorrelated and normally distributed but contemporaneously correlated with each other. The relation between structural shocks and reduced form shocks is:

$$A_0 \mu_t = B\varepsilon_t \quad (3)$$

To identify the relations it is necessary to impose restrictions assuming that some structural shocks have no contemporaneous effects on some variables, according to Cholesky decomposition, the A_0 matrix is the lower triangular matrix and B is n-dimensional matrix, one of the most important disadvantages of this approach is that is necessary to take into account the ordering of the variables, the ordering presented below is according to economic theory and the previous studies and it's as it follows: economic growth, inequality index and poverty rate, and we must assume that:

- ✓ Economic growth is not contemporaneously by any kind of shocks.
- ✓ Inequality index is contemporaneously affected by the economic growth shock.
- ✓ Poverty rate is contemporaneously affected by both of economic growth and inequality shocks.

$$\varepsilon_t^G = b_1 + \varepsilon_t^G \quad (4)$$

$$\varepsilon_t^I = a_1 \mu_t^G + b_2 \varepsilon_t^I \quad (5)$$

$$\varepsilon_t^P = a_2 \mu_t^G + a_3 \mu_t^I + b_3 \varepsilon_t^P \quad (6)$$

$$\begin{matrix} 1 & 0 & 0 & \mu G \\ -a1 & 1 & 0 & \mu I \\ -a2 & -a3 & 1 & \mu P \end{matrix} = \begin{matrix} b1 & 0 & 0 & \varepsilon G \\ 0 & b2 & 0 & \varepsilon I \\ 0 & 0 & b3 & \varepsilon P \end{matrix} \quad (7)$$

3.2 Data:

The present research has carried out the relationship between poverty, inequality and economic growth in Arabic countries, we are led to resort to panel data from 21 arabic country over the period 1970-2013, our data are obtained from different sources :

Poverty: data on poverty in most of the developing countries are very limited because they have started recording data on poverty in the 90s, and to override this lack, many indicators have been proposed, for example the Deininger and Squire

(1996) database or Lundberg and Squire (1998) database, this two databases reckon on income and headcount data from the poor people, many others have used the annual income per capita and others used the rate of population living under 1 or 2$ per day, but on the other side, many recent studies have shown that the measure of poverty by the consumption per capita is more efficacy than income see for Ravallion (1992), Woolard and Leibbrandt (1999), Quartey (2005), Odhiambo (2009) and Dhrifi (2013), therefore, we will use in our study the consumption per capita, and this indicator is exists in the World Bank database for a long period in most of developing countries.

Consumption per capita in constant dollars (international prices, base year 1990), Fig 2.

Inequality : in most of empirical literature inequality is measured by the Gini coefficient, but same problem which in poverty data, in the developing countries this index is not available for long periods, for this reason we shall use Theil index that exists in the University of Texas data (Fig 3), which is calculated as follows :

For a population of N "agents" each with characteristic x, the situation may be represented by the list xi (i=1,...,N} where xi is the characteristic of agent i. For example, if the characteristic is income, then xi is the income of agent i. The Theil index is defined as :

$$T_T = T_{\alpha=1} = \frac{1}{N} \sum_{i=1}^{N} \frac{xi}{\mu} \ln \left(\frac{xi}{\mu} \right) \quad (8)$$

where μ is the mean income:

$$\mu = \frac{1}{N} \sum_{i=1}^{N} xi \quad (9)$$

Growth : the most of studies used the growth rate of GDP per capita which exists in the World Bank database, Fig 4.

GDP per capita measuring as GDP per capita growth (annual %).

Table (1) shows descriptives statistics and the correlation matrix, Jarque-Berra results has reported in table which shows that series are normally distributed having zero mean and constant variable except economic growth, correlation matrix shows mutual relationships between variables, according to results, inequality has negative correlated with both economic growth an poverty rate. Poverty is positively correlated with economic growth.

Table 1 - Descriptive statistics and correlation matrix:

Varibles	G	I	P
Mean	1.439	48.727	59.318
Median	1.496	48.957	61.636
Maximum	102.777	59.957	139.559
Minimum	-65.029	39.336	8.724
Standard Deviation	8.851	3.977	20.475
Skewness	1.363	-0.081	-0.008
Kurtosis	37.821	2.838	3.114
Jarque-Berra	37107.91	0.560	0.372
Probability	0.000	0.755	0.830
G	1.000	/	/
I	-0.193	1.000	/
P	0.226	-0.427	1.000

Source: Author's calculation.

When :
G : real GDP Per Capita in constant dollars (international prices, base year 1990).
I : is income inequality measured by the Theil index.
P : is the index of poverty, it is measured by household final consumption expenditure.

4. Empirical estimation and results interpretation:

4.1 Unit Test Root:

To investigate the stationarity of the series used, we use the unit root tests on panel data (Levin, Lin and Chin (LLC) ; Breitung t-test (BRE) ; Im, Pesaran and Chin W-test (IPS) ; MW-ADF Fisher ; MW-PP Fisger and Hadri test), the results being in table (2) :

Table 2 – Unit test root results:

	Level					First differences				
	LLC	B t-stat	IPS w-stat	ADF	PP	LLC	B t-stat	IPS w-stat	ADF	PP
G	-6.4 0.0*	-6.8 0.0*	-10.18 0.0*	198.7 0.0*	689.5 0.0*	/	/	/	/	/
I	0.23 0.59	-0.35 0.36	0.91 0.82	22.28 0.44	24.75 0.30	-1.23 0.10	-1.85 0.03*	-1.14 0.12	40.90 0.0*	131.20.0*
P	-1.6 0.05	-1.19 0.11	-0.30 0.37	40.61 0.53	57.21 0.058	-9.24 0.0*	-7.95 0.0*	-11.32 0.0*	226.8 0.0*	173.30.0*

* : Represents significant at 5% level of significance.
Source: Author's calculation usingEviews 10.

From table (2) we found that poverty and inequality series are stationary at the first differences and economic growth series is stationary at their level, therefore, we cannot run the Johanssen test for co-integration and we pass to run the VAR model after choosing the optimal lag length, Fig 5.

4.2 Optimum lag length :

The second step in VAR estimation is to investigate the optimum lag length (P) chosen by sequential modified Likelyhood Ratio (LR), Final Prediction Error (FPE), Akaike criterion (AIC), Shwarz criterion (SC) and Hannan-Quinn cretirion (HQ), the table (3) reports the optimum lag length (P=5) out of a maximum of 7 lag lengths as selected by LR, FPE and AIC.

Table 3 - Lag length selection:

Lag	LR	FPE	AIC	SC	HQ
0	NA	85427.55	19.86905	19.95075	19.90204
1	354.8478	1923.833	16.07555	16.402*	16.207*
2	23.54698	1776.708	15.99529	16.56717	16.22620
3	11.94727	1870.145	16.04490	16.86187	16.37477
4	12.69244	1942.416	16.07979	17.14185	16.50862
5	**23.392***	**1748.0***	**15.969***	**17.27669**	**16.49733**
6	10.57415	1852.078	16.02020	17.57244	16.64695

* : indicates lag order selected by the criterion.

Source: Author's calculation.

4.3 A and B matrix estimation:

After select the optimal lag length we estimate the following VAR(5) model:

$$G_{it} = \alpha_{1it} + \sum_{k=1}^{c} G_{it-j} + \sum_{i=1}^{h} \beta_{1it} P_{it-i} + \sum_{j=1}^{l} y_{1it} I_{it-j} + \varepsilon_{1it} \quad (10)$$

$$I_{it} = \alpha_{2it} + \sum_{j=1}^{l} y_{2it} I_{it-j} + \sum_{i=1}^{h} \beta_{2it} P_{it-i} + \sum_{k=1}^{c} G_{it-k} + \varepsilon_{2it} \quad (11)$$

$$P_{it} = \alpha_{3it} + \sum_{i=1}^{h} \beta_{3it} P_{it-I} + \sum_{j=1}^{l} y_{3it} I_{it-ji} + \sum_{k=1}^{c} G_{it-k} + \varepsilon_{3it} \quad (12)$$

When : G is the economic growth, I is the inequality index, P is the poverty rate, h, l and c are the optimal lag length of P_{it}, I_{it} and G_{it}, ε_{1it}, ε_{2it} and ε_{3it} are error terms and are assumed to be white noise with zero mean constant variance and no autocorrelation.

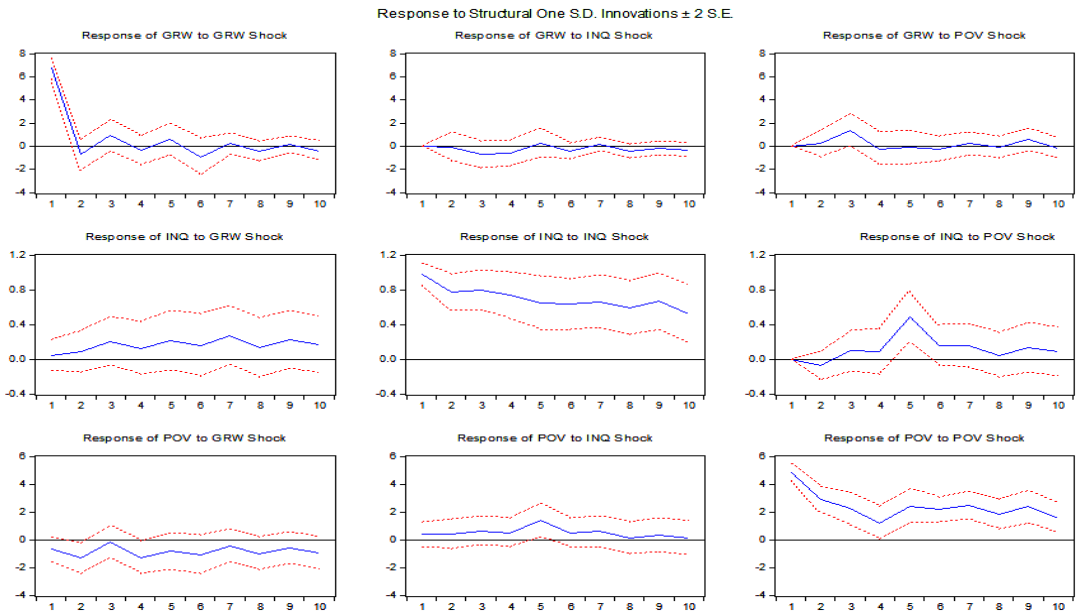
The results of the estimation of A and B matrix are as follow:

$$A = \begin{matrix} 1.000 & 0.000 & 0.000 \\ -0.0064 & 1.000 & 0.000 \\ 0.1061 & -0.3902 & 1.000 \end{matrix} \qquad B = \begin{matrix} 6.7163 & 0.000 & 0.000 \\ 0.000 & 0.9777 & 0.000 \\ 0.000 & 0.000 & 4.8540 \end{matrix} \quad (13)$$

4.4 impulse response functions:

The impulse response functions showed in Figure (1) display the responses of any variable to a variation of one standard deviation of the two other variables, The blue lines in each figure are impulse responses computed from the point estimates and the red lines are 90% confidence bounds. The upper and lower bounds were computed by simulating 100, 000 draws from the asymptotic distribution of the parameter estimates.

Figure 1 - impulse response functions:



Structural impulse response functions according to SVAR model is an alternative method of obtaining information regarding the relationships among the variables, Figure (1) illustrates the response of any shock on the three variables; a shock in economic growth has a positive and increasing effect on inequality index over the 10 years period, and has a negative and wobbling close to zero effect on poverty rate over the 10 years period; and a shock in inequality index has small negative very close to zero effect on economic growth over the 10 years period, and has a positive effect close to zero on poverty rate; finally, a shock in poverty rate has a negative effect on economic growth for the first three years and then a very small effect after the fourth year, and has a positive increasing effect over the first five years on inequlity index then the effect turns up to a positive decreasing effect for the second five years period.

4.5 Variance decomposition:

The essence of the variance decomposition or forecast error variance decomposition (FEVD) is that it measures the proportion of forecast error variance in one variable explained by innovations in itself and the other variables; it determines how much of the forecast error variance of each of the variables can be explained by exogenous shocks of the other variables, and the results are as follows:

The economic growth:

From Table (4), the results shows that the response of economic growth to one standard deviation shock to positive inequality changes was significantly different from zero, and the results suggest that inequality accounted 1.11% of shocks to economic growth in the 3rd period (short-run term); increasing to 3.05% in the 10th period (long-run term), in other hand; poverty contributes 3.96% in the 3rd period, rising marginally to about 4.74% in the 10th period, we conclude that economic growth does not affect by poverty and inequality shocks in both long-run and short-run terms.

Inequality index:

From Table (5), the results suggest that economic growth accounted 2.24% of shocks to inequality index in the short-run term (3rd period), and it's increasing until 5.35% in the long-run term (10th period); indeed, poverty contribute 0.67% in the 3rd period, increasing to about 7.13% in the medium term then it fall to 5.84% in the long-run term, we conclude that inequality index response to itself shocks by plus of 90% in both short-run and long-run terms; when the remaining 10% is from economic growth and poverty shocks.

Poverty rate:

From Table (6), the results suggest that economic growth accounted 5.79% of shocks to poverty rate in the short-run term (3rd period), and it's increasing until 10.87% in the long-run term (10th period); indeed, inequality contribute 1.76% in the 3rd period, increasing to about 5.56% in the medium term(5th period) then it fall to 4.59% in the long-run term, we conclude that poverty rate response to itself shocks by plus of 85% in the both short-run and long-run terms; when the remaining 15% is from economic growth and poverty shocks with a response of plus 10% for the economic growth in the long-run term.

Conclusion:

This paper has considered the relationship between poverty rate, inequality index and economic growth rate in twenty one Arabic countries according to a panel data for the period 1970-2013, using SVAR model based on Blanchard and Perotti (1999) approach according to structural impulse response functions (SIRF) and structural variance decomposition (SVD), the results of the SIRF showed that the dynamic of variables is similar, all the variables shows a weak response to any shock from the other variables, all the multipliers are very small meaning that each variable does not significantly influence by the two other variables.

The results of structural variance decomposition approach show that the major portion of poverty is explained by economic growth by no more than 10% in the long-run term, in other hand all the other portions are less than 10% for both short-run and long-run terms for all the cases, what means the independence between the three variables in the Arabic countries for the period 1970-2013, this result is confirmed by Granger causality test (Table 7 annex) when there is any causality relationship between three the variables.

Policy makers in Arabic countries should focus on economic growth as a mean of rising people's incomes and reducing poverty rates by creates jobs and opportunities for the poor people to support their families, and by encouraged the initiatives that boost production and ensure inclusive economic growth, also can economic growth reduce poverty by promoting employment growth in more productive sectors as manufacturing for example, policy makers also must search for possibilities to boost productivity-intensive growth in less productive sectors, but all of that should be accompanied by a significant reduction in inequality index according to fairer policies of distribution the fruits derived by economic growth; especially the government expenditure policies and the subsides for the poor people.

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Appendix:

Fig 2: Normality test for poverty:

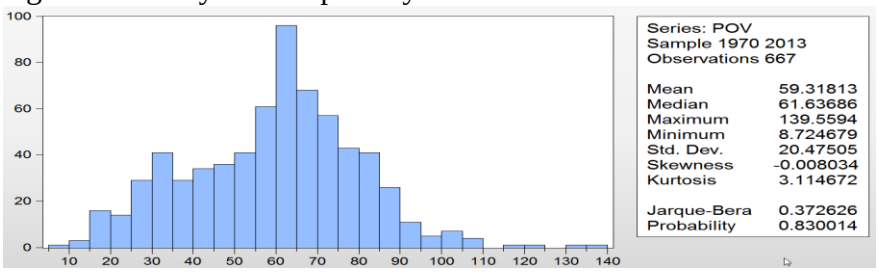

Fig 3: Normality test for inequality:

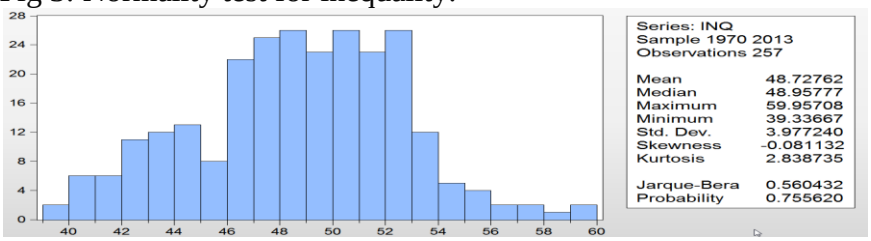

Fig 4: Normality test for growth:

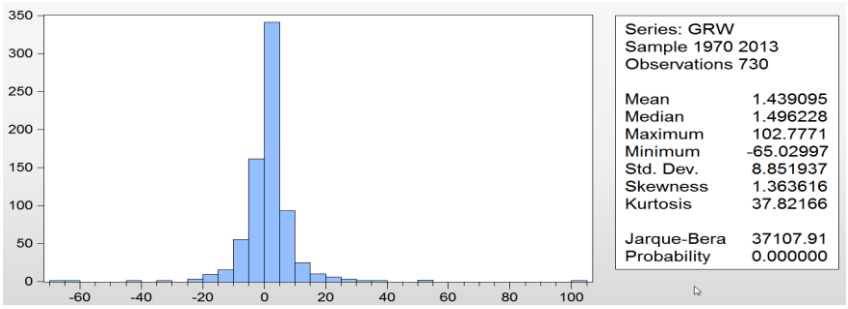

Fig 5: Inverse Roots of AR Characteristic Polynomial :

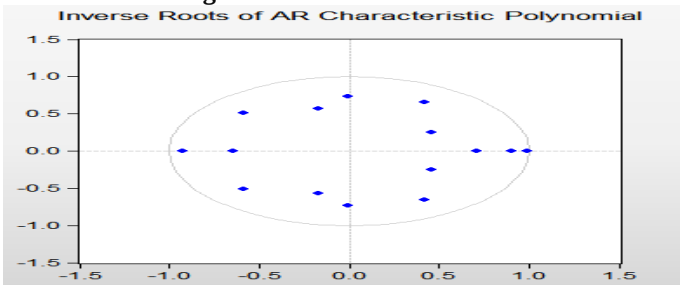

Table 4: Variance Decomposition of growth:

Period	S.E.	Growth	Inequality	Poverty
1	6.716328	100.0000	0.000000	0.000000
2	6.759343	99.88294	0.017312	0.099753
3	6.997009	94.92125	1.112961	3.965785
4	7.038494	94.12826	1.828194	4.043550
5	7.070153	94.00754	1.971857	4.020607
6	7.148075	93.60722	2.335798	4.056979
7	7.157375	93.46991	2.376182	4.153908
8	7.185387	93.10707	2.748028	4.144902
9	7.209936	92.50242	2.800153	4.697424
10	7.233901	92.20326	3.055998	4.740746

Table 5: Variance Decomposition of inequality:

Period	S.E.	Growth	Inequality	Poverty
1	0.978716	0.198454	99.80155	0.000000
2	1.253229	0.586972	99.00979	0.403235
3	1.501028	2.248568	97.07567	0.675759
4	1.676632	2.329677	96.86687	0.803449
5	1.873467	3.141230	89.49357	7.365202
6	1.989198	3.413589	89.44979	7.136623
7	2.119521	4.671693	88.54163	6.786676
8	2.204458	4.685777	89.00335	6.310876
9	2.316821	5.170526	88.78169	6.047786
10	2.380886	5.351194	88.79931	5.849495

Table 6: Variance Decomposition of poverty:

Period	S.E.	Growth	Inequality	Poverty
1	4.918574	2.003279	0.601916	97.39480
2	5.888279	6.601272	0.853810	92.54492
3	6.326086	5.795075	1.763967	92.44096
4	6.590246	9.299520	2.151855	88.54862
5	7.208889	9.167202	5.564551	85.26825
6	7.622247	10.29324	5.397067	84.30969
7	8.050227	9.539197	5.347729	85.11307
8	8.318340	10.44440	5.021150	84.53445
9	8.674691	10.10679	4.773818	85.11939
10	8.867052	10.87838	4.590076	84.53155

Table 7: Granger causality:

Null Hypothesis:	F-Statistic	Prob.
I does not Granger Cause G	2.22120	0.1118
G does not Granger Cause I	1.04697	0.3534
P does not Granger Cause G	0.21969	0.8028
G does not Granger Cause P	2.55752	0.0784
P does not Granger Cause I	2.34064	0.0995
I does not Granger Cause P	1.18526	0.3083